Design and Development of Mask Detectors in Effort to Prevent the Spread of Hepatitis Post-Covid-19 Pandemic Using Viola-Jones Algorithm

by Heri Purwanto

Submission date: 23-May-2023 09:53AM (UTC+0700)
Submission ID: 2099733553
File name: Paper_kami_rev.docx (5.88M)
Word count: 6093
Character count: 31189

Design and Development of Mask Detectors in Effort to Prevent the Spread of Hepatitis Post-Covid-19 Pandemic Using Viola-Jones Algorithm

Heri Purwanto[1*], Agus Nursikuwagus[2], Devie Firmansyah[3], Wahyu Nurjaya WK[4], Tri Ramdhany[5], Diqy Fakhrun Shiddieq[6]

[1]*Department of Information System, Universitas Sangga Buana, Indonesia*
[2]*Department of Informatics Management, Universitas Komputer Indonesia, Indonesia*
[3,4,5]*Department of Information Technology and Digital, Institut Digital Ekonomi LPKIA, Indonesia*
[6]*Department of Digital Business, Universitas Garut, Indonesia*

*heri.purwanto@usbypkp.ac.id

Received: Revised: Accepted: Published:

Abstract - *In the current New Normal Era, people are starting to be free to do activities outside the house. With condition of wearing a mask when doing activities as a prevention from the corona virus. After the number of cases of the Covid-19 pandemic began to decline, the World Health Organization (WHO) received a report on April 5, 2022 from the United Kingdom regarding cases of acute hepatitis that began to spread in children and whose etiology was unknown. The spread of the disease can be through the air, so everyone must wear a mask when outside the house. The Indonesian government through the Ministry of Health reported that as of June 16, 2022, at 16.00 there were 28 suspected cases of severe acute hepatitis with unknown or mysterious causes for Indonesian children. This number increased by three cases from the report on June 9, 2022. Of the 28 cases, there were 13 probable and 15 pending classifications in classifying hepatitis. The purpose of this research is to design a mask detector that functions to assist in monitoring health protocols by detecting the use of masks in public areas or office buildings so that they can continue to carry out normal activities during the pandemic. The design of this mask detection tool uses the Viola-Jones Algorithm, where this method has 4 main keys, namely the Haar feature, Integral image, adaboost, and cascade classifier. Based on the test results, this mask detector can detect mask objects at a distance of 1 to 2 meters, with a limit of the number of people detected up to 3 people. Future research is expected to be able to develop a mask detection device using rasbbary pi hardware to replace the arduino uno to better suit system needs and also add a sound system.*

Keywords - *Mask detection, Viola-Jones, webcam, arduino*

1. Introduction

In this New Normal Era, people all around the world are starting to be free to do activities outside their houses, as well as the Indonesian people. The government makes a policy condition that requires the use of masks to be used by everyone when carrying out activities outside the house [1], [2]. When engaging in activities outside the home, the government and officials working for Covid-19 (the Corona Virus Disease) consistently advise individuals to practise self-protection, maintain a safe distance, and use masks [3], [4]. In order to prevent the spread of Covid-19, it is necessary to design a mask detector, as a reminder when not using a mask in office areas, shopping areas, hospitals and other public places [5]. This can be seen from the low level of public awareness regarding the use of masks in public settings. Public obedience and understanding regarding the prevention of the spread of Covid-19 is still low. [6], [7]. The low public awareness of this health protocol will make it difficult for our country to escape the Covid-19 pandemic [8].

The policies taken by the Indonesian government in terms of studying, working, and worshiping are carried out at home by implementing WFH (Work From Home) and large-scale social restrictions (PSBB), aiming to break the chain of transmission of Covid-19 in Indonesia [9]. On June 1, 2020, Indonesia officially enacted a new normal or adaptation of new habits with several terms and conditions, one of which was wearing a mask when doing activities outside the house as a precaution against the corona virus [10]. Studies show that wearing masks is an important factor in stopping the spread of Covid-19, because the corona virus can easily spread when humans don't wear masks [11], [12]. Therefore, people are required to practice physical distancing and also use masks in crowds to avoid the spread of the Covid-19 virus [13].

After the number of cases of the Covid-19 pandemic began to decline, the world was again shocked by the outbreak of hepatitis cases in children. The World Health Organization (WHO) has received a report on April 5, 2022 from the United Kingdom regarding a case of acute hepatitis of unknown etiology [14], laboratory tests have been carried

out and hepatitis virus types A, B, C, D, and E were not found as the cause of the disease [15], [16]. Active cases have also increased from 2,900 cases as of the end of May 2022 to 4,900 cases as of June 13, 2022. So that it is in the spotlight in Indonesia regarding the ongoing Covid-19 and Hepatitis outbreaks.

