

Report on the TM5 Image Search Project

(Joint Research on Figurative Trademark Search)

Revision History

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1. Objective and its background

This project was agreed on the 10th Expanded Trademark Trilateral in December 2011 with the aim of clarifying the development and implementation of an image search system capable of being utilized for figurative trademark examinations.

The burden of figurative trademark searches is a problem shared with partner offices (reduction in human errors, streamlining of examinations and enhancement of examination qualities) and each office has been deliberating the introduction of an image search system. However, even if the current search precision boasts of high veracity in regard to extracting the identical or very close figures to upper levels, its accuracy is low with reference to extracting similar figures to upper levels it still cannot be utilized for searching figurative trademarks.

Incidentally, why cannot figurative trademarks required of trademark examinations be extracted to upper levels? As one of its causes, in reference to the ambiguous concept of “similarity,” it was considered whether there was a gap in awareness between the examiners and the developer of an image search engine. In this regard, pertaining to the similarity concept in trademark examinations, figures to be extracted to upper levels have been informed distinctively by proposing each office’s actual examination examples to developers.

This report, through exchanges of views with developers, analyzes and puts issue patterns incapable of extracting cited trademarks similar to the application concerned to upper levels of search results in order (reported as the interim report at the first TM5 Annual Meeting in October 2012) and informs these problem solving measures for each issue and the deliberation result regarding utilization of image search systems.

<Problematic patterns incapable of extracting cited trademarks similar to trademark in the application concerned to upper levels of search results in image search systems (14 individual issues and overall issues)>

Issue ① Combination with other figures or characters (without contacted/overlapped parts)

Although these are combined trademarks with other figures or characters, targeting figures and other figures and characters are clearly separated.

Issue ② Combination with other figures or characters (with contacted/overlapped parts)

Whereas combined trademarks with other figures or characters, targeting figures and other figures and characters are contacted or overlapped.

Issue ③ With graphics to form a background, the contour of trademark appearances as a whole varies.

Due to targeting figures for searches holding background figures of circles, squares, escutcheons or the like, the contour of figures is varied.

Issue ④ Several non-linked circles, lines or other shapes form a single figure.

Various circles, lines, dots or other shapes are assembled together to form a single figure.

Issue ⑤ The figures are drawn with light shade.

Due to figures drawn with light shades and gradations, the contours of figures are unclear.

Issue ⑥ The gradations (negative/positive) of figure colors are reversed.

The gradations of targeting figures for searches are reversed.

Issue ⑦ The colors of figures vary.

Colors of the whole or part of targeting figures for searches are varied.

Issue ⑧ The analogous part of figures is small.

The rate of the figure part targeting for searches occupying the whole trademark is small (about 1/5 or less of the whole trademark).

Issue ⑨ The vertical and horizontal ratios vary.

The contours of whole figures vary according to warp and deformation.

Issue ⑩ The direction of the figures varies.

The direction of the figures varies due to the targeted searching figures being inversed or turned.

Issue ⑪ Part of the figures is lacking.

Part of the figures targeting for researches is lacking and the contour is varied as a whole.

Issue ⑫ Similarity according to concepts derived from figures.

Although the external shape targeting for searches is varied, similarity is judged according to the concepts derived from figures.

Issue ⑬ Due to figures to be well-known trademarks, the scope to judge as similar is wide.

Since targeted searching figures are well-known as trademarks, in view of consolidation of its protection, the scope judged as similar is considered wider than usual. (though being approximate with the above ⑫, there is a case of dissimilarity by conceptuality.)

Issue ⑭ Image search for the character parts of trademarks

Character parts in trademarks were searched as image data not as text data.

Overall issues

The resolution of figures is low.

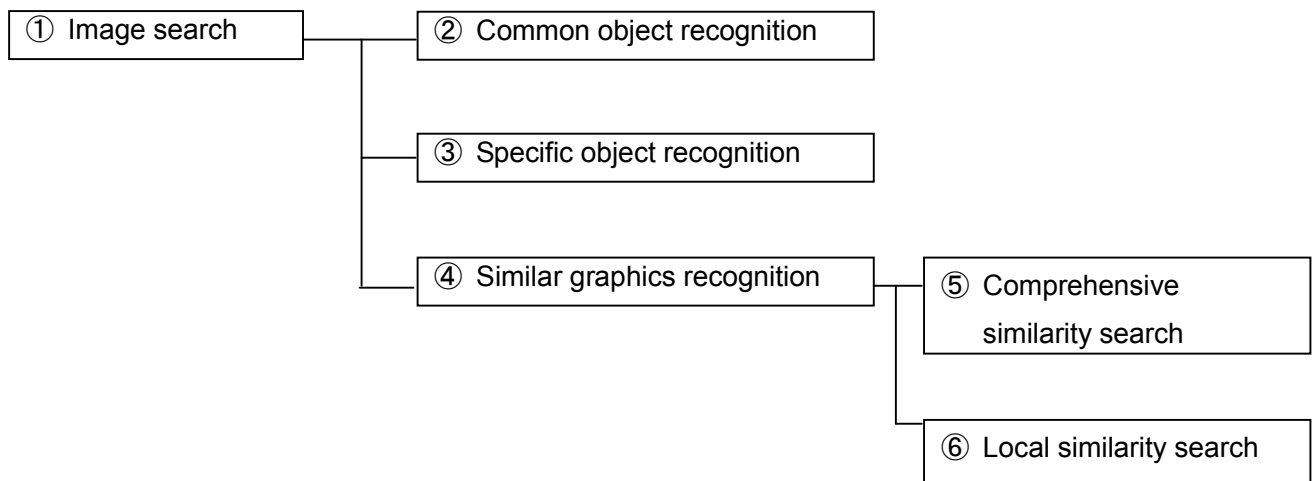
Noises in image data

One trademark often has multiple issues.

In regard to this project, we carried out exchanges of opinions with developers of image search engines. We express our heartfelt gratitude for the cooperation from each developer.

2. Current Image Search technology

Even though the objective to search images is the same, its technology covers a variety of matters, and is roughly classified as follows.



① Image search

Of digitized images, although trials to extract in conformity with a required condition had started since the latter half of the 20th century, the upper limit of computers' calculation speed and data volume to be accumulated was strict initially. In recent years, due to the enhancement of technology in the overall sector of computers, data volume and search speed have reached the limit capable of practical applications, and research of methods as to how efficient and correct search can be carried out have flourished.

② Common object recognition

Of image search technologies, this is the one to learn characteristics from multiple targeting graphics and recognize the same category as its object. For example, if a box type thing with four tires is recognized as a "Vehicle," recognition is carried out for a thing with similar characteristics as a "Vehicle." Inasmuch as this technology specifies categories only, it does not matter in the car examples of distinction between a "Universe" of Hyundai and "Mustang" of Ford. Currently, as a specific example where technical development has progressed, the face recognition technology, in which digital cameras and crime prevention cameras are utilized, can be pointed out. Identifying faces varying according to individuals as a category of "human face," has been utilized in concentrating on focus.

③ Recognition of specific objects

Of image search technologies, this is a technology to extract its characteristics from a single image to recognize the same thing as its object." For example, what is photographed in a picture can be recognized the same as a specific object such as the "Eiffel Tower" in Paris. In accordance with this technology, even if it is the same tower type structure, it is recognized as a different object from the "Tokyo Sky-Tree" of Tokyo. Currently, as a specific example proceeding with technological development, an information searching technology can be selected after recognizing photographs of fine arts. For example, for recognizing specific paintings such as Leonardo Da Vinci's Mona Lisa or the like and searching out the information of those creators on the Web and it has been utilized to investigate preserved venues in the museum.

④ Similar graphics search

Although there are cases when the foregoing 2common objects recognition and 3specific objects recognition are included in the objects recognition technology, not to be seized by specific categories, and beside this, since there is a difference in searching for both the same or similar categories, we introduce it as a unique one. Inasmuch as there is no need to limit objects or categories, this technology is suitable for similarity searches for trademarks.

⑤ Comprehensive similarity searches

This is a technology to acquire a characteristic from a comprehensive image of graphics. It is a method which had been considered from the beginning in the research sector for graphics similarity technology, due to a search-out for an image with similarity by seizing the feature of a comprehensive image, it is a more effective method when searching out for one with similarity in comprehensive features rather than a fine identity. For example, when colors are in reference, due to its capability to judge allocations in whole colors of the graphics as a whole, it is utilized when an emphasis is placed on the ratio and positions of colors rather than shapes.

⑥ Local similarity search

This a technology to acquire characteristics from parts of graphics. Since the latter half of 1990s, sampling a characteristically small territory in graphics and extracting parts strong in edges in a large quantity, and extracting locally characteristic patterns, instead of using whole graphics, and the method to carry out similarity graphics searches have begun to be dealt with according to allocations and distances. The research on graphics searches by this method has recently flourished. Due to detections for local characteristics, it is strong in the judgment of partial identity. If individual characteristics are similar to graphics as a whole, comprehensive similarity can also be judged. A great many developers, with whom opinions have been exchanged, have developed engine mounting technologies based on this method and verification has been carried out using those.

3. Image search engines of each developer

In this paragraph, we introduce the comprehensive contents and comments on the method of current verification and so forth on how image search engines of each company have been developed and researched to the extent possible.

[Company A]

The image search engine of this company has been characterized by technology called object recognition (if it is comprised of graphics composed of $\bigcirc \triangle \square$, it is a technology capable of recognizing each independently), not all but individual objects can independently be recognized and judge similarly.

Loaded graphics for targeting searches comprehensively digitize the vectors at geometric character for each minimum unit object and output search results by computing those from both the parts and the whole and determining the similarity of the individual or overall.

While it is a technology that has been developed mainly for the purpose to automatically recognize specific objects of figures and characters from digitized photographs or frames, this technology is also effective in search of line drawing figures such as trademarks and technological development is being implemented. While photographs have depth, shading or the like, since trademarks essentially are flat surfaces, decent outcomes can be brought about without particular tunings.

With reference to learning functions, if we designate $\bigcirc$ out of $\bigcirc \triangle \square$ using learning functions, recognition is made for $\bigcirc$ to be a significant graphic and it enables us to respond to a search result of as an actor subsequently. However, inasmuch as, even in the same trademarks, there are multiple key parts and cases where important parts vary according to examinations, there are worries for the system to be confused. Utilizing learned contents adopted by the last person or summing up all those aggregated in the past hinges on how the system has been configured. Characters can graphically be recognized as characters. For example, the characters for “kabushikikaisha” can be searched owing to its vectorization. Although it covered only European characters earlier, hiragana, katakana, Chinese characters both simplified and traditional, Hangul letters, Cyrillic letters and so forth can currently be recognized. Even if a font varies, those on the same row can be searched. The same thing as free text retrieval can be performed. Due not to being OCR but vector information, though searches can be done even if the location varies a little bit, specialization in the lateral direction or vertical direction can technically be performed currently. Searching after inputting texts can be done.

Although verification has currently been carried out on the assumption of planar trademarks, if it is desired to use for stereoscopic trademarks, animations or the like, it is considered deliberations are required separately. Texture, gradations or the like are capable of responding in newly developed engine (engine to match the details of the contents of the object). It is better to think of combining advantages of multiple engines. In case of trademarks configured by photos and live-action films, those intrinsically are favorable for us. Response can be done in a few seconds.

