International Journal of Students' Research in Technology & Management
eISSN: 2321-2543, Vol 8, No 1, 2020, pp 01-10
https://doi.org/10.18510/ijsrtm.2020.811

COMPARATIVE ANALYSIS OF IMAGE RETRIEVAL TECHNIQUES IN CYBERSPACE

Rajeev Gupta[1*], Virender Singh[2]
[1]Assistant Professor, Department of Computer Sc. and Engineering, M. M. Engineering College, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, India, [2]Research Scholar, Computer Sc. and Applications, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, India.
Email: [1*]rajeev.gupta@mmumullana.org, [2]seh_74@yahoo.co.in

Article History: Received on 12th November 2019, Revised on 20th December 2019, Published on 26th January 2020

Abstract

Purpose: With the popularity and remarkable usage of digital images in various domains, the existing image retrieval techniques need to be enhanced. The content-based image retrieval is playing a vital role to retrieve the requested data from the database available in cyberspace. CBIR from cyberspace is a popular and interesting research area nowadays for a better outcome. The searching and downloading of the requested images accurately based on meta-data from the cyberspace by using CBIR techniques is a challenging task. The purpose of this study is to explore the various image retrieval techniques for retrieving the data available in cyberspace.

Methodology: Whenever a user wishes to retrieve an image from the web, using present search engines, a bunch of images is retrieved based on a user query. But, most of the resultant images are unrelated to the user query. Here, the user puts their text-based query in the web-based search engine and compute the related images and retrieval time.

Main Findings: This study compares the accuracy and retrieval-time of the requested image. After the detailed analysis, the main finding is none of the used web-search engines viz. Flickr, Pixabay, Shutterstock, Bing, Everypixel, retrieved the accurate related images based on the entered query.

Implications: This study is discussing and performs a comparative analysis of various content-based image retrieval techniques from cyberspace.

Novelty of Study: Research community has been making efforts towards efficient retrieval of useful images from the web but this problem has not been solved and it still prevails as an open research challenge. This study makes some efforts to resolve this research challenge and perform a comparative analysis of the outcome of various web-search engines.

Keywords**:** *CBIR, Image Retrieval, Cyberspace, Semantic.*

INTRODUCTION

In today's digital era, the internet has set an important position in our lives due to its tremendous growth. Electronic gadgets like smartphones, tabs, touchpad, laptops, etc. have inbuilt cameras of good quality to capture the images. Through these electronic gadgets, it has become easier to share these images or videos on the internet, with friends and the members of a family. However, this fact has to lead to a large number of images related to various domains whether desired or undesired being uploaded on cyberspace. Further, people from various domains like scientists, medicine, education, engineering, etc. are generating, uploading and sharing different digital images on the internet by various web-tools like photo-sharing web-portals (e.g. Pixabay, Flickr, Shutterstock, etc.) or social networks (e.g. Snapchat, Facebook, etc.). These shared images consist of different types of information inside itself. A significant amount of images shared on cyberspace are related to the real-life of a person. These images are very close to the social activities of the concerned person. The rapid growth of shared images on cyberspace has challenged many research problems and opportunities for a variety of real-life applications.

The retrieval of these images from the cyberspace is an interesting and challenging task. Whenever a user wishes to retrieve an image from the web, using present search engines, a bunch of images is retrieved based on a user query. But, most of the resultant images are unrelated to the user query. The user realizes overburdened in finding the exact image because useful images are scattered on different pages amongst the unrelated ones. Hence retrieval of the required image from this large collection is troublesome. On the other hand, the users are making random queries and conventional methods can not yield results efficiently and effectively, thus leaving the user unsatisfied most of the time. The research community has been making efforts towards efficient retrieval of useful images from the web but to date, this problem has not been solved and it still prevails as an open research challenge.

There are various types of image retrieval techniques including text-based, and content-based are proposed by many researchers to resolve the image retrieval issues. In this paper, the main aim is to perform the experimental analysis of existing image retrieval techniques for fetching the information from cyberspace.

LITERATURE REVIEW

Various software industries and research centers are working hard towards associating semantics with image retrieval

systems. This section highlights the work of eminent researchers and concentrates on the challenges which still need to be addressed.

Table 1: Literature on Image Retrieval from Cyberspace

Authors / Year	Literature Description
Belongie et al., 1998	The authors proposed a technique to retrieve the specific image from a large dataset of images. They were used texture and color feature as a key to retrieve the image based on segmentation.
Sciascio et al., 1999	They investigated and suggested a prototype image retrieval by the content-based system that uses shape, color and texture of an image. The authors suggested that specific strategies for the ranking in the web-based CBIR system had to be devised.
Lu et al., 2006	The authors suggested a new method for retrieving images, which were JPEG formatted. The characteristics of color, space, and texture, which were leased on the DCT domain, are taken for retrieving the image. this method directly retrieves the images in the DCT domain, without decompressing them.
Amanatiadis et al., 2011	They proposed an analysis based on the comparison between three variables for representing the shape and for retrieving it. Numerous coefficients are required for indexing and retrieving the images using shape as a feature. For the representation of shape, space in curvature scale, angular radial transform (ART) and image moment depiction were studied.
Akgül et al., 2011 Sasikala & Gandhi, 2015	Researchers have emphasized that the use of the CBIR system became popular for retrieving images especially radiology images for medical diagnosis from the large web-based database.
Komali et al., 2012	Authors proposed a technique that can be helpful to retrieve images depends upon their content-based query for better ranking and indexing in the database. Authors investigated that mostly web-based search engines provide metadata-based image filteration.
Yu et al., 2014	They developed a model to increase the performance of image re-ranking in an effective manner in a text-based image retrieval system. They explained the use of click prediction can be beneficial for increasing the level of performance of image re-ranking techniques.
Wang et al., 2014	Researchers suggested a new semantics-based image retrieval method, which follows the context as well as content-based user queries. The content of an image was divided into its salient features and the low-level features of the image, including color and texture used in the image.
Singh, V et al, 2016	Authors have analyzed the detailed survey and made a conclusion that none of the search-engine produced an accurate image retrieval result fetched from a web-based dataset available on the cyberspace.
Kumar, G et al., 2019	Norman AI retrieved the images i.e.Inkblot images from the database to perform Rorschach Test for psychological interpretation.