There are several public spaces such as schools and children's playgrounds that do not apply health protocols, especially in the use of masks [42], [18]. Not using masks is a serious problem in tackling the spread of the Covid-19 virus and preventing hepatitis from entering Indonesia [6], [19], [20]. Masks have a function as a means of personal protection to cover the mouth and nose [21]. Masks can prevent the spread of the virus through the air and avoid splashing saliva (droplets), masks are also the first step to protect people from other diseases that are airborne [22], These masks can be divided into 3 (three) types according to the Indonesian Ministry of Health, the first is an N95 mask, the second is a surgical mask, and the third is a cloth mask [15].

Spreads such as Covid-19 can occur when touching hands, droplets, talking to many people and not wearing a mask. Those things can cause a high spread of the virus [23]. Transmission of Covid-19 can be easily transmitted when in direct contact with sufferers [12]. Covid-19 is characterized primarily by respiratory disease, and the spectrum of infection with this virus ranges from very mild non-respiratory symptoms to severe acute respiratory disease, sepsis with organ dysfunction, and mortality. Some infected individuals are reported to have no symptoms [24], [25]. The best way to prevent the spread is to break the chain of transmission of Covid-19, namely by sanitizing hands, washing hands and using masks, and keeping a distance in carrying out activities [19]. While the spread of hepatitis is unknown, the symptoms that can occur are Nausea, Vomiting, Severe Diarrhea, and Fever [15].

As of April 21, 2022, 169 cases of acute hepatitis of unknown etiology have been reported from 11 countries namely the United Kingdom including Northern Ireland (114 cases), Spain (13 cases), Israel (12 cases), United States (9 cases), Denmark (6 cases), Ireland (<5 cases), Netherlands (4 cases), Italy (4 cases), Norway (2 cases), France (2 cases), Romania (1 case), and Belgium (1 case) [16], as well as in Indonesia, the Ministry of Health (Kemenkes) reported that until 16/6/2022 at 16.00 Western Indonesia Time (WIB) there were 28 suspected cases of severe acute hepatitis with unknown or mysterious causes in Indonesian children. This number increased by three cases from the report on June 9, 2022. Of the 28 cases, there were 13 probable and 15 pending classifications in classifying hepatitis [26].

The spread and transmission can be reduced by wearing a mask. However, awareness of the use of masks in Indonesia is still very low [6]. As a reminder to the public about the causes of disease transmission that spreads through the air, a mask detector is made as a reminder to use masks.

Based on the previous paragraph above, it can be concluded that the number of object detectors focused on the face (nose, eyes, and mouth), gesture recognition and facial recognition. In contrast to some of the studies mentioned above, in this study object detection is focused on the use of masks and the method used is the Viola-Jones algorithm.

2. Literature Review

The mask detector is a renewal of the image detector, the image detector plays an important role in the face recognition process used in the manufacture of the mask detector design [27], [28]. Image recognition involves many variables, such as source images, image processing results, extracted images and required person profile data [29]. This mask detector uses esp32-Cam as an image capture, which will read whether the image (mask) is detected or not. This mask detector also serves as a reminder when in public places or doing activities outside the house.

In previous studies, the design of the mask detector using the Haar Casecade method as a face reader or an image as an object detector [30]–[32]. The final results are Telegram notifications [13], mask detectors as building entrance access rights [33],[34], other studies make these mask detectors using the matlab application [1], [5], [13], [30], [31], [33], [35]–[39].

AdaBoost's weights determine the sequence in which the filters are applied, with the most weighted filter given priority. The Viola-Jones algorithm employs a stratified classification process to produce sub-images that are not thought to be faces. Through the use of OpenCV, it is possible to determine the movement of the camera itself and then guide the camera to monitor a room for any kind of movement. This can make the use of camera features more efficient because it will only light up when it detects a moving object and will automatically perform the recording. It also ensures that memory is not squandered on recording all of the monitoring activities that take place within a room [34]. An upright stance is the primary factor that determines whether or not face detection using this method was successful. The accuracy of this method alone achieves a percentage of 90.9% [34].

3. Method

The Haar Cascade Classifier is a rectangular (square) feature that provides an image with a specific indication. The Haar cascade classifier was conceived by Paul Viola and Michael John, hence the name Viola & John method [27]. The goal of using a Haar-like feature is to recognise objects based not on the pixel values of the object's image but rather on the basic value of the feature itself. This method has the benefit that the computation may be completed extremely quickly because it is dependent only on the number of pixels that are contained within a square rather than each and every pixel value that is contained within a picture [37]. This study uses the *Viola-Jones algorithm*, as a method used to detect images, humans and vehicles [40]. Haar in detecting objects using statistical algorithms. This method applies sample haar-like features. This classifier will use images that are fixed in size (usually 24x24 in size). Haar in detecting objects has a way of working, that is using a sliding window technique that has a

size of 24x24 on all images and looking for the presence or absence of parts in the image that are shaped like objects. The Haar method also has the ability to use scaling which causes the detection of objects that are smaller or larger than the image in the classifier [41]. The use of the *viola-jones algorithm* as an algorithm aims to analyze and find the right system to meet the objectives of this study [35], [42]. The *Viola-jones algorithm* uses *Cascade Function* to take pictures through the 4 (four) stages: (1) determine *Haar features*, (2) take *Integral* images, (3) *Adaboost Training* and (4) perform *Classification* with *Cascading Classifier* [41]. The approach that was taken is one that is associated with image processing and makes use of machine learning in order to investigate the unique qualities of each object, particularly in interpreting facial objects that do and do not make use of masks [43]. Furthermore, the ultimate goal of this research is to produce an image processing system using image processing.

