Face Detection using Haar Cascades to Filter Selfie Face Image on Instagram

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***Abstract*—Instagram is one of the fastest growing social media in recent years. Instagram is a popular social media that is used to share images. An image search on Instagram can use a particular keyword or often called hashtag. There are no rules in giving hashtag when users upload pictures. It makes the hashtag given sometimes not related to the uploaded image. There are images whose contents are dominated by selfie face. It causes the background image or location of an image not to be conveyed entirely. The purpose of this study is to filter selfie face images on search results based on hashtags on Instagram by combining web data extraction technique and human face detection technique using the Haar Cascade method. The experiment was carried out by determining several hashtags as the basis for image search on Instagram. Experimental results show that the applied method produces an accuracy value of 71.48% for detecting human faces. According to the result of human face detection, Haar Cascade method can filter selfie face images that have an accuracy value of 64,6%. We use this assumption because basically, selfie face images contain a human face.**

Keywords—face detection, Haar Cascades, filter selfie images, Instagram image search, web data extraction

I. INTRODUCTION

Social media is overgrowing along with technological developments. The growth makes internet users spend more time on social media than on search engines [1]. Instagram is one of the fastest growing social media in recent years [2]. Based on data from Techcrunch, Instagram has become one of the social media platforms with the most rapid development, which is 1 billion users in June 2018 [3] which has increased from 600 million users in April 2017 [4]. Indonesia is a country with the largest Instagram users in the Asia Pacific, with a total of 45 million users [5].

Instagram is a popular social media that is used to share images [6]. It makes the number of images on social media very abundant. It's impossible to be sure, but the number of images on social media can be counted in billions [7]. The abundance of images on social media, especially Instagram, makes Instagram a reference for people to look for an overview of a tourist place or location in an area.

An image search on Instagram can use a particular keyword or often called hashtag [8]. There are no rules in giving hashtag when users upload images. It makes the hashtag given sometimes not related to the uploaded image. Results indicate that most relevant topics and similarity between content topics of images associated with a particular hashtag description is low [9]. Although there is a link between hashtags and images uploaded by users, there are still images whose contents are dominated by selfie face. It causes the background image or location of an image not to be conveyed entirely.

The purpose of this study is to filter selfie face images on search results based on hashtags on Instagram by combining web data extraction technique and human face detection technique using the Haar Cascade method. We use this method because it is simplicity and effectiveness [10]. Regarding reliability and speed for face detection from a picture, haar cascade classifier method is one of the best detectors [11]. Another reason is due to this method can be used in real time application [12].

II. LITERATURE REVIEW

A. Social Media Image Relevance

In recent years, several studies discuss the relationship between topic content and images on social media:

Fiallos, A. et al. [13], shows a methodology to recognize relevant content topics of images related to a particular hashtag through computer vision tools and text mining methods. There are 7382 images associated with the hashtag #allyouneedisecuador were gathered to support this purpose. Results show the most relevant topics and that the similarity between both descriptions is low.

Liu, S. et al. [14], exploits social data from social media platforms to assist image search engines, aiming to improve the relevance between returned images and user intentions (i.e., social relevance). Facing the challenges of social data sparseness, the tradeoff between social relevance and obvious relevance, and the complex social and visual factors, a community-specific Social-Visual Ranking (SVR) algorithm was used to rerank the Web images returned by current image search engines.

B. Human Face Detection

In recent years, several studies discuss human face detection, especially using Haar Cascade Classifier:

Singh, V. et al. [11], studies the problem of face detection in the first attempt using a method named haar cascade classifier from images containing simple and complex backgrounds. They use a library named OpenCV to perform the haar cascade classifier method. Haar cascade classifier gives high accuracy even the illumination strongly

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affects the image. The haar cascade classifier method has shown superior performance with simple background images.

Rani, P.I., and Muneeswaran, K. [15], proposes a robust and automatic method to detect human faces from the background that is able of processing images fast while reaching high detection rates from video sequences. In this research, Haar-like rectangle features are processed very quickly using the integral image that is most compatible for face/non-face classification. The experimental result is presenting assuring results by conducting the experiments on video sequence as against the existing work on images.

Savaş, B.K. et al. [16], uses Haar Cascade Classifiers to take instant images by the mobile device. The medium of the image is analyzed, and faces of the people are detected. The research shows that the system works successfully.