Splendid research has already been done in CBIR with different technologies. But, after the completion of the detailed survey since the year 1998 to 2019, a conclusion has been made that none of the search-engine produced an accurate image retrieval result fetched from a web-based dataset available on the cyberspace.

IMAGE RETRIEVAL TECHNIQUES IN CYBERSPACE

An image is worth more than ten thousand words. Image retrieval is a process by which a computer system handles the large database of digital images to retrieve the desired image in cyberspace, with the help of different internet browsing applications. Most conventional and common methods of adding metadata to the image such as adding some keywords, basic description related to image and introducing caption to the images, so that image retrieval process can be accomplished based on the keywords tagged with the images.

There are two approaches followed: Text-based and Content-based. Text-based Image Retrieval (TBIR) used annotations that were mapped manually to the pictures and these images were employed by the database for retrieving purpose. But on the other hand, in Content-based Image Retrieval (CBIR), content means that description concerning any explicit topic or description of one thing.

CBIR is also known as query by image content (QBIC), and it is also named as content-based visual information retrieval. It uses a computer application to retrieve the desired image from the database. Thus it suffers from the problem of finding a relevant image from the large databases. To overcome the problem of traditional concept-based approaches, the content-based method is used.

During the last decade, the size of image databases available on cyberspace is drastically increased. As an illustration, Flickr.com is an image hosting website and online community platform claims to host more than two billion images during the years from 2004 to 2007. Based on such types of huge-developments, most of the researchers suggested

various mechanisms for retrieving, accessing, annotating and cataloging such type of image data for effective usage in various domains such as Computer Forensics, Surveillance, Image transmission over secure WSN, Satellite images for further enhancement (Manocha, N. & Gupta, R., 2019), and Biomedical information management, etc. Thus, many researchers from different fields of science have focused their attention on image retrieval methods. In Figure-1, the number of images items has been described that the CBIR topic has been illustrated. CBIR is a set of challenging techniques that aim to retrieve semantically requested relevant image concepts from large-scale image databases.

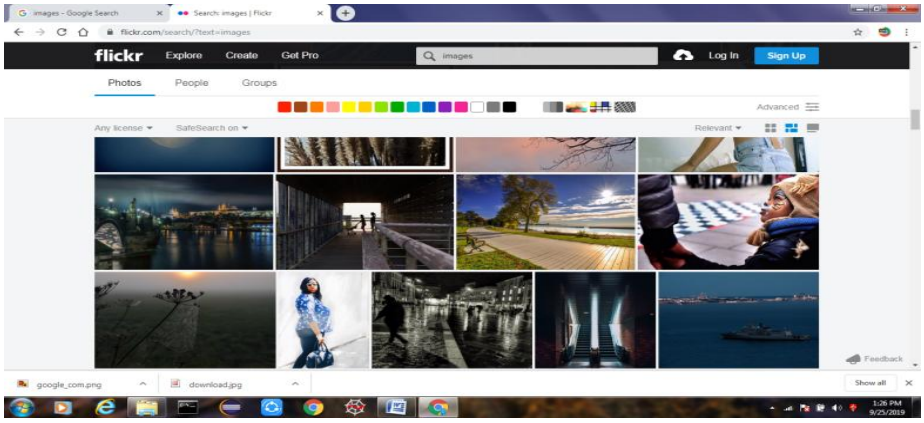

Figure 1: Different Image Retrieval from Cyberspace (source:flickr.com)

DATASET FOR IMAGE RETRIEVAL

For the experimental analysis, a specific dataset is used by authors. These datasets of images are available either on a local database or a remote database i.e. available on Cyberspace. These images are stored in the local database of the image or the database available on the cyberspace for their future processing. For computing, the complexity of a design of a Web-based image retrieving system, it is very difficult to understand the nature, type, purpose, scope, and quality of an image dataset. The proposed system design is mostly influenced by many factors like User-traffic over system, purpose, and usage of the dataset, expected image transmission technique over Wireless Sensor Network (Dalia, R. & Gupta, R., 2019). Normally, the dataset used in research can be categorized into the following segments:

Archives: In this segment large volume of heterogeneous data related to specific domains can be stored. The dataset stored in archives can be in the form of structured, semi-structured or hybrid-structured.

Domain-Specific Dataset: In this segment, homogeneous or heterogeneous data can be stored. But, stored data may be related to some specific domain to achieve particular objectives. Such types of collections are having controlled access by authorized users. E.g. Satellite image data set used by NASA and ISRO, etc.