4. Result and Discussion

In the *Viola-Jones Algorithm*, this algorithm takes pictures through 4 (four) stages. First: (1) determine *Haar features*, (2) take *Integral* images, (3) *Machine Learning Adaboost* and (4) perform *Classification* with *Cascading Classifier*. The initial step taken in the Viola-Jones face detection method is to read a sample image where from changing RGB images to grayscale with the aim of making it easier to perform *Haar features*.

(a) (b)

Fig 1. Example conversion image (a) original in RGB format (b) conversion results in greyscale format

4.1. Determine Haar features

In the Viola-Jones method, the characteristics that are utilised are referred to as Haar features. These features can also be referred to as square single wave features (one high interval and one low interval), but in two dimensions, these features are referred to as one light and one dark. The existence of anything is calculated by deducting the average pixel count from the average pixel count in a region that is predominantly light.

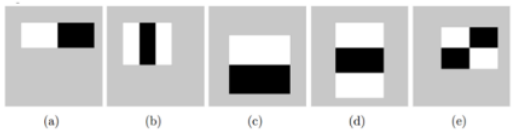


Fig 2. Rectangular Haar features

Various types of *Haar features* with three types of features based on the number of rectangles contained in them. The features in sections (C) and (A) consist of two rectangles, section (E) consists of 4 rectangles, and sections (B) and (D) consist of three rectangles. And changed to gray or black and white in *Haar features* for the first step of the *Viola-jones algorithm*.

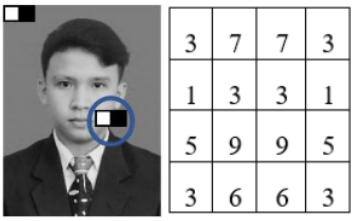
To obtain different conditions of brightness level, all images must be in the form of an average value that has been normalized from the previous variations. All of these images have a lower variation value than the others, having little information will be discarded from the assessment. As seen in Figure 3. Haar feature, the background in the template (A) is grayed towards the lighter part of the color.

From the application of the Rectangular Haar features, the technique used is by dividing each area in the image from the top left to the bottom right. This process is done to find out if there are facial features in the area. For the application in this study, it works when the rectangular passes through the specified image, when it passes through the mouth area. It is expected that from the features taken there is the information needed as facial characters and facial images can be detected by the haar features naturally. Therefore, however, several crucial things cause this haar feature set to be sequential.

Fig 3. Rectangular Haar features implementation

4.2. Take Integral image

Integral image is a type of image in which the value of each pixel is equal to the sum of the values of the pixels in the image, moving from top left to bottom right. Integral image makes it possible to perform pixel calculations easily at low cost, calculation based on the total number of pixels contained in the haar feature window constraint, mirroring technique is used for cumulative function distribution. The Integral Image example is used to determine the presence or absence of hundreds of haar features in an image. Rectangular features can be computed very quickly using the integral representation of the image.



3	7	7	3
1	3	3	1
5	9	9	5
3	6	6	3

Fig 4. Integral Image

It is possible to determine the pixel values for a number of other rectangles by making use of an integral image. This can be done, for instance, by combining the number of pixels in the area to select specific features to be used and to set the threshold value. Viola and Jones did this by making use of a method of machine learning known as AdaBoost. In order to produce a powerful classifier, AdaBoost combines the results of a number of less effective classifiers. "Weak" in this context refers to the fact that the filter order in the classifier only generates a smaller number of valid answers.

In a general sense, the integration brings together a number of separate parts. In this instance, the little units that are being discussed are pixel values. The sum of all of the individual pixels, working from the top down, constitutes the integral value of each pixel. The entirety of the image can be tackled using several integer operations per pixel by moving from the top left to the bottom right and starting there. Then, a technique of machine learning known as AdaBoost is utilised in order to choose the particular Haar feature that will be used, as well as to determine the threshold value.

4.3. Machine Learning Adaboost

AdaBoost is able to produce a powerful classifier by combining a large number of less effective classifiers. By merging multiple AdaBoost classifiers into a single sequence of filters, it is possible to categorise image regions in a manner that is both efficient and accurate. Each filter is its own individual AdaBoost classifier, and each classifier is either a weak classifier or a Haar filter. During the process of filtering the image, if one of the filters is unable to pass a particular region of the image, then that region is immediately labelled as a non-face region. However, when the filter passes through an image area and passes through all the filter processes in the filter circuit, the image area is classified as a face. It can also be interpreted as the image below.