[Company B]

Using two algorithms called “Similarity graphics search” and “Local matching,” this company’s image

search engine has calculated each score (digitized one as how far placed in distance from the application concerned, absolute value against application concerned) and put a ranking based on it.

As an idea of utilizing an image search engine in the examination for figurative trademarks, a method not deciding the number of upper rankings, but making a certain score a criteria and indicating what exceeds the criteria and does not indicate what falls below the criteria is considered. In regard to a core to make criteria, verification shall be carried out in the prior system and it might be considered better to specify by finding out a score for which examiners come not to judge as similarities. In the search system, it is better to design not to indicate what exceeds the standard score and it seems to connect to the efficiency for examinations.

For an intrinsic search engine of this company, an algorithm specialized to photographs has been utilized. If algorithm is changed to what is specialized in illustration for trademarks, its result also will become changed.

To take character recognition in a searching element has been considered. Character recognition currently has not been provided yet as a function of products. However, the research institute of our company has an algorithm for character recognition. Accuracy seems to be enhanced by its incorporation. For others, prior cutout for parts to intensively be searched and designation of the search scope enables enhanced accuracy. In so doing, extracting cited trademarks at upper levels can be expected even as there is a difference between capital letters and small letters.

[Company C]

Graphics search system is composed of 1) index preparation (extraction of graphics data characteristics volume) and 2) graphics search (search for graphics data). This company can search according to the information inherently possessed by graphics themselves (graphics data characteristics volume). In the past, although graphics with partial similarity could not be searched for due to the utilization of the characteristics volume of global graphics, automatic object sampling has made it possible to extract automatic object from graphics.

[Company D]

In the verification of this time, we studied regarding a technology to take out characteristic small territories in graphics and parts strong in edges in a large quantity which is used in the image search engine in general. As a method, it captures characteristic points for the trademark in the application concerned, and extracts the pattern of brightness around periphery. Database graphics are the same. Searches are made for the one whose pattern has the best similarity from object graphics.

As a result of the whole, as for issue patterns, "Matching between part and the whole," "Deformation of graphics," though local similarity search was efficient in comparison with comprehensive similarity search for existing method, in respect to other issue patterns, local similarity search was not recognized as more efficient, although the local similarity search which is a new method was more efficient, in reference to issue patterns.

[Company E]

The image search engine of this company is constituted from two categories, the technology which enables to evaluate and search comprehensive similarity and that minutely evaluate and search for local similarities. This time, we implemented evaluations for each search technology and investigated the trend of efficiency in each method.

To start with, as a point where local similarity search was predominant, it was effective when evaluating comprehensive configuration without regard to colors and minute configurations. However, when other composition elements are incorporated, detection has become difficult. This point can be relieved by virtue of integration with local similarity searches.

Next, as a point where the local similarity search was superior, it was effective when partial cohesion coincides, even if comprehensive composition and configuration are different. Although similar parts different from heavily evaluated composition elements were detected and in the case where configuration was extremely simple in the past, thereafter, tuning search engines were provided so as to obtain more stable and a wide variety of features (information) from search object figures, in order to restrict characteristic adverse effects extracted unnecessarily and by calculating the degree of importance of each characteristic from statistical volume and implemented the enhancement of search accuracy.

[Company F]

As an image search engine background technology of this company, we have employed "Multiple Resolution Wavelet Decomposition." We judge similarity from the level of space density. The JPEG compressibility ratio or the like is affected in picture quality and size. We have employed algorithm extracting multiple information such as color, texture, contour and so forth.

[Company G]

The graphic search technology of this company has been classified into similar groups from its characteristic volume, analyzing characteristics of graphics using multiple algorithms. Although graphics search technology is in the research stage, we consider it difficult to yield search results to completely replace searches using the Vienna Classification. We think it one of the goals to automatically grant the Vienna Classification. We consider there are certain availabilities if a certain accuracy is ensured to eliminate human errors in the grant of Vienna Classification or prevent creation of variability in the classification to be granted or the like.

Graphic search belongs to a sector where the technology has accelerated in a few years and the research institute of this company has collaborated with academic research institutes. However, inasmuch as to realize practical products requires a considerable period of time, we would like to periodically exchange opinions with users.

4. Problems of each issue and arrangement for countermeasures

In this paragraph, with respect to 14 individual issues, we describe analyzed results in the following forms.

[○－1] For specific example ※○, issue number is described.

⇒ Exemplify figures containing issues.

[○－2] Difficulty level of issues and general evaluation

⇒ Indicate difficulty of actual issue solution in 3 stages.

Low : Issue itself is on the level capable of being solved with existing technology.

Middle : The enhancement of accuracy is expected by tuning or the like for search engines.

High : In the actual state, clarified method solution could not be found.

⇒ Describe general evaluation for issues.

[○－3] : Analysis of issues

⇒ Describes specific points of questions, problems and expected solutions in the system.

[○－4] : Main comments from developers

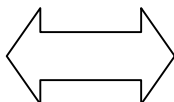
⇒ Describe what specific comments were provided from developers with whom exchanged opinions.

Issue ①

Combination with other figures or characters (without contacted/overlapped parts)

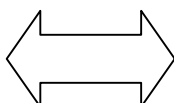
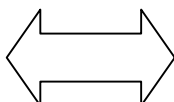
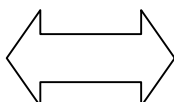
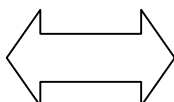
Although these are combined trademarks with other figures or characters, targeting figures and other figures and characters are clearly separated.

〔①—1〕 Specific example



Swallow Transport

WEATHER RePORTs



〔①—2〕 Issue difficulty level and general evaluation

Difficulty level of issues : LOW (Solvable with the current technology)
General evaluation : Many image search engines have been capable of extracting cited trademarks at upper levels, without cutting out targeting figures parts from trademarks beforehand. In the venue of opinion exchanges with developers, there are plenty of opinions to regard it not difficult as a single issue. In a case where the figures part to be a targeting object and other parts are completely separated, cited trademarks have been extracted with particularly high precision. It was a distinctive example where local similarity search was excellent. Although it is common in other issues, in order to comprehend characteristic points as accurately as possible, the higher the resolution of a figure itself, the better the quality and noises by contamination are also decreased. In comparison with other issues, as a single issue, high accuracy engines have already been developed, and from a technological viewpoint, existing engines are capable of solving the issues.

〔①—3〕 Analysis of issues

- Q1. In this issue, despite the fact that the same figurative element has been contained in the trademark side in the application concerned and in the cited trademark side in the application concerned, due to other elements to be contained in the one or both sides, a problem comes out in the point that the element as trademarks as a whole varies.
- A1. In order to judge partial coincidence, a local similarity search is effective. High accuracy can be obtained without special tuning.

〔①—4〕 Main comments from developers

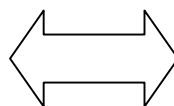
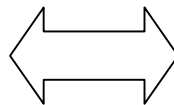
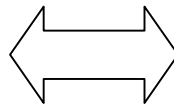
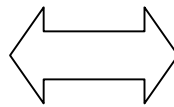
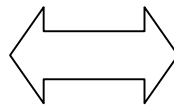
- (A): Issue ① seems to be no problem.
- (D): Local similarity search seems to be suitable. Local similarity has no need to cut out the figure part in advance. It is a method suitable for searches having such issues. Existing methods capture characteristics of the whole figures, accordingly, color histogram (ratio of colors) and morphogenic characteristics (indicated with numerical values) were focused on. Figures on the trademark in the application concerned side and figures on the figures database side are in the relationship between a part and the whole, even if figure part on the figures database side is not cut out, search can be carried out with high precision.

Issue ②

Combination with other figures or characters (with contacted/overlapped parts)

Whereas combined trademarks with other figures or characters, targeting figures and other figures and characters are contacted or overlapped.

〔②－1〕 Specific examples



〔②—2〕 Difficulty level of issues and general evaluation

Difficulty level of issues : **Middle** (Accuracy can be improved by tuning search engines.)

General evaluation :

Many of the developers' search engines, for which opinions were exchanged, similar trademarks could have been extracted without carrying out cutout for the targeting figure part for searches.

If stress is placed on the perfect coincidence of characteristic points, although a figure whose perfectly coincided part can be extracted, similar trademarks without perfect coincidence in characteristic points have come to fall in accuracy to that extent, and points to be deliberated relevant to the level for tuning remain.

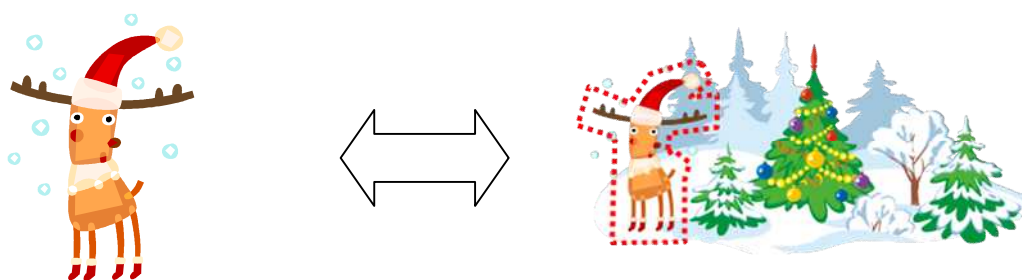
Although this issue itself is close to issue ①(combination with other figures or characters (without contacted/overlapped parts), due to contact or overlapping with targeting figure parts for searches, according to a method to cut out figure parts for searches, the enhancement of more accuracy can be expected. Furthermore, cutout of targeting figure parts for searches and so forth shall be automatically extracted by the system so as to reduce manual operations as much as possible and should be accumulated in the figures database.

Although a difference in accuracy emerges according to the figures, as for a single issue itself, due to anticipation of the enhancement in accuracy according to methods of tuning and cutout, a solution can technically be expected.

〔②—3〕 Analysis of issues

- Q1. This issue is a constructive one from issue ①. Varied parts indicate the points lacking of coincidence at targeting figure parts for searches: Figures for searches are contacted or overlapped or lacking with other figures to have no perfect coincidence at figure part for searches
- A1. In order to judge partial coincidence, although the efficiency of local similarity searches is the same as issue ①, since there are differences in targeting figures for searches, more local characteristics are necessary to be judged.
- Q2. Does the accuracy increase by designating the scope of searches? In addition, what sorts of methods are there for designation?
- A2. As a method to designate searches, it is not necessarily designated with squares and it also is possible to designate by free curved lines. Moreover, it does not designate the scope, but there is a method to erase parts without connections with a paint brush. In any case, if the information of characteristic points can be converged on, accuracy inevitably will be enhanced. Configuration to ignore specific conditions in searching and a method to observe coincidence at specific parts or the like can be discussed.

(An example where cutout by free curved lines is effective)



〔②—4〕 Main comments from developers

(A): Issue ② is considered not to be an error.

(C): Even if targeting figure parts for searches partially cut or overlapped, extraction of cited trademarks can be conducted with current technology. However, a problem regarding how far precisely to judge coincidence remains.