Enterprise-Dataset: In this segment, homogeneous or heterogeneous data can be stored. But, stored data may be related to a specific organization. Such types of collections are accessed by controlled users over a local intranet.

Personal Dataset: In this segment, homogeneous data can be stored related to the social activities of a person. Generally, the stored data available in small size, accessible by the owner of that dataset. Such types of data are stored in the local system.

Web Dataset: Images stored on the web, generally accessible to everyone with an internet connection.

Local databases provide a direct view of the folders present on a user's hard disk. Such type of databases restricts the users to see the images only. The user does not have any authorization for updating the organization features of data. Local databases give maximum flexibility to their users and present the same data in front of the user what the user has created on the local system. While they provide maximum flexibility, manual organizers rely on the user to have his/her own method to organize their images.

Cyberspace databases provide the data from a remote system available in different locations. Cyberspace refers to an interactive domain-specific system based on the digital global network available on the web for storing, managing, retrieving the data. It is a large database available on worldwide computer networks to aid in communication and data exchange activities. It is a virtual and interactive web-space for a broad range of authorized users. Cyberspace databases are beneficial to all users for exchanging their business ideas, sharing as well as accessing the domain-specific information, conducting meetings or enhance social activities, etc. Data especially images stored in cyberspace databases are known as web-images, which are easily accessible to authorized users via the help of an internet connection. In cyberspace databases, the large volume of homogeneous or heterogeneous data can be stored. The dataset stored in such types of databases can be in the form of structured, semi-structured or hybrid-structured related to a specific domain to

achieve particular objectives. Many web servers are available in the cyberspace from where we get the images. Such as pixabay.com, shutterstock.com, everypixal.com, bing.com, flickr.com, etc.

Flickr.com is an image hosting service website created in 2004 with a vision to provide optimized results. Flickr has an official mobile app for Android as well as iOS mobile users. Figure-2 shows the image retrieval for the book with pen and flower from flickr.com.

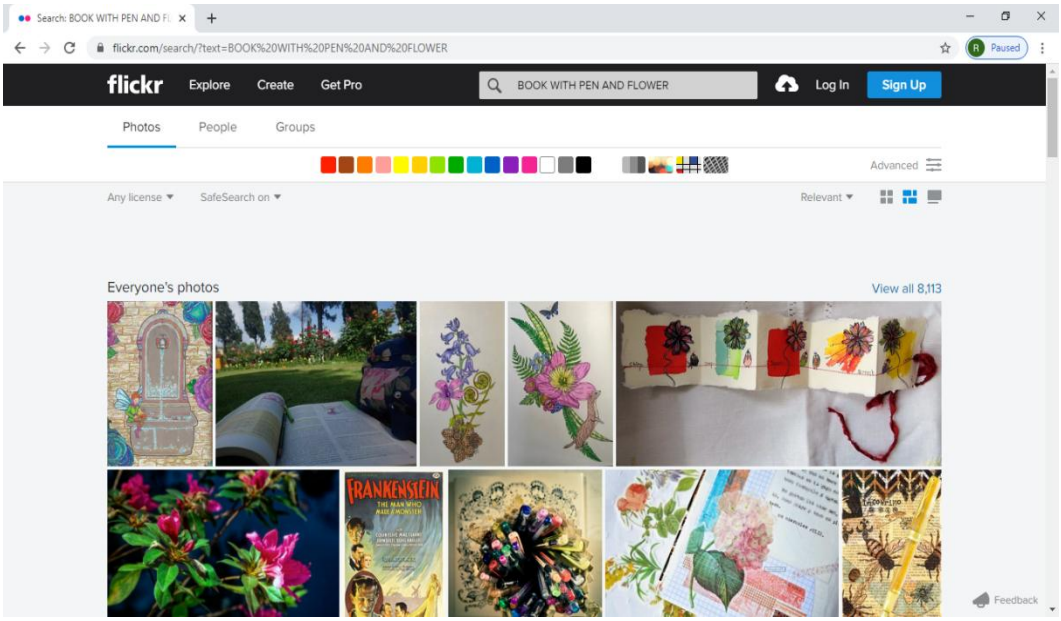

Figure 2: Image retrieval for Book with pen and flower from filckr.com

Pixabay.com is also an image hosting website for retrieving the free-to-use web-images accessible by authorized users at the international level. Pixabay offers around 12 lacs free web-images, vector graphics, illustrations and film footage in the cyberspace as of November 2017. Figure-3 shows the image retrieval for the book with pen and flower from pixabay.com.