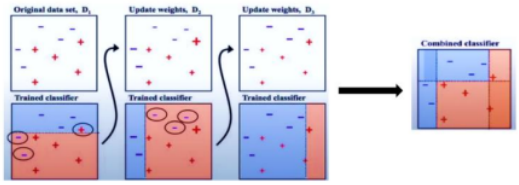


Fig 5. Machine Learning Adaboost

Where it has the original data set with symbols minus (-) and plus (+) with the aim of being the initial classification in finding the smallest possible error by using the 2 classes and taking the line where there is the least error by being marked with a circle in each class. Then the original data set is updated and the initial error in the original data set in the next update is added to the weight by making it bold as pictured above, repeated continuously until there are no errors in each class or part of it. With the aim of increasing accuracy in classifying objects.

4.4. Cascading Classifier

The cascade constitutes the subsequent stage. The weights that are given to AdaBoost are what decide the sequence in which the filters in the cascade are applied. The filter with the most weight is given priority in the first step of the process, and the goal is to get rid of the parts of the image that are not faces as quickly as possible. The Viola-Jones algorithm is distinguished by the presence of a stratified classification, which is a defining feature of the algorithm. This algorithm employs a categorization process that is comprised of three levels, each of which results in the production of a sub-image that is not thought to be a face. This is done because determining if a sub-image contains a face is more difficult than determining whether or not it contains a sub-image that is believed not to be a face. Figure 6 illustrates the workflow form of the stratified classification.

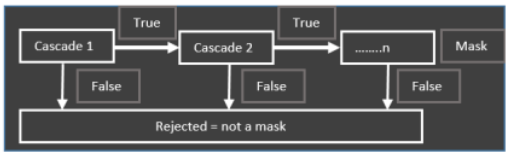


Fig 6. Cascading Classifier

Each sub-image will be categorised at the first level using a single characteristic. For photos that match specific Haar features, the outcomes of this first classification are (True); otherwise, they are (False). About half of the sub-images will still need to be categorised in the second stage as a result of this categorization. The second classification yields the results (True) for images that adhere to the integral image process and (False) for those that do not. More precise requirements are required as the classification level rises so that more features can be employed. There will be just about 2% of sub-images left after classification. When images comply with the AdaBoost procedure, the classification results are (True); otherwise, they are (False).

4.5. Mask Detector Design Schematic

Hardware system design aims to see the functions performed by the system such as the workings of the sensors and applications used. A series of interfaces using an external webcam for image capture to be processed, then sending a signal to the buzzer.

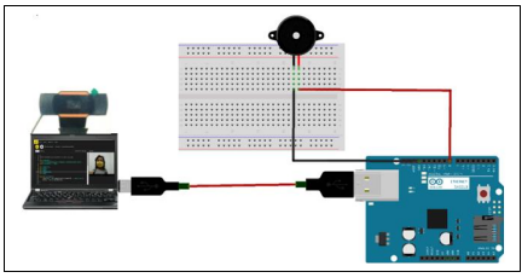


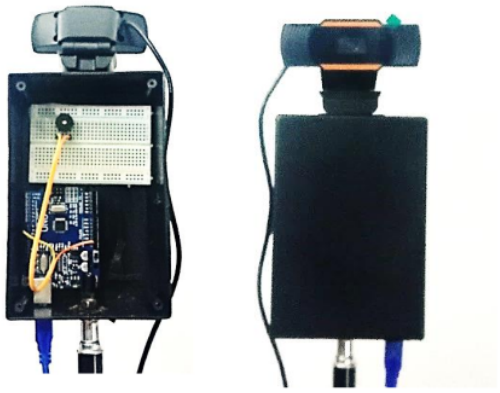
Fig 7. Mask Detector Design

The workings of the mask detector design tool as shown in Figure 2 above, by taking the mask object on the face using a webcam and processing it on Arduino, the process that occurs as a mask object classification is a

requirement to enter the room, after being detected or not, the mask will proceed to the buzzer as a result of the notification pro-cess. The design of this mask detector allows the system to carry out the facial recognition process using medical mas[41]non-medical masks, the wrong mask position, and not wearing a mask. The system can also identify the feasibility of wearing masks based on the class classification of face mask recognition.

4.6. Implementation and Testing

In the implementation phase, the results of the analysis are implemented in a real environment. The process of implementing this tool starts from designing hardware such as Arduino to store and run programs, a webcam to take pictures of objects and a buzzer that will sound as a warning when someone is not wearing a mask. As shown in the circuit pictures below:



(a) (b)

Fig 8. Peripheral mask detector (a) circuit design (b) display interface

The mask detector interface circuit at Figure 8(a) is the result of a series of tools used in making the mask detector including a webcam as an image capture, an Arduino as a tool for program code processing, and a buzzer as an output in the form of sound. Furthermore, it is implemented with a 3d printing box as shown in Figure 8(b) which shows the entire device or tool after it is fully implemented using a 2.1 meter high tripod that can be adjusted in height.

Testing, after implementation for the tool. In the next stage, testing of the tool is carried out, in this test there are 2 types of testing where the first type of test includes testing in terms of age, the distance between humans and tools, and testing how many people. The second testing stage is testing of masks, such as color, position of the mask, and masks with face image. It can be seen from the table below which shows the first stage of testing.