(D): In the current system, when cutout or the like of figure parts for searches has not been conducted beforehand in particular, favorably performed cases and reversal case are split. When the ratio of targeting figure parts for searches on the side of trademark in the application concerned taken up in the structure of cited trademarks is large, accuracy is high, however, if the targeting part for searches in cited trademark becomes reduced in size, extraction becomes difficult. When the coincided territory is relatively ample in comparison with trademarks as a whole, extraction can accurately be carried out, whereas, it is hard in the case of a small territory.

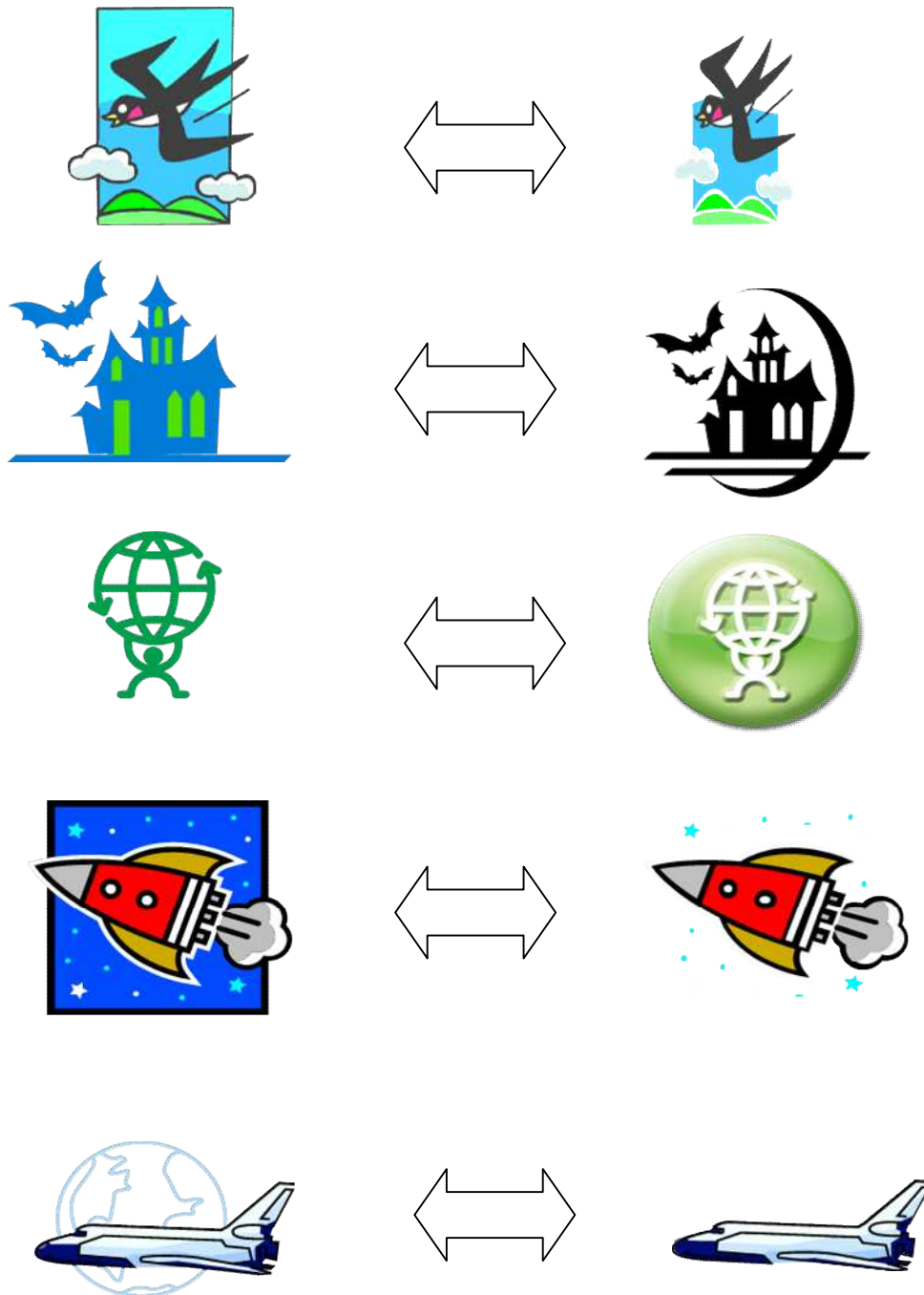
(E): With reference to issue ②, in order to restrict adverse effects of characteristics extracted unnecessarily in the local similarity searches, calculating the extent to which each characteristic is important or not, from statistical volumes of figures database and the enhancement of accuracy can be expected by reflecting to the weight of characteristics. Also by using such a method, search range is only to specify the focused point in rough, the enhancement of accuracy can be expected.

Issue ③

With figures to form a background, the contour of trademark appearance as a whole varies.

Due to targeting figures for searches holding background figures of circles, squares, escutcheons or the like, the contour of figures is varied.

〔③—1〕 Specific examples



〔③－2〕 Difficulty level of issues and general evaluation

Difficulty level of issues : **Middle** (Accuracy can be improved by tuning search engines.)

General evaluation :

This issue scarcely occurs as a single body but frequently arises simultaneously in a large quantity with other issues particularly with issue ② (combination with other figures or characters (with contacted/overlapped parts))

While photographs frequently have complex backdrops as objects, trademarks frequently are artificially allocated by simple backdrops. Anticipating the development of image search technology for trademarks, many developers have developed a technology to identify the similarity of a part of a photograph (for example, face identification technology of digital cameras and crime prevention cameras), and there are many opinions as to whether to regard the issue as resolved or as relatively easy in resolution.

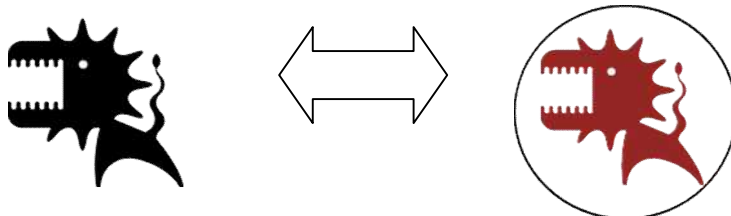
Although segmentation was conducted as an issue pattern, this issue and issue ② can be resolved at the same time.

〔③－3〕 Analysis of issues

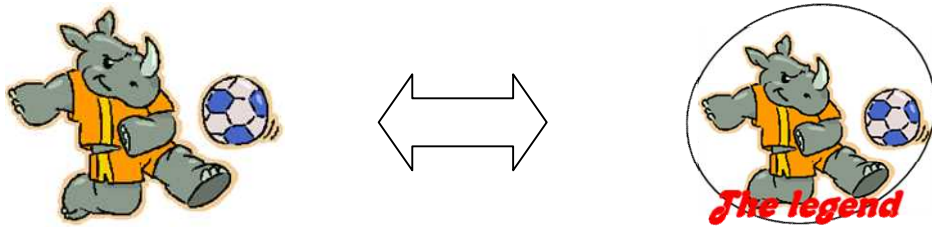
Q1. Even if this issue has coincided with targeting figure parts for searches, due to varied backdrops, what figures as a whole (contours in particular) vary becomes a problem for this issue.

A1. Regarding the point of “having figurative elements other than figure parts targeted for searches,” because it is a common problem with issue ②, a local similarity search is also effective for figures with this issue. While cited trademarks can be extracted without conducting special tuning or the like when targeting figure parts for searches and the backdrop is not entirely contacting, when those are overlapping, accuracy is liable to fall.

(An example where extraction is relatively easy when targeting figure parts for searches and the backdrop is not entirely contacting.)



(Because the targeting figure part for searches and its background are overlapping and the contours vary as trademarks as a whole, it is an example where searching precision degrades.)



(A circle is allocated in the background of the character rhinoceros, in addition due to the circle contacting with the character part in the lower row, as a contour for the trademark, it varies greatly.)

〔③—4〕 Main comments from developers

(A): The issue has been cleared

(D): While targeting figures for searches with plenty of geometric characteristics proceed favorably, simple figures are difficult.

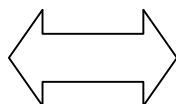
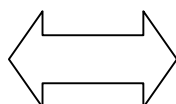
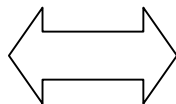
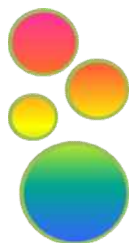
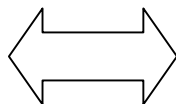
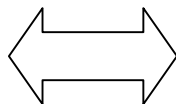
(E): In order to restrict adverse effects of characteristics unnecessarily extracted, issue ③ can expect the enhancement of accuracy by reflecting the weight of characteristics, calculating to what extent each characteristic is important or not, from the statistic volumes.

Issue ④

Several non-linked circles, lines or other shapes form a single figure.

Various circles, lines, dots or other shapes are assembled together to form a single figure.

〔④—1〕 Specific examples



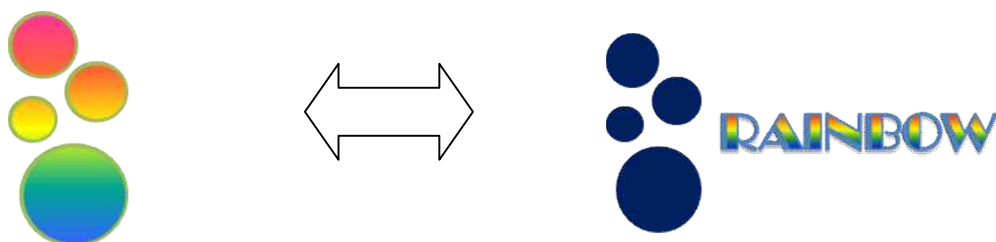
〔④—2〕 Difficulty level of issues and general evaluation

Difficulty level of issues : Middle (Accuracy can be improved by tuning search engines.)
General evaluation : Although the extraction of cited trademarks was expected to be difficult due to the separation of individual figurative elements in reference to this issue at an initial stage of deliberations, when actually carrying out investigation, the similarity of characteristic points as an integrated set of figures contributed to capability to extract cited trademarks comparatively to upper levels. Although tuning methods to enhance accuracy have been demonstrated by developers and it is considered to be an issue where enhancement of search accuracy can be expected, since variability emerges according to categories and numbers of individual figurative elements composed of figures as a single body, the level of tuning is required for deliberations. So to speak, square and star shapes with plenty of apexes can readily be extracted for cited trademarks, moreover, the more the number of individual figurative elements constituting figures as an integrated body, the easier for extraction. Methods to severally allocate simple geometric figures are the ones frequently seen in the commercial sector. While searching according to Vienna Classification is efficient, when the number of individual figurative elements constituting figures as a single body is multiple, because of its inclination to become comprehensive classifications (for example, “over three lines or belts”), image searches where the number of individual figurative elements can also be recognized seems capable of extracting closer compositions to upper levels

〔④—3〕 Analysis of issues

- Q1. This issue configures figures as a single body by gathering separated individual figurative elements and, due to having no characteristics with separated individual figurative elements only, it becomes a problem whether or not figures as a single body constituted by gathering those in a multiple number.
- A1. With regard to local similarity searches in current image search, inasmuch not only separated individual figurative elements, but also positions and distances of characteristic points of figures as a whole can be recognized, a high quality of similarity as an integrated body can be extracted.