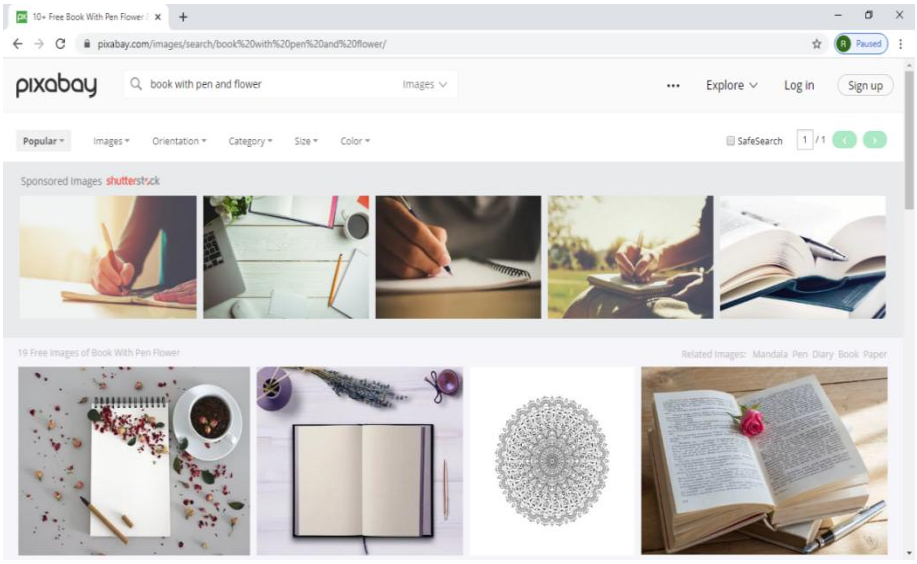

Figure 3: Image retrieval for Book with pen and flower from pixabay.com

Bing.com is a web-based search engine, which provides various search services like domain-specific images, videos, news, music, maps, locations, and other search services available on the cyberspace. Bing is a product of Microsoft. It is an extended version of Microsoft's previous search engines (MSN Search, Windows Live Search and Live Search). Figure-4 shows the image retrieval for a lion from bing.com.

Shutterstock is an internationally web-based service provides of photos, music, videos, editing tools and other footages of live events. It was founded by Jon Oringer, an American photographer as well as a programmer in the year 2003. This cyberspace database maintains a huge-collection of royalty-free photos, music, videos, illustrations, vector graphics and

more. The company had over 100,000 contributors as of March 2016, with an "active customer base of 1.4 million people in 150 countries" with around 200 million collections in the library. Figure 5 shows the image retrieval for a lion from shutterstock.com.

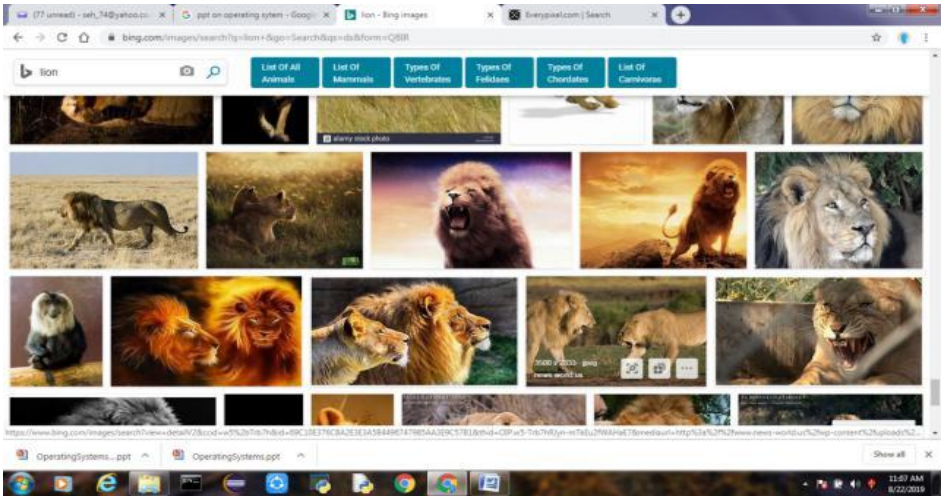

Figure 4: Image retrieval for lion from bing.com

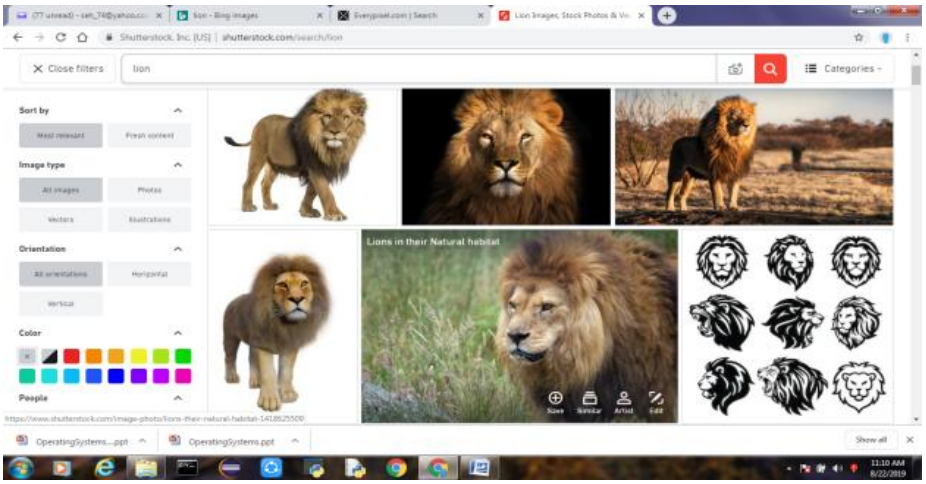

Figure 5: Image retrieval for lion from shutterstock.com

Everypixel.com is also an image hosting website for retrieving the free-to-use web-images, illustrations, film footage and vector graphics accessible by authorized users at the international level. It removes the redundancy of images and also provides the right links of the real image sources. This web-based database aggregates all the licensed content from