The tests in the tables above are carried out at the *Cascading Classifier* stage, the *Cascading Classifier* functions to classify an object in the form of a mask. After testing, it can be seen in Table 1 Mask detector testing at multiple ages, getting results in the form of a tool that can detect objects in the form of masks and can detect them from various age ranges, because when doing *data training* using a collection of images of faces that are wearing masks which makes the mask the object of the criteria for detecting. From Table. 2 Mask detector testing at a distance gets the maximum distance of only 1 to 2 meters. If a distance of more than 2 meters will not work properly, because [45] results of the mask detector can be influenced by the intensity of the light obtained, the more light intensity and the appropriate distance, the better in classifying objects. From Table. 3 Mask detector testing of the number of people gets results, the mask detector can detect as many as 3 people as listed in Table 3, the same as Table 2 the test can be influenced by the intensity of the light obtained, as well as from the distance and color of the mask. It is also a requirement to carry out the results from Table 3. The testing occupied reach in two conditio[12]ke detected or not. The examples of results from testing Table 1, Table 2, and Table 3 as shown below:

Table 1. Mask detectors testing at various age

Age	Detected	Not
4-9	Detected	
11-20	Detected	
21-50	Detected	
52-56	Detected	

Table 2. Mask detectors testing at a distance

Dist[11]e (m)	Detected	Not
1 m	Detected	
2 m	Detected	
3 m		Not
4 m		Not

Table 3. Mask detector testing based

Number of people	[11]ected	Not
1	Detected	
2	Detected	
3	Detected	
> 4		Not

Fig 9. results from the table test

In Figure. 9 above performs the[25]t by covering[12] Table 1, Table 2, and Table 3. The result can be seen in Figure 9. With the number of people at the time of doing this detection 3 people, the distance tested is at a distance of 1 meter and includes all ages. This detection can run properly, getting the indicator number 1 in the image above which indicates that the tests carried out are as shown in the test table below.

The second stage testing includes testing of masks such as color, position of the mask, masks with face image, and testing when the face is covered. This test is to test the results of the stages of the Viola-Jones *Cascading Classifier* algorithm. Testing to detect an error in the mask detector against the color of the mask image and testing to detect errors in the use of a mask detector, Color testing serves to test from the results of the *Cascading Classifier* whether it can detect masks with different colors as shown below.

Tests were carried out on Figure 10(a), Figure 10(d) white, and Figure 10(b) black, according to the test results Figure 10.c brown tends to be unstable in classifying because brown is the same color as the skin color that makes the brown mask is unstable in the classification results, while testing for red, white, black is fairly stable in detecting masks because these colors are more dominant than the color of the skin itself so that it can be detected up to a maximum distance of 2 meters from the mask detector tool. Testing of Mask Detectors in Detecting errors, in addition to colors that can affect the classification of mask detectors, testing of masks with face image and the position of the mask can also be an error in classifying as shown below.

Fig 10. Image error in classification when detecting the mask colored (a) red mask (b) black mask (c) brown mask (d) white mask

The results that contain errors can be seen from Figure. 11(a), Figure 11(b), Figure 11(c), where the results of the test using a mask with face image will be detected like not using a mask because there are images of the face (nose and mouth) making Figure 11(a) detected an error. In the test in Figure 11(b), there is an error in the position of the use of the mask, although in Figure 11(b) it uses a brightly colored mask, the tool can detect the presence of parts of the face (nose and mouth) which makes the mask detector detect an error. In the test Figure 11(c), the man covered the face area with the hands, although the nose and mouth areas are covered by the palms of the hands, the tool can detect the absence of the use of masks because at the *Cascading Classifier* stage, which is when doing training data in addition to using a data set in the form of a collection of images of people using masks, data sets of faces that do not use masks are entered during data training or during the *Machine Learning Adaboost* stage. What makes the mask detector can distinguish between people who wear masks and those who do not.

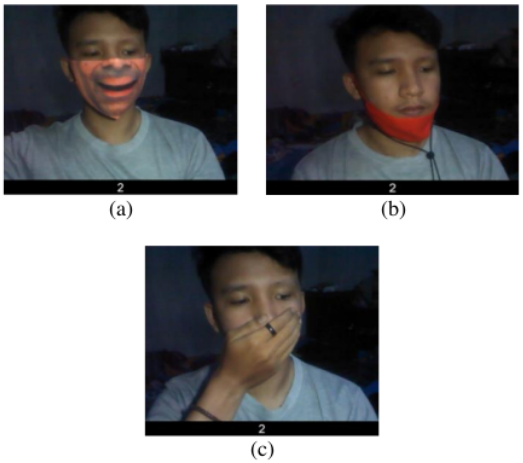


Fig 11. (a) Error Detecting mask with face image (b) Error Detecting from the position of the mask (c) Error in Detecting by covering the face area