III. METHODOLOGY

The filtering selfie face image process on Instagram consists of three step "Fig. 1".

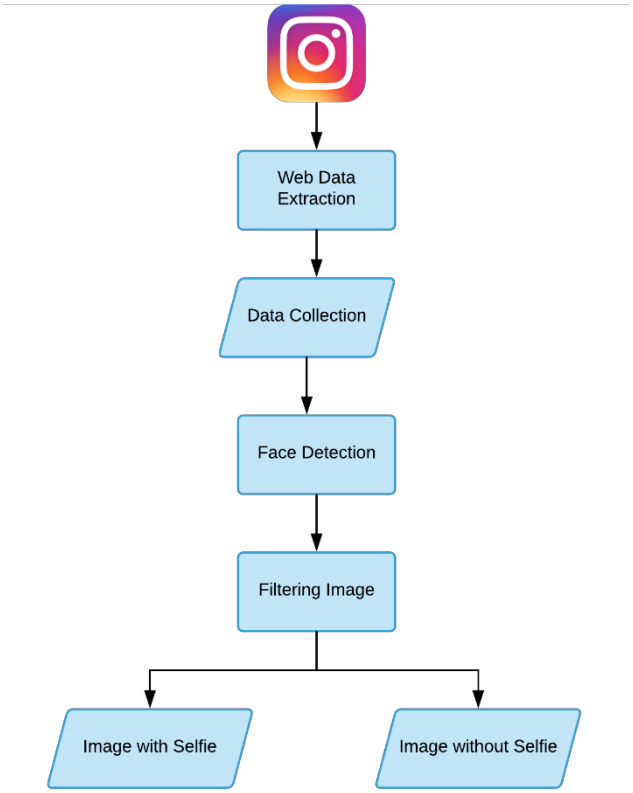

Fig. 1. Framework for filtering selfie face image on Instagram.

A. Web Data Extraction

The uploaded image on Instagram consists of three essential parts, namely: uploaded image, a caption that is the core of the message, and hashtag. Hashtags written with symbols # are used to index keywords or topics on Instagram. This function is created on Instagram and allows users to follow topics that they are interested in easily. Fig. 2, illustrates the basic anatomy of a search using a hashtag.

The image collection process utilizes the beautifulsoup library to extract image data from Instagram. The image search results based on specific hashtags on this system are in the form of JSON. From the JSON, the data needed in this study is taken. The data received is a link from the picture.

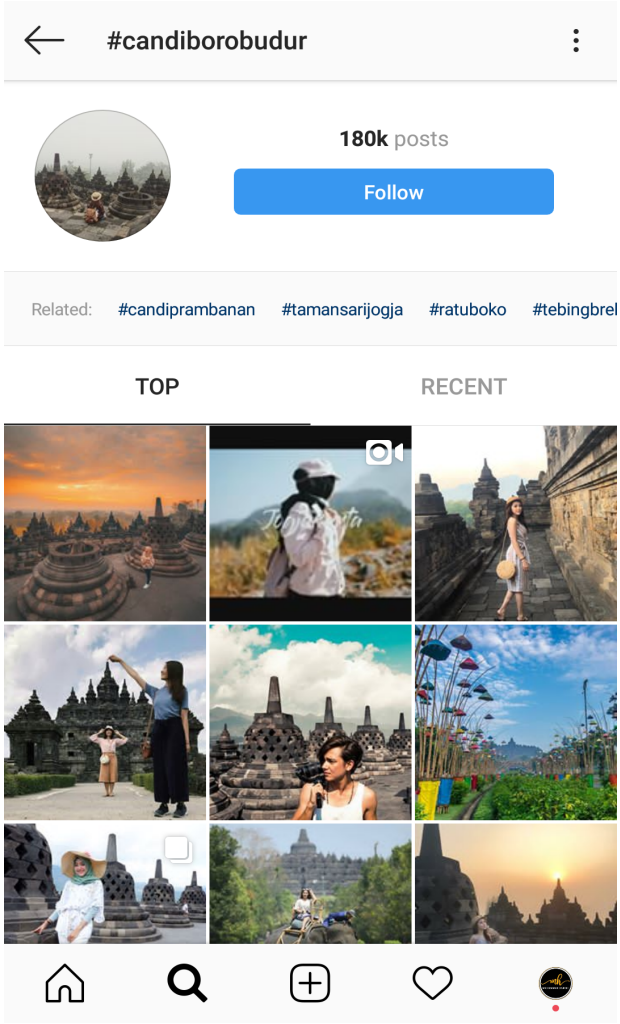

Fig. 2. An image search on Instagram based on a hashtag.