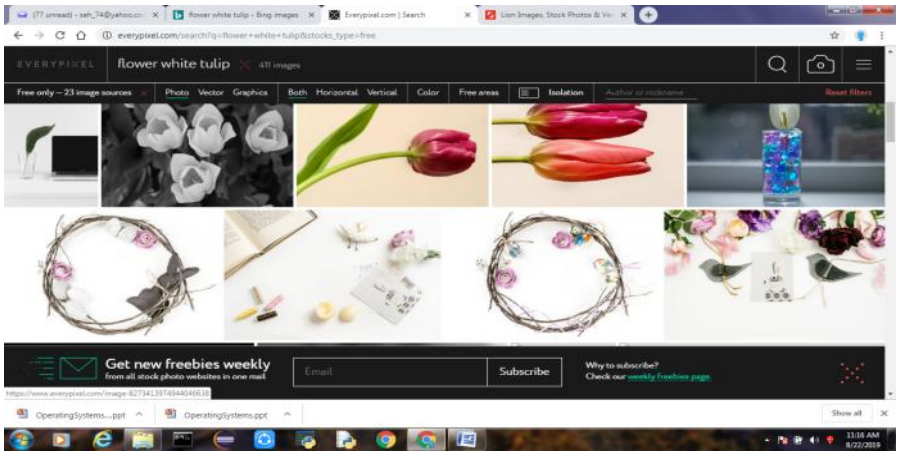

Figure 6: Image retrieval for flower white tulip from everypixel.com.

all the relevant agencies. Figure-6 shows the image retrieval for flower white tulip from everypixel.com.

FINDINGS / RESULTS

After performing the experimentation, the following results have been fetched on the basis of given sample same queries to different web-based search engines. The following tables illustrate the related images retrieved, time taken (in a sec) and accuracy (in %) on different data set sizes like 100, 200 and 300 images performed on various web-based search engines.

Table 2: Related image retrieval accuracy from www.flickr.com

www.flickr.com										
Sr. No.	**Query for Image**	**Data Set Size - 100**			**Data Set Size - 200**			**Data Set Size - 300**		
		Related Images Retrieved	**Time Taken (in Sec)**	**Accuracy (%)**	**Related Images Retrieved**	**Time Taken (in Sec)**	**Accuracy (%)**	**Related Images Retrieved**	**Time Taken (in Sec)**	**Accuracy (%)**
1	APPLE RED	65	0.29	65	125	0.29	62.5	165	0.29	55.00
2	BOOK WITH PEN	15	0.37	15	36	0.37	18	45	0.37	15.00
3	BOOK WITH PEN AND FLOWER	11	0.42	11	19	0.42	9.5	25	0.42	8.33
4	BOOK WITH PEN AND ROSE FLOWER	5	0.42	5	9	0.42	4.5	16	0.42	5.33
5	MOTOR CYCLE	62	0.38	62	102	0.38	51	125	0.38	41.67
6	MOTOR CYCLE WITH HELMET	35	0.43	35	65	0.43	32.5	86	0.43	28.67
7	SNAKE COBRA	75	0.31	75	145	0.31	72.5	189	0.31	63.00
8	FLOWER ROSE RED	90	0.26	90	175	0.26	87.5	201	0.26	67.00
9	BANANA WITH APPLE	72	0.36	72	124	0.36	62	145	0.36	48.33
10	FlOWER TULIP PINK	81	0.24	81	152	0.24	76	201	0.24	67.00

Table 3: Related image retrieval accuracy from www.shutterstock.com

www.shutterstock.com										
Sr. No.	**Query for Image**	**Data Set Size - 100**			**Data Set Size - 200**			**Data Set Size - 300**		
		Related Images Retrieved	**Time Taken (in Sec)**	**Accuracy (%)**	**Related Images Retrieved**	**Time Taken (in Sec)**	**Accuracy (%)**	**Related Images Retrieved**	**Time Taken (in Sec)**	**Accuracy (%)**
1	APPLE RED	93	0.16	93	165	0.16	82.5	205	0.16	68.33
2	BOOK WITH PEN	55	0.24	55	102	0.24	51	134	0.24	44.67
3	BOOK WITH PEN AND FLOWER	35	0.39	35	81	0.39	40.5	91	0.39	30.33
4	BOOK WITH PEN AND ROSE FLOWER	37	0.35	37	55	0.35	27.5	65	0.35	21.67
5	MOTOR CYCLE	61	0.25	61	95	0.25	47.5	124	0.25	41.33
6	MOTOR CYCLE WITH HELMET	12	0.34	12	21	0.34	10.5	29	0.34	9.67
7	SNAKE COBRA	65	0.29	65	105	0.29	52.5	145	0.29	48.33
8	FLOWER ROSE RED	50	0.28	50	79	0.28	39.5	102	0.28	34.00