5. Conclusion

This study aims to assist in the supervision one of the health protocols, that is the use of masks in public places, such as in offices, shopping places, and also places of worship, so that they can still carry out normal activities during the pandemic. This research was conducted in a crowded environment, especially in the area near the entrance. Based on the results of the research that has been done, the conclusions are to answer the formulation of the research problem. The program can be used to detect masks at a distance of 1 to 2 meters with up to 3 people at once in detecting this mask object. It can detect errors in the mask position and can detect if someone is using a mask with face image or by covering the face area with their hands, this detector mask can detect it quite stable. From the research that has been done, suggestions for the development of the program in the future. Using a Rasbarry Pi microcontroller is recommended for further object detection and can add a sound sensor to detect masks by adding a mini dfplayer device. As for suggestions in taking pictures of masks objects to be more accurate, by doing more in training images, using images that vary in terms of color, distance, position, and light from each image to be trained in order to make the resulting data more accurate.

References

[1] T. R. M. Fitrah, Y. Nurdin, and R. Roslidar, "Rancang Bangun Pengembangan Pintu Otomatis Pendeteksi Masker Dan Suhu Tubuh Menggunakan Raspberry Pi 4," *J. Komputer, Inf. Teknol. dan Elektro*, vol. 6, no. 2, pp. 7–14, 2021, [Online]. Available: http://e-repository.unsyiah.ac.id/kitektro/article/view/21428

[2] K. Pritasari, "Surat Edaran Direktur Jendral Kesehatan Masyarakat," *Akrab Juara*, vol. 5, no. 1, pp. 43–54, 2020, [Online]. Available: http://www.akrabjuara.com/index.php/akrabjuara/article/view/919

[3] F. Fadhlurrahman, "Alat Pengingat Penggunaan Masker Sebelum Keluar Rumah Berbasis Arduino Uno," *Tek. Elektro*, 2021.

[4] A. Wilder-Smith and D. O. Freedman, "Isolation, quarantine, social distancing and community containment: Pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak," *J. Travel Med.*, vol. 27, no. 2, pp. 1–4, 2020, doi: 10.1093/jtm/taaa020.

[5] S. Irsyad, R. Putra, and B. Kurniawan, "Rancang Bangun Human Interface Pendeteksi Suhu Serta Masker Menggunakan Matlab Design and Build a Temperature Detection Human Interface and Mask Using Matlab," *Telekontran*, vol. 9, no. 2, 2021.

[6] C. Arumsari, E. Yulianto, E. N. Afifah, U. M. Tasikmalaya, and U. Siliwangi, "Sosialisasi dalam Rangka Memelihara Kesadaran Warga pada Kesehatan di Masa Pandemi COVID-19," *J. Pengabdi. Kpd. Masy.*, vol. 2, no. 1, pp. 272–276, 2021, doi: 10.31949/jb.v2i1.676.

[7] H. Bundgaard *et al.*, "Effectiveness of adding a mask recommendation to other public health measures to prevent sars-cov-2 infection in danish mask wearers a randomized controlled trial," *Ann. Intern. Med.*, vol. 174, no. 3, pp. 335–343, 2021, doi: 10.7326/M20-6817.

[8] A. Aswani, O. B. Tumanggor, and A. S. Hasibuan, "Peningkatan Kesadaran Terhadap Protokol Kesehatan Pada Anak-Anak Panti Asuhan Aisyiah Bandar Klippa Kecamatan Percut Sei Tuan Kabupaten Deli Serdang," *J. Abdi Ilmu*, vol. 1, no. 14, pp. 1–7, 2021, [Online]. Available: https://jurnal.pancabudi.ac.id/index.php/abdiilmu/article/view/1917

[9] Taufik and H. Warsono, "Birokrasi Baru Untuk New Normal: Tinjauan Model Perubahan Birokrasi Dalam Pelayanan Publik Di Era Covid-19," *Dialogue J. Ilmu Adm. ...*, vol. 2, no. 1, pp. 1–18, 2020, [Online]. Available: https://ejournal2.undip.ac.id/index.php/dialogue/article/view/8182

[10] W. Darmalaksana, "New Normal Perspektif Sunnah Nabi Saw.," *Fak. Ushuluddin UIN Sunan Gunung Djati Bandung*, vol. 19, pp. 1–5, 2020, [Online]. Available: http://digilib.uinsgd.ac.id/id/eprint/31093

[11] M. Moyo and C. Yuefeng, "COVID-19 Face Mask Detection Alert System COVID-19 Face Mask Detection Alert System," no. March, pp. 0–15, 2022, doi: 10.7176/CEIS/13-2-01.

[12] W. Wahyudin and H. Purwanto, "Prediksi Kasus Covid-19 Di Indonesia Menggunakan Metode Backpropagation Dan Regresi Linear," *J. Inf. Syst. Applied, Manag. Account. Res.*, vol. 5, no. 2, p. 331, 2021, doi: 10.52362/jisamar.v5i2.420.