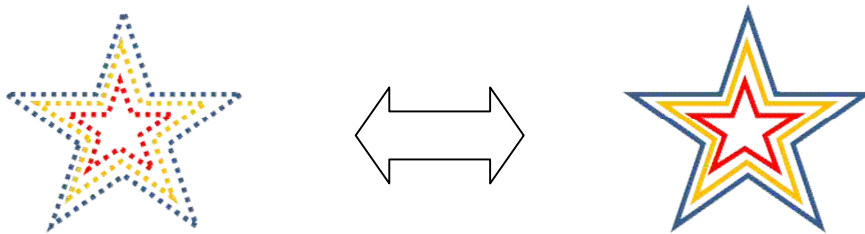
(Although separated individual figurative elements merely have few characteristics, examples illustrate to constitute figures as a single body by gathering those.)



Q2. Is it possible to search for a single body figure integrated by individual figurative elements and for a case where single body figures are similar?

A2. If stick to the number of characteristic points and allocation only, though what is entirely different comes out, in a case being consolidated in a certain density or having regularities, if tuning to recognize as a mass or the like is carried out, the enhancement of precision can be expected. When there is nothing on the background of the targeting figure part for searches, although cited trademarks can easily be extracted, in a case there are figures with plenty of characteristic points or the like, extraction of cited trademarks is difficult. With respect to the method of tuning, deliberations are necessary.

(A case where single body figures integrated with separated individual figurative elements and an example where single body figures are similar.)



〔④—4〕 Main comments from developers

(A): If the outline of the image object is not clear, it is possible to utilize the engine as it is by using the image processing technology, such as seen blurred the targeting figure for searches.

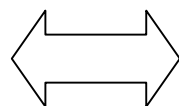
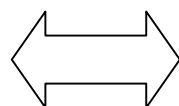
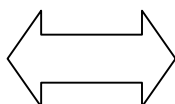
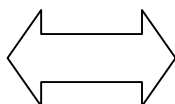
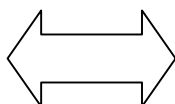
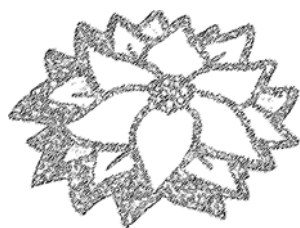
(D): Since local characteristics of trademarks in the application concerned and cited trademarks relatively coincide, extraction of cited trademarks is comparatively easy. The search engines tried this time are poor in their extracting results because countermeasures for inversion of colors have not yet been dealt with. Multiple sets of uncombined circles, lines or the like are more effective than the method to compare the whole due to the similarity among local characteristics.

Issue ⑤

The figures are drawn with light shade.

Due to figures drawn with light shades and gradations, the contours of figures are unclear.

〔⑤－1〕 Specific examples



〔⑤—2〕 Difficulty degree of issues and general evaluation

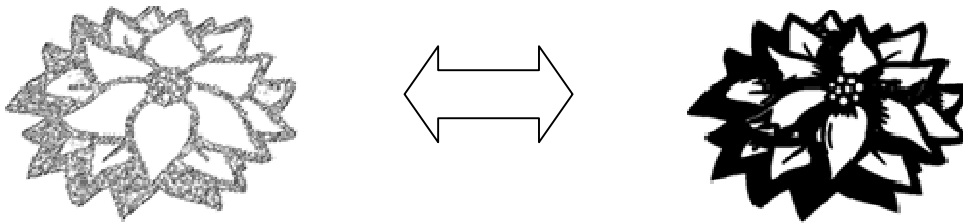
Difficulty level of issues : Middle (Accuracy can be improved by tuning search engines.)
General evaluation : In regard to other issues, the number of evaluations to judge local similarity was greater than that of judging comprehensive similarity. However, when providing no particular tuning, in respect to figures with particularly light colors, even in the engines to judge local similarity, accuracy in extraction was not sufficient. Regarding this issue, issue ④ (several non-linked circles, lines or other shapes form a single figure.), and issue ⑪ (part of the figures is lacking), there is a case in which the human complement lacking parts as an image to judge similarity, and it is an issue where the difference between mechanical similarity and that judged by a human is liable to become distinctive. In addition, this is an issue most susceptible to effects of the prettiness of the figure data itself and excellent resolutions affecting image searches itself (in other words, how minimal is the noise data that is not the trademark itself being caused by contamination in the background or the paper quality when scanning). However, problematic points affecting accuracy are obvious and efficiency of combination with engines to judge tuning and comprehensive similarity has been understood. In consideration of closeness of problematic points to issue ④, the enhancement of extraction accuracy can be expected it specific deliberations advance.

〔⑤—3〕 Analysis of issues

- Q1. Even it composition of trademarks in the application concerned and cited trademarks are similar, since the figures are drawn with light colors, the point where its contours cannot accurately be captured becomes a problem.
- A1. With light colors in use and even if the cut lines of figures are unclear for human eyes, it is possible to capture them as contours if the figure data is linked. However, when putting stress on variation in the shading of colors, in a case where one side is covered with light colors, accuracy falls due to the difference emerged in characteristic volume. If there is no shading in colors but tuning to recognize the existence of colors is carried out, the enhancement of accuracy can be expected.
- Q2. When the contour of figures is discontinued as data, can searches carried out?
- A2. This problem is close to issue ④. If tuning to recognize a mass when characteristic points are fixed with a fixed density, the enhancement of accuracy can be expected.
- Q3. Even if the contour of figures is clear and the interior on the one side is faded, can the extraction of similar figures fully painted be carried out?
- A3. With engines placing stress on the number of characteristic points and allocation only, the accuracy

will fall. A combination with tuning and engines to judge comprehensive similarity to compare figures as a whole is effective.

(Interior of the figure is faded and the difference in characteristic points has been detected)



(While the left figure is faded and interior minute points have been detected, the interior of the right figure has fully been painted to the extent characteristics cannot be detected other than the contour.)

〔⑤—4〕 Main comments from developers

(A): Issue ⑤ is the one at which the engine of our company is not good.

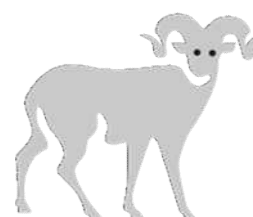
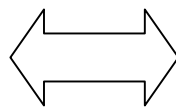
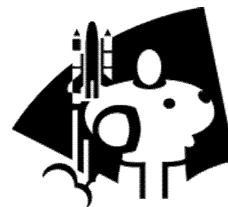
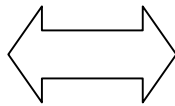
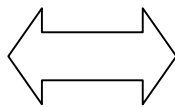
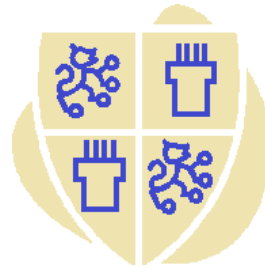
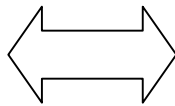
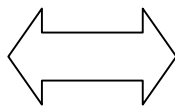
(D): According to the sharpness of the contour, a response can be made to some extent. As the color is faded, extraction of cited trademarks becomes difficult. If the figures are coarse (figure quality is bad), since characteristics as points will be removed in a large quantity and noise increases, extraction of the cited trademarks becomes difficult. For example, if the black paint is scraped and noise occurs, accuracy will be degraded (due to characteristic points extracted in a large quantity).

Issue ⑥

The gradations (negative/positive) of figure colors are reversed.

The gradations of targeting figures for searches are reversed.

〔⑥—1〕 Specific examples



〔⑥—2〕 Difficulty degree of issues

Difficulty level of issues: Low (Solvable with the current technology)
General evaluation: Although engines have been split into ones regarding a reversal of colors as a similarity and those with an opposite recognition, in the view of the developers, either was possible. A simple reversal or the like, if anything, had a case capable of resulting in accuracy close to extraction of the same figure. In spite of the existence of the reversal of colors, although the point where the difference in accuracy emerged due to a plethora in either the search targeting figures part or other parts than what was common with other issues, as a single issue, it was clarified to be able to extract the cited trademarks with high precision In case of trademarks, since there are many cases which are regarded as similar despite the fact that the colors are reversed, it would be desirable to build in a logic to judge reversal as similarity in image search engines.

〔⑥—3〕 Analysis of issues

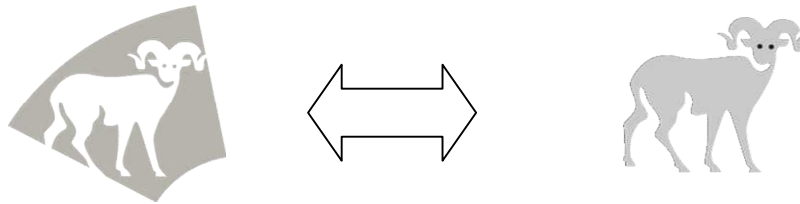
Q1. Inasmuch as the colors of the figures are reversed, this issue becomes a problem in a point the vector direction of characteristic points becomes completely reversed.

A1. There was both an engine to judge negative/positive as different objects and an engine to intrinsically judge as similarity. Many engines are capable of extracting cited trademarks and the engine to judge negative/positive as different objects can also extract cited trademarks by comparatively easy tuning.

Q2. If there is background elements on one figure and the colors are reversed, there are cases in which the contour varies greatly.

A2. The point that accuracy falls when characteristic points of background elements are numerous is the same as issue ③ (With figures to form a background, the contour of trademark appearances as whole varies.). If a case where simple backgrounds such as circles and squares are attached, extraction of cited trademarks is easy due to a scarcity of characteristic volume on the background.

(An example in which there are background elements and the contour varies by simply being reversed only.)

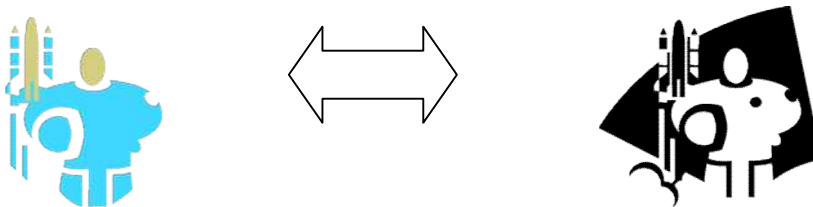


(With reversing the figure on right-hand only, the information having a fan-shaped element on the contour is lost.)

Q3. How is it considered when there is no perfect reversal relationship with colors?

A3. When there is no perfect reversal relationship with colors, due to a coincidence in characteristic points between trademarks in the application concerned and the cited trademarks, extraction of the cited trademarks can be implemented. A little difference in elements that constitute figures does not matter much, in the case of simple figures as the whole composition of trademarks; accuracy is destined to fall according to differences in elements that compose trademarks.

(An example where there is no perfect reversal relationship with colors)



〔⑥—4〕 Main comments from developers

(A): Issue ⑥ has no problem.

(B): Issue ⑥ is capable of searching.

(D): The accuracy of engines used this time was poor due to regarding negative/positive as different matters. To mechanically incorporate logic beforehand capable of extracting the reversion of colors is possible. The perfect reversion of colors or the like can be expected with considerable precision.