9	BANANA WITH APPLE	61	0.39	61	112	0.39	56	95	0.39	31.67
10	FlOWER TULIP PINK	79	0.32	79	145	0.32	72.5	179	0.32	59.67

Table 4: Related image retrieval accuracy from www.bing.com

www.bing.com

Sr. No.	Query for Image	Data Set Size - 100			Data Set Size - 200			Data Set Size - 300		
		Related Images Retrieved	Time Taken (in Sec)	Accuracy (%)	Related Images Retrieved	Time Taken (in Sec)	Accuracy (%)	Related Images Retrieved	Time Taken (in Sec)	Accuracy (%)
1	APPLE RED	92	0.22	92	165	0.22	82.5	190	0.22	63.33
2	BOOK WITH PEN	77	0.32	77	145	0.32	72.5	168	0.32	56.00
3	BOOK WITH PEN AND FLOWER	65	0.43	65	85	0.43	42.5	95	0.43	31.67
4	BOOK WITH PEN AND ROSE FLOWER	33	0.46	33	52	0.46	26	65	0.46	21.67
5	MOTOR CYCLE	86	0.24	86	151	0.24	75.5	186	0.24	62.00
6	MOTOR CYCLE WITH HELMET	0	0.43	0	0	0.43	0	0	0.43	0.00
7	SNAKE COBRA	90	0.28	90	170	0.28	85	175	0.28	58.33
8	FLOWER ROSE RED	91	0.27	91	185	0.27	92.5	250	0.27	83.33
9	BANANA WITH APPLE	51	0.35	51	75	0.35	37.5	95	0.35	31.67
10	FlOWER TULIP PINK	91	0.34	91	175	0.34	87.5	262	0.34	87.33

Table 5: Related image retrieval accuracy from www.everypixel.com

www.everypixel.com

Sr. No.	Query for Image	Data Set Size - 100			Data Set Size - 200			Data Set Size - 300		
		Related Images Retrieved	Time Taken (in Sec)	Accuracy (%)	Related Images Retrieved	Time Taken (in Sec)	Accuracy (%)	Related Images Retrieved	Time Taken (in Sec)	Accuracy (%)
1	APPLE RED	89	0.26	89	161	0.26	80.5	186	0.26	62.00
2	BOOK WITH PEN	75	0.31	75	86	0.31	43	175	0.31	58.33
3	BOOK WITH PEN AND FLOWER	19	0.52	19	45	0.52	22.5	42	0.52	14.00
4	BOOK WITH PEN AND ROSE FLOWER	17	0.54	17	24	0.54	12	26	0.54	8.67
5	MOTOR CYCLE	85	0.21	85	121	0.21	60.5	168	0.21	56.00
6	MOTOR CYCLE WITH HELMET	45	0.42	45	71	0.42	35.5	82	0.42	27.33
7	SNAKE COBRA	86	0.26	86	161	0.26	80.5	160	0.26	53.33
8	FLOWER ROSE RED	89	0.25	89	180	0.25	90	259	0.25	86.33
9	BANANA WITH APPLE	46	0.36	46	85	0.36	42.5	125	0.36	41.67
10	FlOWER TULIP PINK	88	0.35	88	171	0.35	85.5	273	0.35	91.00

Table 6: Related image retrieval accuracy from www.pixabay.com

www.pixabay.com										
Sr. No.	**Query for Image**	**Data Set Size - 100**			**Data Set Size - 200**			**Data Set Size - 300**		
		Related Images Retrieved	**Time Taken (in Sec)**	**Accuracy (%)**	**Related Images Retrieved**	**Time Taken (in Sec)**	**Accuracy (%)**	**Related Images Retrieved**	**Time Taken (in Sec)**	**Accuracy (%)**
1	APPLE RED	86	0.12	86	156	0.12	78	161	0.12	53.67
2	BOOK WITH PEN	89	0.25	89	125	0.25	62.5	164	0.25	54.67
3	BOOK WITH PEN AND FLOWER	25	0.52	25	40	0.52	20	41	0.52	13.67
4	BOOK WITH PEN AND ROSE FLOWER	15	0.61	15	24	0.61	12	25	0.61	8.33
5	MOTOR CYCLE	87	0.24	87	128	0.24	64	135	0.24	45.00
6	MOTOR CYCLE WITH HELMET	56	0.52	56	78	0.52	39	80	0.52	26.67
7	SNAKE COBRA	89	0.12	89	159	0.12	79.5	165	0.12	55.00
8	FLOWER ROSE RED	90	0.32	90	178	0.32	89	251	0.32	83.67
9	BANANA WITH APPLE	45	0.36	45	81	0.36	40.5	123	0.36	41.00
10	FlOWER TULIP PINK	86	0.42	86	167	0.42	83.5	265	0.42	88.33

With the results fetched, figure-7, figure-8, and figure-9 show the graphical representation of experimental analysis with the concern of accuracy of image retrieval from different web-based databases available on cyberspace on data set size 100, 200 and 300 images respectively.