[13] M. M. Lambacing and F. Ferdiansyah, "Rancang Bangun New Normal Covid-19 Masker Detektor Dengan Notifikasi Telegram Berbasis Internet of Things," *Dinamik*, vol. 25, no. 2, pp. 77–84, 2020, doi: 10.35315/dinamik.v25i2.8070.

[14] T. Divala *et al.*, "Investigasi kasus hepatitis dengan etiologi yang tidak diketahui di antara anak-anak , Skotlandia , 1 Januari 2022 hingga 12 April 2022," no. April, pp. 1–7, 2022.

[15] Kementrian Kesehatan Republik Indonesia, "Kasus Hepatitis Akut Yang Tidak Diketahui Etiologinya (Acute Hepatitis Of Unknown Aetiology)," 2022, [Online]. Available: https://infeksiemerging.kemkes.go.id/situasi-infeksi-emerging/kasus-hepatitis-akut-yang-tidak-diketahui-etiologinya-acute-hepatitis-of-unknown-aetiology

[16] World Health Organization, "Multi-Country – Acute, severe hepatitis of unknown origin in children," 2022, [Online]. Available: https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON376

[17] Mushidah and R. Muliawati, "Pengetahuan dan Sikap dengan Kepatuhan Penggunaan Masker Sebagai Upaya Pencegahan Penyebaran Covid-19 Pada Pedagang UMKM," *J. Ilm. Permas J. Ilm. STIKES Kendal*, vol. 11, no. 1, pp. 35–42, 2021.

[18] R. Güner, İ. Hasanoğlu, and F. Aktaş, "Covid-19: Prevention and control measures in community," *Turkish J. Med. Sci.*, vol. 50, no. SI-1, pp. 571–577, 2020, doi: 10.3906/sag-2004-146.

[19] C. V. P. Lesilolo, "Pengetahuan Masyarakat tentang Covid-19 Berhubungan dengan Kepatuhan Menggunakan Masker pada Masa Pandemi Covid-19," *J. Penelit. Perawat Prof.*, vol. 3, no. 3, pp. 557–564, 2021, doi: 10.37287/jppp.v3i3.551.

[20] E. M. Onyema, "Impact of Coronavirus Pandemic on Education," *J. Educ. Pract.*, vol. 11, no. 13, pp. 108–121, 2020, doi: 10.7176/jep/11-13-12.

[21] D. R. Inayah, "Penggunaan Masker Dan Kejadian Maskne Di Era Pandemi Covid-19 : Sebuah," *Lomb. Med. J.*, vol. 1, no. 1, pp. 52–60, 2022.

[22] K. Kishore, G. Jyothi, V. Sundarajan, S. B. Banappagoudar, S. P. Subashini, and Sridevy, "Smart Facial Mask Detector," *Int. J. Spec. Educ.*, vol. 37, no. 3, pp. 775–780, 2022.

[23] T. V. Radhitya, N. Nurwati, and M. Irfan, "Dampak Pandemi COVID-19 Terhadap Kekerasan dalam Rumah Tangga," *J. Kolaborasi Resolusi Konflik*, vol. 2, no. 2, p. 111, 2020, doi: 10.24198/jkrk.v2i2.29119.

[24] Y. S. Cyntia Bella Anggraini, Dewi Mayasari, "Efek Pemberian Obat Herbal terhadap Penderita COVID-19," *Proceeding Mulawarman Pharm. Conf.*, 2020.

[25] R. T. Handayani, D. Arradini, A. T. Darmayanti, A. Widiyanto, and J. T. Atmojo, "Pandemi covid-19, respon imun tubuh, dan herd immunity," *J. Ilm. Stikes Kendal*, vol. 10, no. 3, pp. 373–380, 2020.

[26] Tirto, "Kemenkes Laporkan 28 Suspek Hepatitis Akut Misterius, 6 Meninggal." 2022. [Online]. Available: https://tirto.id/kemenkes-laporkan-28-suspek-hepatitis-akut-misterius-6-meninggal-gs4V

[27] P. Viola and M. Jones, "Haar-like," *Cvpr*, vol. 1, pp. I-511-I–518, 2001, [Online]. Available: http://ieeexplore.ieee.org/document/990517/

[28] S. Li, X. Dong, Y. Shi, B. Lu, L. Sun, and W. Li, "Multi-angle head pose classification with masks based on color texture analysis and stack generalization," *Concurr. Comput.*, no. October 2020, pp. 1–11, 2021, doi: 10.1002/cpe.6331.

[29] D. Suprianto, R. Hasanah, and P. S., "Sistem Pengenalan Wajah Secara Real-Time Dengan Adaboost, Eigenface PCA & MySQL," *J. EECCIS*, vol. 7, no. 2, p. pp.179-184, 2013.

[30] Ahmadi, A. C. Saputra, and A. Lestari, "Rancang Bangun Aplikasi New Normal Covid- 19 Deteksi Penggunaan Masker," *J. Teknol. Inf.*, vol. 15, no. 2, pp. 199–209, 2021.

[31] B. Budiman, C. Lubis, and N. J. Perdana, "Pendeteksian Penggunaan Masker Wajah Dengan Metode Convolutional Neural Network," *J. Ilmu Komput. dan Sist. Inf.*, vol. Vol.9 No.1, 2021.