B. *Haar Cascade Classifier* for *Human Face Detection*

In this research, we implement Haar Cascade Classifier to detect human faces using an Open Source Computer Vision Library named OpenCV [17]. Initially, this method was given by Paula Voila and Michael Jones [18]. For human face detection, haar features are the main part of haar cascade classifier. Haar features are used to detect the existence of features in the given image [11]. Each feature produces a single value that is calculated by subtracting the number of pixels under the white rectangle from the number of pixels under the black rectangle. Haar features are the rectangle features for rapid human face detection "Fig. 3".

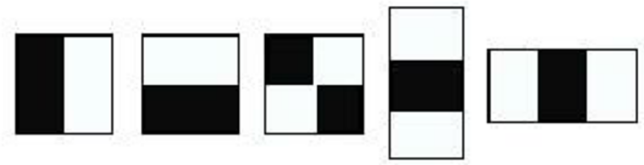

Fig. 3. Haar features.

Haar-like features scanning is done on the image to detect human faces, starting from the upper left corner and ending in the lower right corner of the image "Fig. 4". Scanning is done several times to detect human faces in an image.

Fig. 4. Haar like features scan in images.

To calculate rectangular features quickly, the concept of integral images is used. Four values are needed in the rectangular corners for calculation of the number of pixels in the given rectangle. In the integral image, the value is in pixels (x, y) is the number of pixels above and on the left (x, y).

A 24x24 window as the base window size is used by the Viola-Jones algorithm to begin evaluating these features in the given image. If we consider all possible parameters of haar features such as type, position, and scale, then we have to count 160,000 features in this window. However, this is almost impossible. Therefore, using of AdaBoost algorithm become the solution to this problem. AdaBoost is a machine learning algorithm that able to find the best features among 160,000. These features are weak classifiers. Adaboost builds powerful classifiers as linear combinations of weak classifiers.

Cascade using like haar feature can detect human face "Fig. 5 ". This system will detect the image of a human face in this process if it passes through all steps. If it does not go through one of the steps, it indicates that no human face is detected in the image.

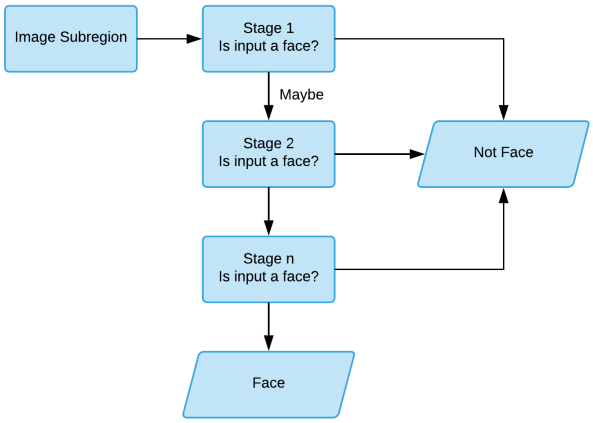

Fig. 5. Cascade Classifier.

C. Human Face Detection in Instagram Images

In this research, human face detection process with Haar Cascade Classifier method will be applied to every image obtained from Web Data Extraction process. If a human face is detected on an image, the image will automatically be filtered. Eventually, this system will only display images that do not contain a human face.

IV. RESULTS

The experiments in this work are finished with Python programming language, incorporated with the OpenCV 3.4.1 module, on a desktop computer with an Intel (R) Celeron (R) CPU N3060 @ 1.60 GHz CPU and an internal RAM of 4 GB. It needs minutes for processing dozens of images from Instagram that based on a particular hashtag. Computer specifications and internet connections take an essential role in this system.

The experiment was carried out by determining several hashtags as the basis for image search on Instagram. Some hashtags are used in this experiment. The hashtags are #selfie, #selfiee, and #selfies. Human face detection on the Instagram image is shown in Fig. 6.