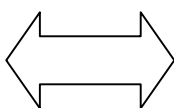
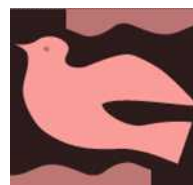
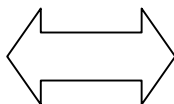
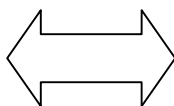
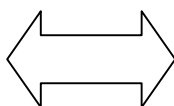
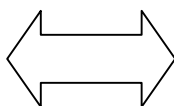
(E): Issue ⑥ can be expected to have an enhancement in precision, due to its calculating the degree from statistical volume of figures database as to how important each characteristic is and reflecting to the weight of characteristic. In the extracted characteristics locally, the enhancement of accuracy can be expected by adding normalization process to be robust to the variation of colors.

Issue ⑦

The colors of figures vary.

Colors of the whole or part of targeting figures for searches are varied.

〔⑦－1〕 Specific examples



[⑦—2] Difficulty degree of the issues and general evaluation

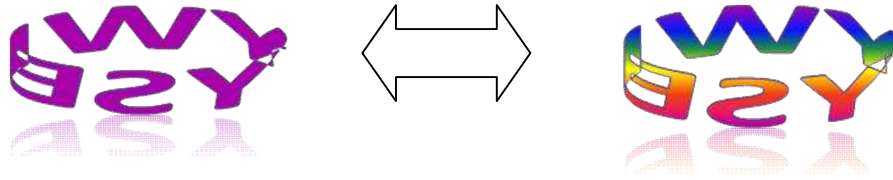
Difficulty level of issues: LOW (Solvable with the current technology)
General evaluation: Similarly to issue ⑥ (the gradation (negative/positive) of figure colors are reversed), this issue was capable of extracting using a great many of search engines. In respect to trademarks, due to the scarcity of cases to become complex in color allocations as compared with photographs, a judgment to place a cognitive stress on configuration rather than colors is easy and there also were views to regard problems in regard to colors as being more readily solvable than photograph image search engines. To be sure, in the cases other than particular trademarks composed of colors only, the similarity of the figurative element itself frequently tends to be a problem and there seem to be few cases when being designated as dissimilarity due to difference in colors. However, in view of cases where the difference in color itself shall emphatically be observed, it would be necessary to have an [ON], [OFF] function and tuning as to what extent the difference in colors is to be emphasized in searching. Although this issue requires deliberate detailed tuning such as the method of a combination with other engines or the like and specific configurations, it can be solved by existing technologies.

[⑦—3] Analysis of issues

- Q1. This issue deals with the problem in which search precision falls in image search engines, despite targeting composition elements of figures for searches are close to, the image search engine to judge the difference in colors as different figures, takes it as a problem in that the search precision falls.
- A1. Many of image search engines, due to the affinity with engines to judge the similarity of photographs and so on, most of them can judge the difference in colors. The search engines to be provided free of charge on the Internet, due to many cases for searches focusing on the genre of objects and goods, there also are plenty of search engines placing an emphasis on colors (for example, search for “Red Jacket” on a shopping site; search for a yellow open car on a car selling site or the like). With reference to image search engines used for figurative trademark examinations, appropriate extractions become possible by making specifications focusing on contours and characteristic points rather than color recognition.
- Q2. Inasmuch as there is a case to focus on colors in judgment as to whether identical or similar, it cannot fully ignore color elements.
- A2. It is possible to have [ON] [OFF] functions in consideration of colors to be considered or not. When searching, a tuning to place how much emphasis on colors in searching is possible. When colors are gradually changing similarly to gradation, excessively delicate tuning for colors is considered

unnecessary because there is a possibility for characteristic points to be detected in a large quantity.

(An example where characteristic points possibly be extracted excessively due to gradation of colors)



〔⑦—4〕 Main comments from developers.

(A): Issue ⑦ has no problem.

(B): Issue ⑦ can be extracted.

(D): Similarly to existing method (method for judging comprehensive similarity), since the difference in color can be absorbed if the number of colors is scarce, extraction is possible.

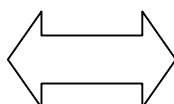
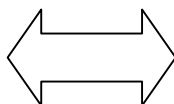
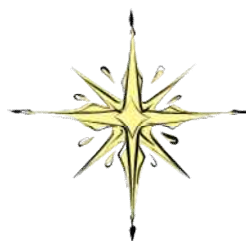
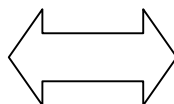
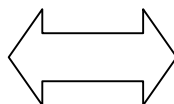
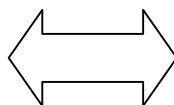
(E): Inasmuch as issue ⑦ restricts adverse effects of unnecessarily extracted characteristics, calculating how important each characteristic is from the statistical volume of figures database, the enhancement of precision can be expected by reflecting the weight of characteristics. In the extracted characteristics locally, the enhancement of accuracy can be expected by adding normalization process to be robust to the variation of colors.

Issue ⑧

The analogous part of graphics is small.

The rate of the figure part targeting for searches occupying the whole trademark is small (about 1/5 or less of the whole trademark).

〔⑧—1〕 Specific examples



〔⑧—2〕 Difficulty degree of issues and general evaluation

Difficulty level of issues: **Middle** (Accuracy can be improved by tuning search engines.)

General evaluation:

Although the smaller the ratio of the targeting figures part for searches occupying in the whole trademarks the stronger the trend of other parts to be buried by the characteristics of the other part has become, according to prior cutout and a method to specify searching scope, the enhancement of precision can be said to be expected to a certain extent. Furthermore, in order to reduce manual cutout for targeting figures part for searches or the like, automatically extract by system and these should be accumulated in the figures database.

In addition, when data in application is intrinsically coarse and the targeting part for searches becomes indistinctive due to tininess of the whole figure, as those may seem unable to deal with in such cases, other issues are the same as this point.

〔⑧—3〕 Analysis of issues

Q1. Even if this issue is the same or similar in the targeting figure part for searches, since the ratio of the part concerned occupied in the whole trademarks small, it has been buried in the characteristics of other parts, making the extraction of cited trademarks difficult becomes a problem.

A1. If the ratio of the targeting figure part for searches occupying the whole trademark is small, extraction of cited trademarks readily becomes a difficult issue in combination with other issues. The method of cutting out the targeting figure part for searches in advance and method of designating the targeting figure parts for searches on the side of application concerned are effective. When ultra-small amounts are allocated on the part required of searches, extraction of cited trademarks will be difficult unless searches are carried out after eliminating excessive information as much as possible. Furthermore, from the standpoint of the smallness of figures, accuracy of figures (high resolution and scarcity of noise) in comparison with other issues becomes important. If the figure part is crushed making the targeting figure part for searches too small, the information of characteristic points has varied.

(Examples of crushed figures due to the targeting small figures parts for searches)



(Original dimension ⇒ Enlarged ⇒ Enlarged further)

〔⑧—4〕 Main comments from developers

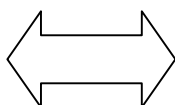
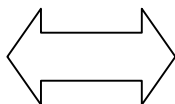
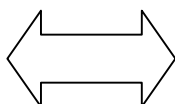
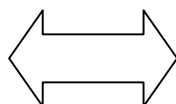
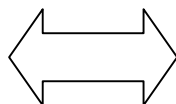
- (A): With respect to issue ⑧, it is basically possible, although it is hard for those of which the targeted searching figure parts are too small and crushed already.
- (D): Although response can be done to a certain extent, it is difficult when the targeted figure part for searches has become around 1/10.
- (E): Since it seems hard to push up an expected result to the upper level, implementation of searches by designating the part largely preferred is considered realistic. According to our company' s method, partial figure searching is expected to realize easily by designating rough location and dimensions using a large mouse or the like. Further, up to certain size, improvement in accuracy can be expected by tuning detection method of the characteristics.

Issue ⑨

The vertical and horizontal ratios vary.

The contours of whole figures vary according to warp and deformation.

〔⑨—1〕 Specific examples



〔⑨—2〕 Difficulty degree of issues and general evaluation

Difficulty level of issues: **Middle** (Accuracy can be improved by tuning search engines.)

General evaluation:

In a case where the whole targeting figures parts for searches are distorted, when grasping the location of characteristic points, most positions become inconsistent. However, many image search engines, taking into account location information comprehensively, can respond to the degree of changes in the vertical/lateral ratios and distortions, though it was replied that the extraction of cited trademarks becomes difficult as this degree increases.

As for similarity of trademarks, due to its ambiguity in ranges of how far percentage point to be allowed as similarity, since the trademark itself is in the direction to be judged as dissimilarity as the ratio of changes increases, a tuning to correspond to the ratio of extreme changes seems unnecessary.

〔⑨—3〕 Analysis of issues

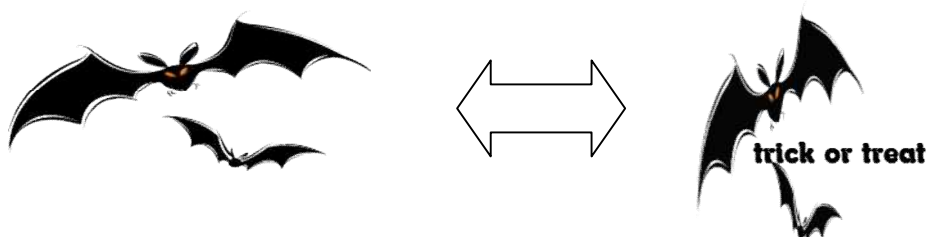
Q1. Although this issue interactively resembles targeting figure parts for searches, due to the location of characteristic points irregularly deviating owing to distortion and deformation, the difficulty in judging coincidence of characteristic points becomes a problem.

A1. When the targeting whole figure parts for searches are distorted, if the location of characteristic points are accurately attempted for comprehension, most locations become inconsistent. However, inasmuch as a great many of image search engines take location information of multiple characteristic points into consideration comprehensively, single body figures are capable of extracting them in spite of a little distortion.

Q2. To what extent can changes in the vertical and lateral ratio be tolerated?

A2. Although there are differences according to engines and the content of tuning of each company, for example, in regard to an engine, either for the vertical and lateral direction, the precision could be maintained until 70% reduction. Inversely, in case of reduction of 30% or less, the precision becomes extremely degraded. Furthermore, not in a case of single body figure but one that includes other elements; the point of falling precision is common with other issues.

(An example where precision falls due to inclusion of elements other than the targeted search figures)



〔⑨—4〕 Main comments from developers

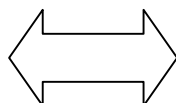
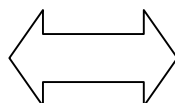
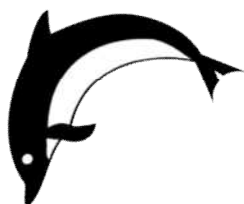
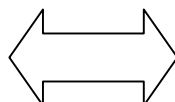
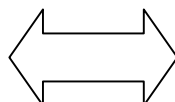
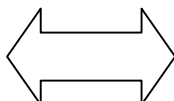
- (A): If the elements of the targeted searching elements of the figure part geometrically resemble issue ⑨, a little distortion is no problem.
- (D): Although single body figures as a whole can absorb the vertical/lateral ratio, in respect to trademarks combined with other elements, precision falls. Even in similar figures, the difference in resolution causes variation in the extraction ranking.

Issue ⑩

The direction of the figures varies.

The direction of the figures varies due to the targeted searching figures being inversed or turned

〔⑩—1〕 Specific examples



[⑩—2] Difficulty degree of issues and general evaluation

Difficulty level of issues: **Middle** (Accuracy can be improved by tuning search engines.)