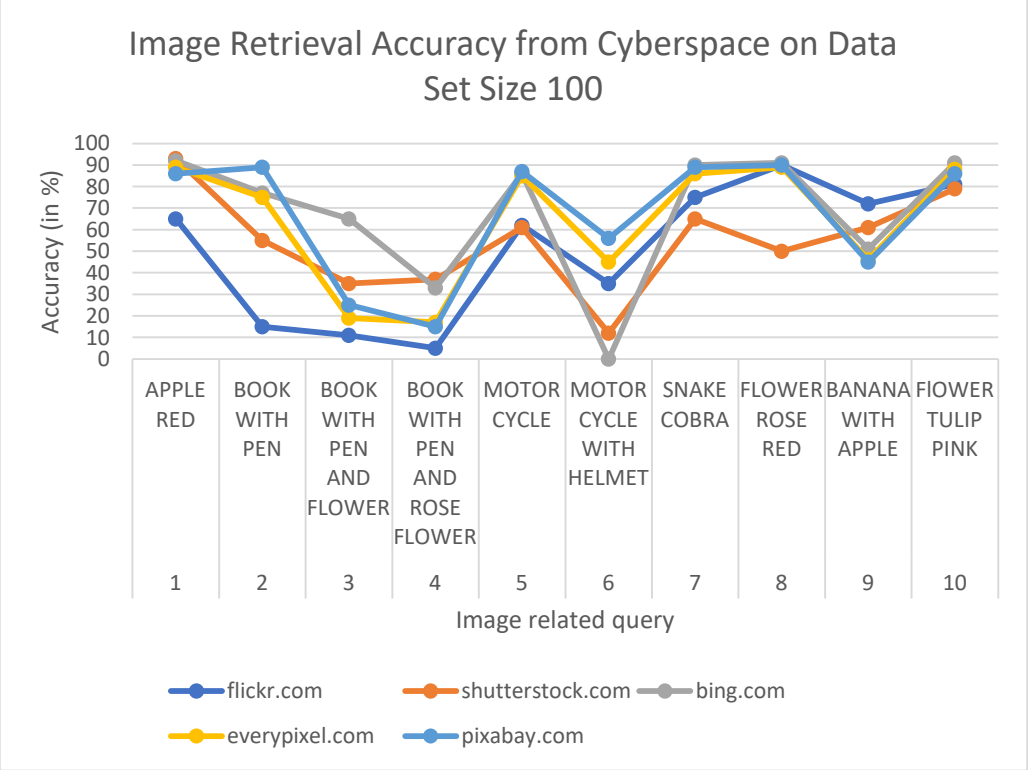

Figure 7: Image Retrieval Accuracy from Cyberspace on Data Set Size 100

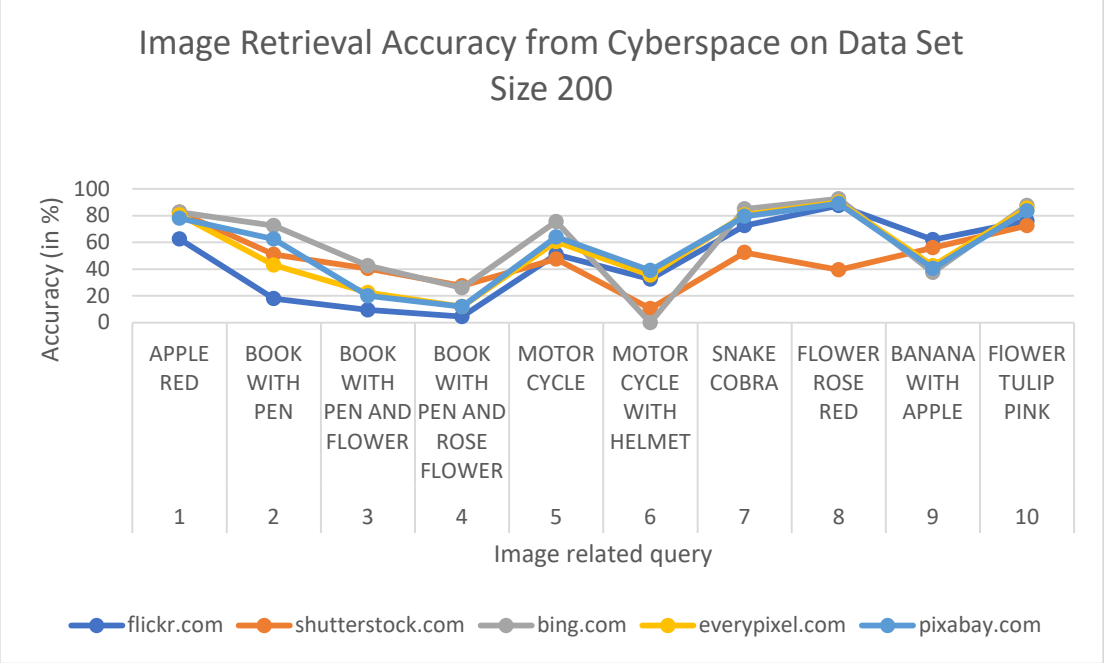

Figure 8: Image Retrieval Accuracy from Cyberspace on Data Set Size 200

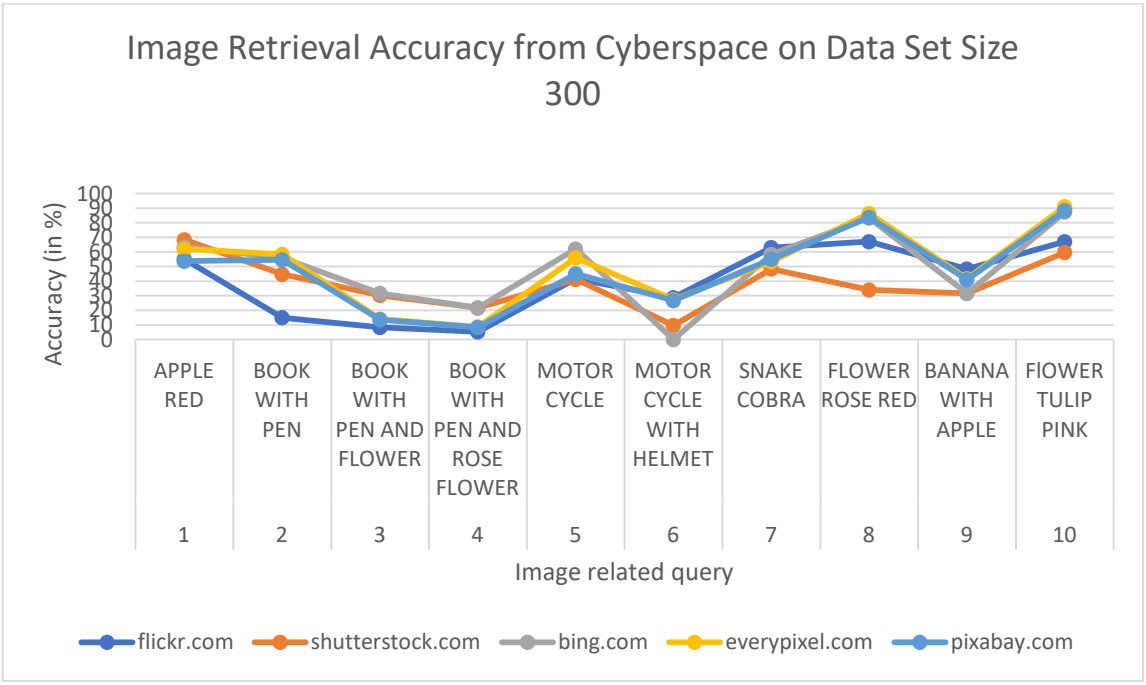

Figure 9: Image Retrieval Accuracy from Cyberspace on Data Set Size 300

CONCLUSION

As people are uploading and downloading images frequently, hence the retrieval of the required image has become a promising area of research nowadays, due to its utility. The search tools e.g. pixabay.com, shutterstock.com, everypixal.com, bing.com, flickr.com, etc. Searches the images by using textual annotation of the image. The recently developed techniques of image retrieval have been discussed in the paper.

LIMITATION AND FUTURE SCOPE

This comparative analysis of image retrieval techniques was carried out and the results obtained were successful. However, a further enhanced framework can be proposed to improve the accuracy of the searched image from cyberspace.

CONFLICT OF INTEREST AND ETHICAL STANDARDS

There is no conflict of interest with the present organization and no unethical practices followed in the completion of this study.

ACKNOWLEDGMENT

Authors are greatly thankful and wish to acknowledge Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, India for providing the facilities and new path to explore this area of research.

REFERENCES

1. Akgül, C. B., Rubin, D. L., Napel, S., Beaulieu, C. F., Greenspan, H., & Acar, B. (2011), Content-based image retrieval in radiology: current status and future directions. *Journal of Digital Imaging*, 24(2), 208-222. https://doi.org/10.1007/s10278-010-9290-9
2. Amanatiadis, A., Kaburlasos, V. G., Gasteratos, A., & Papadakis, S. E. (2011), Evaluation of shape descriptors for shape-based image retrieval. *IET Image Processing*,5(5), 493-499. https://doi.org/10.1049/iet-ipr.2009.0246
3. Belongie, S., Carson, C., Greenspan, H., & Malik, J. (1998), Color-and texture based image segmentation using EM and its application to content-based image retrieval. *IEEE 6th International Conference on Computer Vision*, 675-682. https://doi.org/10.1109/ICCV.1998.710790