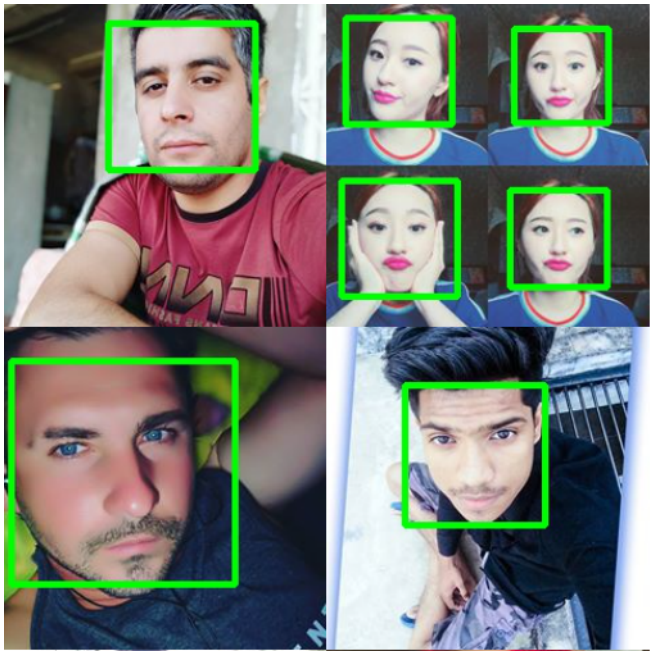

Fig. 6. Human face detection on Instagram image.

The results of the accuracy of human face detection are displayed Table I. System evaluation for human face detection is done using accuracy calculations, defined as:

$$accuracy = (TP + TN) / (TP + TN + FP + FN) \quad (1)$$

where *TP* (true positives) indicates the amount of correct detected faces (faces detected as faces), *TN* (true negatives) indicates the amount of correct detected faces (non-faces detected as non-faces), *FP* (false positives) indicates the amount of incorrectly detected faces (faces detected as non-faces), and *FN* (false negatives) indicates the amount of incorrectly detected (non-face detected as faces).

From Table I, it can be seen that the detection method used to detect a human face has an accuracy value of 71,48 %. The statistical results show that the FP value is 33.82% which significantly affects the results of system accuracy. FP means the wrong detection where there is a human face, but the system does not detect.

TABLE I. RESULT FOR DETECTING HUMAN FACE

Hashtag	Number of images	Faces detected by Haar Cascade Classifier			
		TP	TN	FP	FN
#selfie	68	18	27	21	2
#selfiee	72	36	17	18	1
#selfies	67	24	26	16	1
Total	207	78	70	55	4
Accuracy	71,48 %				

The results of the accuracy of selfie face detection are displayed in Table II. System evaluation for selfie face detection is done using positive predictive value (PPV) calculations, defined as:

$$PPV = TP / (TP + FP) \text{ x } 100\% \quad (2)$$

where *TP* (true positives) indicates the amount of correct detected selfie faces, and *FP* (false positives) indicates the amount of incorrectly detected selfie faces (selfie-faces detected as non-selfie-faces). Because the true negatives are enormous and the false negatives are tiny, comparison of other measures, such as sensitivity and specificity partly concerning true negatives or false negatives are of little significance.

TABLE II. RESULT FOR DETECTING SELFIE FACE

Hashtag	*Number of images with selfie face*	*Selfie face detected by Haar Cascade Classifier*	
		TP	*FP*
#selfie	24	12	**12**
#selfiee	45	32	13
#selfies	30	20	10
Total	99	64	35
PPV	64,65 %		

From Table II, it can be observed that the detection method used to detect selfie face has a positive predictive value of 64,65%. The statistical results show that the FP value is 35.35% which also significantly affects the results of system accuracy. The number of the image with selfie face was obtained manually by looking at the image containing the selfie face. According to the result, Haar Cascade method can filter selfie face images on Instagram that has an accuracy value of 64,65 %. We use this assumption because basically, selfie face images contain a human face.

V. CONCLUSIONS

In this paper, we performed and analyzed human selfie face images on Instagram by determining several hashtags as the basis. We have shown how the image data was detected as human face using Haar Cascade method. Our analysis shows that the applied method produces an accuracy value of 71.48% for detecting human faces. According to the result of human face detection, Haar Cascade method can filter selfie face images that have an accuracy value of 64,6%. We use this assumption because basically, selfie face images contain a human face. We want to extend this work by incorporating other features on Instagram such as user's comments, and social network as a part of our future work. We also plan to analyze sentiments associated with the photos and their associated text.

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