General evaluation:

Although this issue took up the two elements of inversion and turning as one issue, strictly speaking, different problems and ideas to be solved for each have been found.

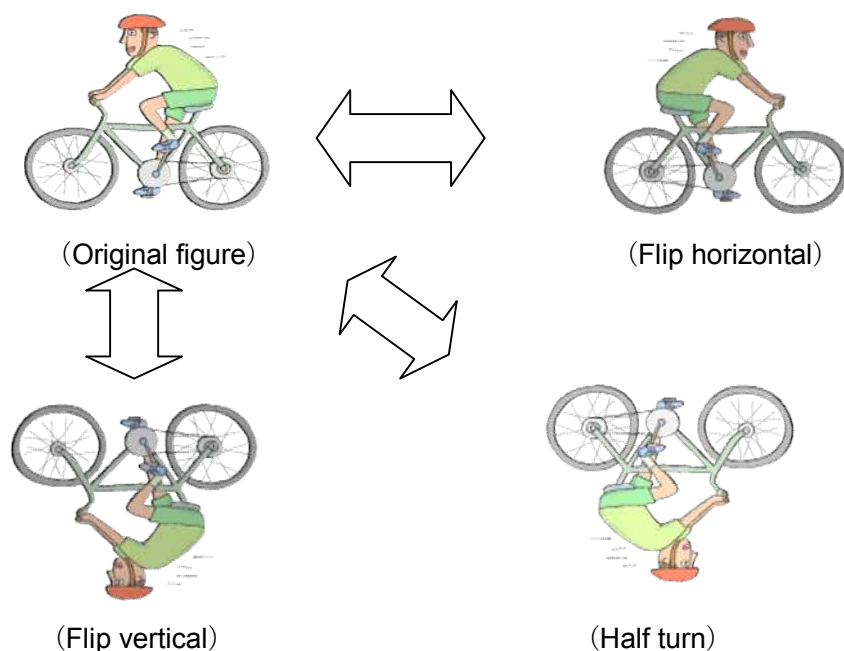
Initially, in regard to turning, although angles to be turned exist in innumerable numbers within the scope between 0 degrees and 360 degrees, characteristic points become varied around 180 degrees, which is the exact opposite (eliminating figures to become the same configuration as original figures). Although a phenomenon with regard to what extent of turn the extraction precision can be maintained varies according to the targeted searching figures in exchanges of opinion with developers, it was reported that precision can be maintained in changes around 10 degrees, and in changes more than that it tends to readily be judged as different figures.

Accordingly, for instance, it becomes necessary to accumulate laterally reversed figures in the figures database beforehand, or accumulate figures turned to every certain angle (depends on to what extent the search engines withstand turns) or tunings to automatically configure figures by turning trademarks in the application concerned.

As for inversion, extraction of cited trademarks become possible by accumulating figures laterally reversed in the database beforehand or if tuning to prepare automatic configuration for figures by laterally reversing trademarks in the application concerned is carried out. In order to correspond to what is turned after lateral inversion (what is turned 180 degrees equals what is vertically reversed of the original figures), a response is required at every certain angle, similarly to the response measures to turning.

With reference to this issue, although it depends on the performance of engines configured on its basis, expectations for the enhancement of precision have been acknowledged by provision of certain countermeasures. Despite the fact that there is a risk to extract dissimilar figures whose characteristic points got close by chance when decreasing in searching speed and in a specific angle, the issue can be resolved. Moreover, there also were developers who made it possible to extract cited trademarks through the performance of search engines by nature.

(Reference figure in respect to inversion/turning)



[⑩—3] Analysis of issues

Q1. Despite the fact that this issue is regarded as targeted searching figures parts interactively the same or similar, due to the configured inversions and turns, the point in cases with great differences when comparing with characteristic points becomes a problem.

A2. While there are figures whose composition is unchanged in spite of inversions and turns, many compositions vary according to inversions and turns. However, differing to issue ⑨ (The vertical and horizontal ratios vary.), since there is a certain regularity in the changes of composition, there was a search engine capable of extracting cited trademarks without particular tuning. In respect to this issue, although there are some partially incapable of extracting cited trademarks appropriately, through tuning and methods to prepare reversed and turned data in advance, cited trademarks can be extracted.

Q2. In case of search engines with no consideration over turning, how far can changes be expected for resistant properties?

A2. Although there are differences according to categories of engines, for example, some of those can extract figures turned up to around 15 – 30 degrees. However, it affects the overall configurations of figures, as for the whole figure being close to square, due to the large scale of changes in characteristic points, its resistance property is weak and precision cannot be maintained for turns over around 10 degrees. The resistance properties against turns vary according to the composition of figures.

[⑩—4] Main comments from developers

(A): Issue ⑩ also has no problem.

(B): Issue ⑩ can be searched.

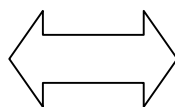
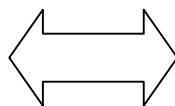
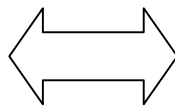
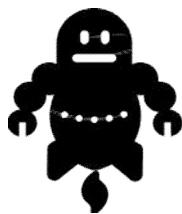
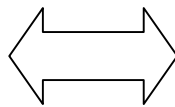
(D): In view of the properties of the search methods of engines used this time, enhancement in precision can be expected according to provision of a variety of turning patterns beforehand in reference to targeted figures similarly to negative/positive.

Issue ⑪

Part of the figures is lacking.

Part of the figures targeting for researches is lacking and the contour is varied as a whole.

〔⑪—1〕 Specific examples



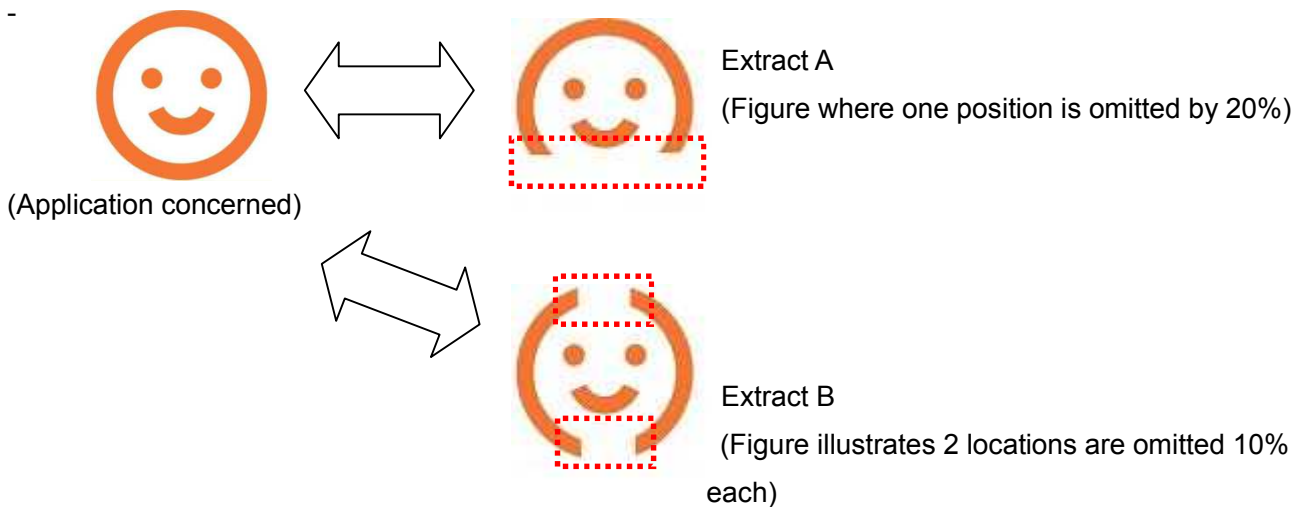
〔⑪—2〕 Difficulty degree of issues and general evaluation

Difficulty level of issues: LOW (Solvable with the current technology.)
General evaluation: When part of the targeted searching figures is lacking, while humans can comparatively easily complete the image, but they can only judge whether or not systems exist or whether or not they are the same. This point is shared with issue ⑫ (similarity according to concepts derived from figures) and issue ⑬ (due to figures to be well-known trademarks, the scope to judge as similar is wide). However, this issue has parts for trademarks in the application concerned and cited trademarks to become identical or similar searching object and local similarity searching also is an effective issue. In particular, judgment regarding identical or extremely similar parts is configured precisely even in the present status. When other elements than targeted searching figures exist in a large quantity in trademarks, in reference to a point to indicate matters with which level of coincidence shall preferentially be ranked on the upper level of extracted results, although there is a need to continue tuning after verifications, on a point coincident part can be discovered even it figures are lacking, this issue seems to already be on the level to respond to on the current technical level.

〔⑪—3〕 Analysis of issues

- Q1. Among identical or similar targeted searching figure, due to partially omission, since similarity as a whole falls in comparison with the case with no omissions, the point that the precision of extraction is degraded becomes a problem.
- A1. As compared with comprehensive similarity searching, local similarity searching is an especially effective issue. Even if part is omitted, existence of identical or similar part on the targeted searching part makes it possible to recognize on the search engine. However, in a case where part of the targeted searching figure parts have more characteristic points of other part in trademarks than identical figures, similar figure coincided with it can possibly be ranked on the upper level of searching.
- Q2. What sort of changes will occur in the searching precision according to lacking condition of figures?
- A2. As a major factor to decrease extraction precision, first of all, the ratio of omission becomes a problem. The part omitted, where “If the ratio of dissimilar figure part becomes plenty, similarity will decrease,” is common with other issues. Even in a case where omissions are made with the same ratio, the more the location of omissions, the lower the precision, For example, with regard to trademarks and cited trademarks, omission of 10% with each of two locations becomes more difficult than 20% with one location as a whole. This is because even if the ratio of coincidence is made 80% all together, when taking into account the similarity as a whole, the similarity as a big mass makes it easier for extraction.

(Examples in which precision varies according to lacking shapes of figures)



(Although the ratio of omission is common, extract B falls in extraction precision.)

Q3. Does the difference in extraction of precision come out according to omission in either side of trademark in the application concerned or cited trademark?

A3. Someone replied that the difference comes out distinctively according to the developers. When the figure of trademark in the application concerned is not omitted but the figure part of cited trademark is omitted, “the figure holding similar part with figure part of trademark in the application concerned” shall be searched. When the figure part of the trademark in the application concerned is omitted and that of the cited trademark is not omitted, the “figure partially holding the figure of the trademark in the application concerned shall be searched.” Resembled searching method as that might seem, as a local similarity searching engine, the former was said to easily be judged. However, at any rate, extraction of a coincided place with the trademark in the application concerned and cited trademark is possible and what figure with an appropriate coincidence should preferentially be extracted can be altered by tuning.

〔⑪—4〕 Main comment from developers

(A): As for issue ⑪, how far lacking is progressed is a problem. If lacked places are plenty, precision falls. Even if a part is lacked, if composition elements of the whole trademarks have common points, extraction of cited trademarks is possible.