4. Dalia,R. & Gupta, R. (2019), Comparison of Image Compression Methods for Image Transmission Over Wireless Sensor Network. *Journal of Computational and Theoretical Nanoscience*, 16, 3912-3916. https://doi.org/10.1166/jctn.2019.8270
5. Di Sciascio, E., Mingolla, G., & Mongiello, M. (1999), Content-based image retrieval over the web using query by sketch and relevance feedback. *Visual Information and Information Systems, Springer Berlin Heidelberg*. 123-130. https://doi.org/10.1007/3-540-48762-X_16
6. Komali, A., Kumar, V. S., Babu, K. G., & Ratnam, A. S. K (2012). 3D color feature extraction in content-based image retrieval. *International Journal of Soft Computing and Engineering*, 2(3), 560-563.
7. Kumar, G., Singh, G., Bhatanagar, V., & Jyoti, K. (2019). Scary Dark Side of Artificial Intelligence: A Perilous Contrivance to Mankind. *Humanities & Social Sciences Reviews*, 7(5), 1097-1103. https://doi.org/10.18510/hssr.2019.75146
8. Lu, Z. M., Li, S., & Burkhardt, H. (2006), A content-based image retrieval scheme in JPEG compressed domain *International Journal of Innovative Computing, Information and Control*, 2(4), 831-839.
9. Manocha, N. & Gupta, R. (2019), A Comparative Analysis of Existing Satellite Image Enhancement Techniques for Effective Visual Display, *Journal of Computational and Theoretical Nanoscience*, 16, 4003-4007. https://doi.org/10.1166/jctn.2019.8285
10. Sasikala, S., & Gandhi, R. S. (2015), Efficient Content Based Image Retrieval System with Metadata Processing. *International Journal for Innovative Research in Science and Technology*, 1(10), 72-77.
11. Singh, V. & Gupta, R (2016), Semantic Based Image Retrieval from Cyberspace: A Review Study, *International Jouurnal of Advanced Research in Computer Science. 7(4)*, 16-21.
12. Wang, X., Qiu, S., Liu, K., & Tang, X. (2014). Web Image Re-Ranking Using Query-Specific Semantic Signature. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 36(4), 810-823. https://doi.org/10.1109/TPAMI.2013.214
13. Yu, J., Rui, Y., & Tao, D. (2014), Click prediction for web image re-ranking using multimodal sparse coding. *IEEE Transactions on Image Processing*, 23(5), 2019-2032. https://doi.org/10.1109/TIP.2014.2311377