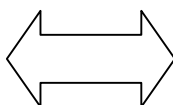
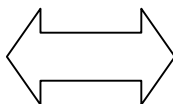
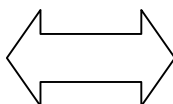
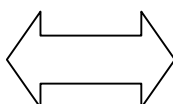
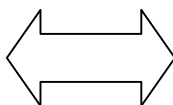
(D): Intrinsically, issue ⑪ is a strong part, and if characteristic points between trademarks in the application concerned and cited trademarks coincide even partially, extraction of cited trademarks can be conducted. When figures on the side of cited trademarks are omitted and accompanied by deformation, precision falls.

Issue ⑫

Similarity according to concepts derived from figures

Although the external shape of targeting for searches is varied, similarity is judged according to the concepts derived from figures.

〔⑫—1〕 Specific examples



〔12—2〕 Difficulty degree of issues and general evaluation

Difficulty level of issues: High (Definite solutions cannot be found at this time.)
General evaluation: Extraction of similar figures is in a difficult situation with image search technology alone. The developers as a whole expressed an impression of difficulty in respect to issues. As an indirect solving method, although there is a possibility to extract cited trademarks by accumulating ideological figures as a trademark in the database by machine learning, it is an unknown quality as to how much sample data is necessary. Similarity by a concept arising from figures, although searching according to the Vienna Classification is effective, as a prioritized point of image search, since prevention of human errors such as granting miss or the like of the Vienna Classification can be expected, still further technical development in the future can be expected. This issue requires a great deal of manpower for collection of reference figures , accumulation work and so forth as a solving method by current technology, in view of similarity patterns existing infinitely, in order to carry out high precision machine extraction, the technical problem is an immensely big issue.

〔12—3〕 Analysis of issues

Q1. Although this issue is similar as an image sensitized by human, due to a shortage of similar points as figures, in comparison among figures as a whole, the difficulty in extraction becomes a problem.

A1. Inasmuch as there is a fundamental reason lacking of similarity as figures, the enhancement of precision by technology to simply observe the similarity of figures is impossible under the current situation

Q2. Is there any method to mechanically search by image search engines?

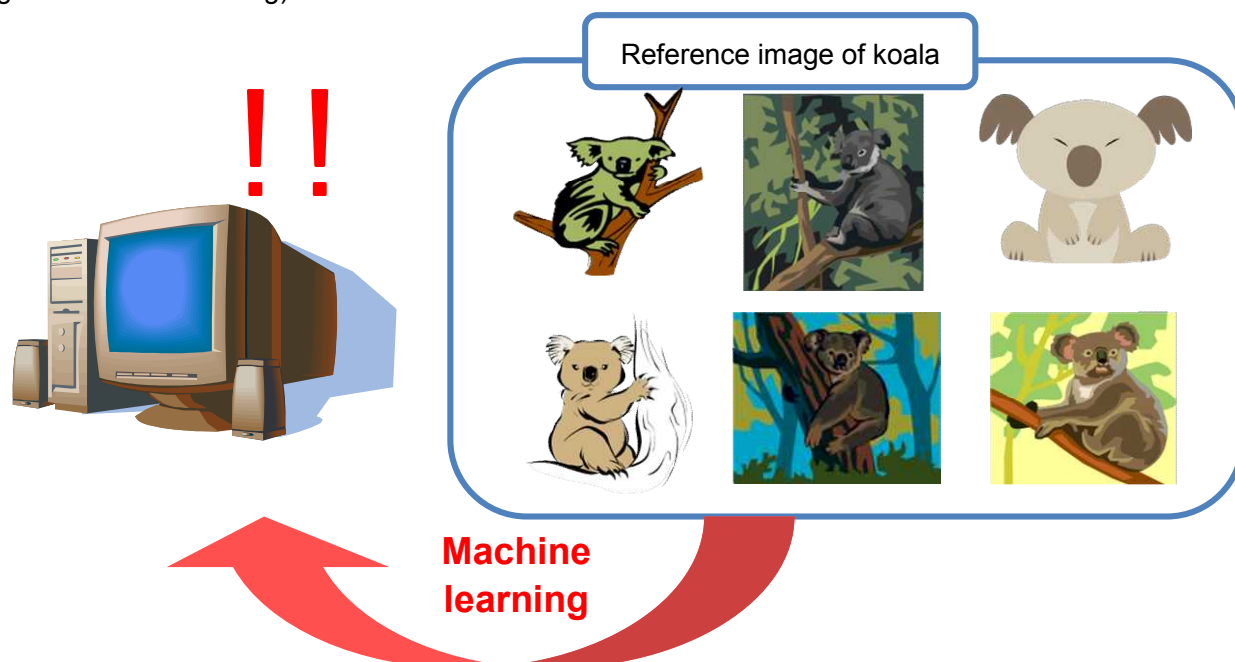
A2. As a countermeasure, by proceeding with mechanical learning to read into a search engine multiple units of figure information with a certain image, a judgment to read, “This figure pattern is liable to belong to classification of ○○,” becomes possible. As a method, in combination with aforementioned technology, “General object recognition,” becomes effective.

Q3. How many images are required for mechanical learning?

A3. There are no criteria in regard to the number of figure patterns to be stored. According to developers, reference information is better with larger quantities and categories and patterns of figures also are better with larger quantities. In the case of “koalas,” for example, similarly to the above examples, other than the above characterized example, actual photograph and face only, figures seen from horizontal directions and so on, it is desired that a wide variety of patterns are accumulated. For accumulation of information, accumulation of reference information based on the Vienna Classification attached to existing trademarks is also proposed. For example, it has been learned

that in the case of “koalas,” in the Vienna Classification, appropriate ones shall be accumulated from trademarks given the classification of “kangaroo, koala.”

(Image of machine learning)



〔12—4〕 Main comments from developers

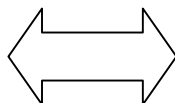
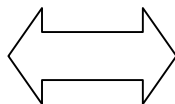
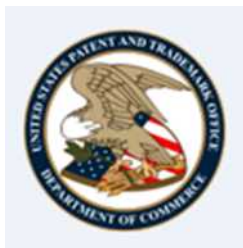
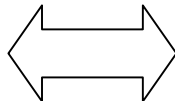
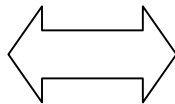
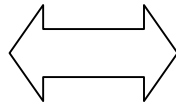
- (A): Issue 12 can be provided as a part of system although it is not a direct visual match by a combination with the Vienna Classification. Beside this, since search engines of our company have automatic identification functions (In addition to configurations and colors natural objects and artificial construction etc.), though it is not a concept itself, automatic classification can be carried out to some extent and extraction precision also can be enhanced by increasing this.
- (B): Issue 12 is difficult. With reference to conceptual similarity, it is considered there is no other way to enhance precision than by storing similar figure patterns in search engines as much as possible.
- (D): Local similarity search, due to the method based on characteristics in regard to figure appearance, conceptual similarity is difficult after all.
- (E): As figure searching, it does not aim at upper levels, but it is considered useful to aim at levels capable of searching correctly with granularity for around the level of figure classification.

Issue ⑬

Due to figures to be well-known trademarks, the scope to judge as similar is wide.

Since targeted searching figures are well-known as trademarks, in view of consolidation of its protection, the scope judged as similar is considered wider than usual. (though being approximate with the above ⑫, there is a case of dissimilarity by conceptuality.

〔⑬—1〕 Specific examples



〔13—2〕 Difficulty degree of issues and general evaluation

Difficulty level of issues: **High** (Definite solutions cannot be found at this time.)

General evaluation:

Regardless of going beyond a figural range, with reference to similarity within the purview recollected by humans, in harmony with issue ⑫ (similarity according to concepts derived from figures), in consideration of existing image search system itself, judgment is still in a difficult situation. Developers also comprehensively expressed sentiments of difficulty.

As a solution method deemed in current situations, though a method by machine learning is assumed for this issue, similar to issue ⑫, due to the variable scope of similarity according to the level of prominence, it was discovered there is a problem of difficulty in collecting samples than similarity by conception.

In addition, trademarks intentionally analogized with well-known trademarks (so to speak, parody trademarks), inasmuch as composition as trademarks as a whole are similar despite species of animals or the like varies, while persons well-known of distinguished trademarks can readily judge as similarity, when characteristic points as trademarks as a whole vary, judgment according to a system is difficult.

Although a method called machine learning was proposed from developers, due to difficulty in accumulation of samples and infinite existence of patterns judged as similar, in developing image search engines in parallel with issue ⑫, it is a supremely hard problem.

〔13—3〕 Analysis of issues

Q1. As for this issue, since the targeted searching figures are well-known, the impression of images to be recollected is strong, the scope to make it similar is inclined to be widened as compared with those which are not well-known trademarks.

A1. To say the impression of well-known trademarks is strong entirely depends on subjective view of humans, while mechanical similarity does not affect well-known properties. Similar to issue ⑫, the enhancement of precision by technology to simply view figures similarity is currently impossible.

Q2. Is there any method for searching mechanically by image search engine?

A2. As a countermeasure, similarly to similarity by conception of issue ⑫, according to accumulating machine learning to store figure information with similar to well-known images multiple pieces, it is possible to judge that “This figure pattern tends to be judged as similar to the well-known trademark ○○.” As a method, a combination with aforementioned technology “General Object recognition” becomes effective.

Q3. How many numbers of images is required for machine learning?

A3. Similarly to issue ⑫ there is no criteria how many patterns shall be stored. It says the more the better for reference information and the more the better for categories of figures and patterns.

However, aside from issue ⑫, the collection of reference images is a still further difficult problem. In regard to examples actually applied and judged as similarity, though there is a possibility to be collected, even in the same theme, inasmuch as Judgment might possibly be made as dissimilarity according to the outcome of design level, angles of the targeting figures for searches and so forth, it is not necessarily be said enough to collect figures simply with the same theme.

〔⑬—4〕 Main comments from developers

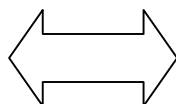
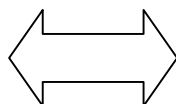
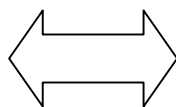
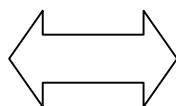
- (A): Though issue ⑬ is hard to judge similarity by direct search engines, it is possible to approach the high rank of similarity.
- (B): As for well-known trademarks, due to taking into consideration the enhancement of precision by storing as many as figures patterns intensively, regarding as similarity in search engines, solution of issue ⑬ is considered hard.
- (D): Elements of issue are considered to be a composition of existing patterns. In reference to test results, the propensity relevant to each coincided pattern came out.

Issue ⑭

Image search for the character parts of trademarks

Character parts in trademarks were searched as image data not as text data.

〔⑭—1〕 Specific examples



〔14—2〕 Difficulty degree of issues and general evaluation

Difficulty level of issues: **High** (Definite solutions cannot be found at this time.)

General evaluation:

In the initial stage of deliberation, due to the finiteness of type font, although it had been expected that the extraction precision may have readily been increased, character trademarks are frequently stylized and in reference to those stylized surpassing the range of general fonts, so it was said to be difficult to solve by ordinary character identification functions. Judgment to distinguish as to whether a certain element in the trademark is a character or figure depends on human subjective views, regarding the point, similarly to issue ⑫ (similarity according to concepts derived from figures) and issue ⑬ (due to figures to be well-known trademarks, the scope to judge as similar is wide), so mechanical judgment is difficult.

Although trademarks comprised of characters are capable of being searched for by analyzing composed characters and taking hold of text information of each language, in case of trademarks comprising from a combination of figures and characters, both figure searching and character searching are required to carry it out. If characters also become capable of being searched by image search engines, efficiency can be realized due to a reduction to one category of searching.

Inasmuch as the examination of trademarks is not limited to contrast observation only, searching for what is dissimilar as a figure is sometimes required. Ideological similarities between figures and characters, characters and characters may emerge. If machine learning is required for up to ideological similarity with respect to characters, a multitude of still further sample data becomes necessary to make countermeasures difficult.

Although the odds of the realization of perfect similarity searches have not been prepared yet by image search engine only, utilizing method of parallel use with existing text searching can be considered. Furthermore, taking into account the already developed high precision character identification technology for general fonts, application method of notations for foreign languages, characters and automatic preparations for text data or the like which are unfamiliar with overseas users.

〔14—3〕 Analysis of issues

- Q1. If the matters capable of being recognized as characters are searched as figures without using text information, due to the fall in similarity as figures according to differences in fonts and design, the decrease in extraction precision becomes a problem, this issue has dealt with.
- A1. Even if categories of character itself are finite, since classes of fonts and designs exist infinitely, targeted searching figures exist infinitely. If figures of application concerned and figures of cited trademarks are close, though characteristic points, searching with image search engines is possible, in a case where difference in fonts and designing is large, due to becoming dissimilar as figures, extraction of cited trademarks is difficult by simply comparing by figures. However, excessively

designed characters tend to become unable to be recognized as characters, the enhancement of the extraction precision by accumulating figure data in a degree capable of recognizing as characters is possible.

Q2. For example, in a case while the external shape is similar, internal patterns are different, is it possible to extract cited trademarks to upper levels?

A2. If tuning to put an emphasis on external shape is carried out, the enhancement of extraction precision can be expected. In case of characters, when specifying a species of characters, the external shape becomes important. In addition, due to the necessity to identify each character as a specific character, tuning with different propensity becomes necessary.

Q3. Regarding regular handwriting of the alphabet and Arabic and so on, can searching be conducted when characters are connected?

A3. If there are parts high in characteristic points with already registered data, extraction of cited trademarks is possible. As for this point, technology to find partial coincidences by characteristic points is effective. Although the precision falls when a character part to be a targeting object is excessively simplified, “when recognizing this figure as a character, indication of the closest character data is possible.” When you wish to search both figures and characters by image search engines, tunings suitable for each can be used, by indicating figural similarity searching results and searching results by character identification results separately.

〔⑭—4〕 Main comments from developers

(A): As for issue ⑭, if text information is acquired, extraction of cited trademarks is possible.

(B): It depends on how many types of characters' shapes can be recognized. The same character has a great many classes of font. It seems difficult to deal with all fonts.

(C): It is possible to extract cited trademarks in any language if the shape of the trademarks as a whole and composition is close. Although character is capable of accumulating case example data, it is unclear how far the quantity of fonts shall be contained.

(D): If the trademarks concerned and cited trademarks resemble each other graphically, extraction of cited trademarks is possible. Difference in design lowers precision. Since there is a technology to recognize characters, isn't this combination effective? We possess a strong technology in character identification. Printing types can be extracted nearly 100%. Although handwritten characters can be extracted if they are clear, extraction of ornamental characters and designed characters is difficult.

(E): As for characters, introduction of technologies for character identification and document analysis, these combination uses are considered useful.

(Issue pattern by difficulty level)

Thus far, after the analyses for 14 individual issues, the following results have been obtained by classifications according to difficulty degrees.

➤ Issue difficulty level: Low (Solvable with the current technology.)

Issue ①: Combination with other figures or characters (without contacted/overlapped parts)

Issue ⑥: The gradation (negative/positive) of figure colors are reversed.

Issue ⑦: The colors of figures vary.

Issue ⑪: Part of the figures is lacking.

➤ Issue difficulty level: Middle (Accuracy can be improved by tuning search engines.)

Issue ②: Combination with other figures or characters (contacted/overlapped parts)

Issue ③: With graphics to form a background, the contour of trademark appearances as a whole varies.

Issue ④: Several non-linked circles, lines or other shapes form a single figures.

Issue ⑤: The figures are drawn with light shade.

Issue ⑧: The analogous part of figures is small.

Issue ⑨: The vertical and horizontal ratios vary.

Issue ⑩: The direction of the figures varies.

➤ Issue difficulty level: High (Definite solutions cannot be found at this time.)

Issue ⑫: Similarity according to concepts derived from figures

Issue ⑬: Due to figures to be well-known trademarks, the scope to judge as similar is wide.

Issue ⑭: Image search for the character parts of trademarks

5. Comprehensive notable points for issues of image searches

In this section, we describe issues affecting over all search engines and notable points on system.

(1) The resolution of figures is low

Although we touched on this in the section for individual issues, the precision of searches increases when the resolution of figures rises to a maximum extent. However, at the same time, it is resulting in the increase in the data volume to affect the volume of system and search speed. Furthermore, since what is required of extreme high resolution data in application links to burdens of applicants, operations will be carried out with appropriate criteria set up for operations.

(2) Noises in image data

Compared with trademarks data electronically configured, what applied with paper are liable to generate noises in case of being digitized. For instance, when digitizing, although ignoring the color of paper and implementing processing for eliminating minute dusts will make data more accurate, in consideration of costs for processing, to remove a certain noise in image search engines or to prepare a specification for ignoring in searches is ideal. A technology to automatically clean to a certain extent has already been developed. Moreover, there also is a searching method with both methods of removed noise and kept it as it is.

(3) One trademark often has multiple issues.

There was a provision from each developer concerning the pattern classification, pointing out its validity. With regard to the development for the image search engine, although it will become to continue verifying the content of tuning, trademarks holding single issues only as a problem are rare in reality, and an actual state tells us that trademarks in combination with multiple issues are plenty. Accordingly, although it is a matter of course to verify the content of tuning after preparing artificial data specialized in issues for single bodies, well-balanced tuning adaptable to trademarks combined with multiple issues or the development combined with multiple search engines is essential.

6. Notable points on the occasion of the development for image search engines

In this section, we introduce what is required of in the development image search engines for the future.

(1) Notable points on the occasion of development for image search engines

Utilization methods for image search engines are considered in a variety of ways, there are many opinions from developers, delineating constant outcomes will be expected. However, if it proceeds with the development for engines by developers only, they were worrying about deviation from the functions really sought by users or to have grown to unsatisfactory products in regard to convenience.

Engines capable of products to markets cannot be developed from the beginning but development for prototype certainly is carried out. At a time when its prototype was developed, to set up the venue for opinion exchanges as to whether or not the result and judgment criteria conform to examiners' recognitions was required by a great many of developers. Coincidence with the targeting direction is important and harmonization with consciousness shall be expedited.

Developers had been showing the strongest interest in regard to carrying out key-part observation by examiners how far comprehending trademarks. In relation to designated commodities and designated services, even the same figure sometimes varies part to be the key part. If examples and judgment methods can be informed of as much as possible, developers can also increase confirmation patterns in verifications and use such machine learning data as conception similarity. For this reason, data that can be proposed should be provided as much as possible. These become substantial references when conducting tuning to judge local similarity.

Furthermore, from developers deliberating automatic grant for the Vienna Classification, opinions to be well informed of the method and concept are expressed. Asking examiners for trial use of developed system as a class of tools for checking the consistency of the Vienna Classifications and they asked for still further opinions in reference to its result. In particular, at the initial stage of database structuring, there were requirements for confirming as to whether or not the accumulating information data is correct. Aside from differences in figures genuinely from a mechanical viewpoint, if there is a judgment peculiar to trademarks examinations, the enhancement of precision can be expected by its incorporation.

(2) Specification of the searching scope and automatic extraction

When a human specify the searching scope, although skill and costs to judge the searching scope, technically it is in an adaptable condition currently. Inasmuch as the enhancement of precision by eliminating excessive information and carrying out searches is confirmed, to incorporate a mechanism specifying the searching scope into image search is effective. As a method to enhance the searching precision other than reform from the facet of system such as tuning and the development of searching method, it is one of the realistic and effective methods.

However, there still are a great many of issues with respect to automatic extraction of the searching scope. The problem is how the composition of targeted searching figures is judged. When specifying the

searching scope, to make the scope recognized by human and the scope recognized by system coincide becomes a big issue. Although human can quickly judge the concept of characters and figures or the conception of each figure, there is a problem as to how system understand as a composition. Regarding this point, if the precision of character identification functions increases, a character recognized as the character itself and the other part will be able to be searched as figures. However, to automatically judge further part of figures as a key part is difficult. As for the technology to judge a part in a figure, consolidating functions to judge local similarity of an image search engine itself and to make it possible to find partial coincidence will be realistic rather than automatic extraction of the searching scope.

7. Utilization method of image search system

In this section, we propose the utilization method for image search system.

(1) Grant subsidy for the Vienna Classifications

Currently, the Vienna Classifications has a few risks caused by human error to grant different classifications in spite of being similar figures due to the grant visually provided by human. With reference to searching the same or similar trademarks, in view of quality precision by existing search engines, as a function to propose candidates for the Vienna Classifications possessed by the same or similar figures for application matters, there was a proposal to make it possible to realize right away. In terms of supplementing human errors such as grant leakage, grant miss or the like of the Vienna Classifications, effective as it may seem, even if it becomes capable of automatically searching out candidates for the Vienna Classifications in the future, it absolutely is a function as suggestions and examiners are required to judge at the final stage.

(2) Parallel use with the Vienna Classification searches

Under the existing image search system, even though those who are not granted the Vienna Classification by artificial errors, if it is the same or closely resembled trademark, extraction of cited trademarks to upper level is possible.

Accordingly, in addition to the Vienna Classification searches, according to parallel uses for image search system, the precision of examinations can be enhanced.

(3) Provision as reference information for general users

Under the current state, when general users search for already registered or prior applied figurative trademarks, since the Vienna Classification shall be granted by themselves, there also are voices of general users to say figures searches using the Vienna Classifications are troublesome and difficult.

In figures searches according to image search system, since searches can easily be carried out due to readiness for searches by uploading inquiry figures or the like, there is no trouble and difficulty in granting the Vienna Classifications by themselves, and if the system is on the condition to search for the same or closely resembled trademark only, it functions effectively.

However, inasmuch not only the same or closely resembled but also similar figures are made examination targets, although extraction results obtained by condition "Searches are conducted the same or closely resembled trademarks only" are absolutely limited to provision as reference information, there is a constant convenience as abovementioned.

8. Conclusion

Deliberations for issues and countermeasures aiming to the development for existing image search engines, in cooperation with each Agency, compilation has been carried out to a certain extent by this project.

The image search engine which enables to completely replace the searches according to the Vienna Classifications has not yet been developed, and there were some without the prospect of future resolution according to issues. However, with respect to image search engines, parallel use with searches according to the Vienna Classifications and promoting the leveling for the Vienna Classification data or the like, existence of efficient points has been discovered in compliance with its utilization methods.

Even as research for image search engines recently has especially advanced, the development of engines which can be used independently in trademarks searches is the situation that will take much more times.

We will be happy if the information and outcomes obtained from this project will be utilized for future researches and so forth.