[32] H. A. Saputra, F. Utaminingrum, and W. Kurniawan, "Deteksi dan Pengenalan Wajah sebagai Pendukung Keamanan Menggunakan Algoritme Haar-Classifier dan Eigenface Berbasis Raspberry Pi," *J. Pengemb. Teknol. Inf. dan Ilmu Komput. Univ. Brawijaya*, vol.

3, no. 2, pp. 1372–1380, 2019.
[33] F. M. Alwy, “Masker Detektor Sebagai Hak Akses Pintu Masuk Gedung B Politeknik Harapan Bersama Menggunakan Web Camera Berbasis Raspberry Pi,” p. 6, 2021.
[34] I. Gusti Ngurah Made Kris Raya, A. N. Jati, and R. E. Saputra, “Analysis realization of Viola-Jones method for face detection on CCTV camera based on embedded system,” *Proc. 2017 Int. Conf. Robot. Biomimetics, Intell. Comput. Syst. Robionetics 2017*, vol. 2017-Decem, pp. 1–5, 2017, doi: 10.1109/ROBIONETICS.2017.8203427.
[35] A. Thariq and R. Y. Bakti, “Sistem Deteksi Masker dengan Metode Haar Cascade pada Era New Normal COVID-19,” *J. Sist. dan Teknol. Inf.*, vol. 9, no. 2, pp. 241–244, 2021, doi: 10.26418/justin.v9i2.44309.
[36] R. Khoirunnisa and M. R. Ridho, “Rancang Bangun Sistem Identifikasi Penggunaan Masker Menggunakan Arduino,” *J. Comasie*, vol. 01, no. 02, pp. 53–61, 2021.
[37] F. Luthfillah Ahmad, A. Nugroho, and dan Alfa Faridh Suni, “Deteksi Pemakai Masker Menggunakan Metode Haar Cascade Sebagai Pencegahaan COVID 19,” *Edu Elektr. J.*, vol. 10, no. 1, pp. 13–18, 2021.
[38] P. Oktavianty, Suparmi, and A. N. Putri, “Kebiasaan Belajar Dan Minat Membaca Berpengaruh Terhadap Perastasi Belajar Siswa,” vol. 1, no. 1, pp. 29–38, 2020.
[39] W. Silfianti, “No Title,” no. April, pp. 1–6, 2017.
[40] R. A. B. SITANGGANG, “Monitoring Laju Kendaraan Berbasis Ip Camera Menggunakan Metode Haar,” 2021.
[41] A. Y. P. Bayu, Suroso, and Sholihin, “Sistem Pemantauan Penggunaan Protokol Kesehatan Covid-19 Menggunakan Metode Haar Cascade Dan Neural Network,” *J. Qua Tek. Vol. 11 No. 2 Sept. 2021 ISSN 2088-2424 (cetak); ISSN 2527-3892*, vol. 11, no. 2, pp. 32–46, 2021.
[42] V. K. Gudipati, O. R. Barman, M. Gaffoor, Harshagandha, and A. Abuzneid, “Efficient facial expression recognition using adaboost and haar cascade classifiers,” *2016 Annu. Connect. Conf. Ind. Electron. Technol. Autom. CT-IETA 2016*, pp. 0–3, 2017, doi: 10.1109/CT-IETA.2016.7868250.
[43] L. Marifatul Azizah, S. Fadillah Umayah, and F. Fajar, “Deteksi Kecacatan Permukaan Buah Manggis Menggunakan Metode Deep Learning dengan Konvolusi Multilayer,” *Semesta Tek.*, vol. 21, no. 2, pp. 230–236, 2018, doi: 10.18196/st.212229.

Design and Development of Mask Detectors in Effort to Prevent the Spread of Hepatitis Post-Covid-19 Pandemic Using Viola-Jones Algorithm

ORIGINALITY REPORT

16%	11%	11%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	I Gusti Ngurah Made Kris Raya, Agung Nugroho Jati, Randy Erfa Saputra. "Analysis realization of Viola-Jones method for face detection on CCTV camera based on embedded system", 2017 International Conference on Robotics, Biomimetics, and Intelligent Computational Systems (Robionetics), 2017 Publication	2%
2	fayllar.org Internet Source	1%
3	setkab.go.id Internet Source	1%
4	Kevin, Eugene Reginald Patrick, Samuel Wijaya, Edy Irwansyah. "The Search for the Best Real- Time Face Recognition Method for Finding Potential COVID Patients", 2021 1st International Conference on Computer	1%

Science and Artificial Intelligence (ICCSAI), 2021
Publication

5	simple.ascee.org Internet Source	1 %
6	www.ncbi.nlm.nih.gov Internet Source	1 %
7	journal.umy.ac.id Internet Source	1 %
8	voi.id Internet Source	<1 %
9	"NEWS FOCUS", Practice Nursing, 2022 Publication	<1 %
10	journal.uniku.ac.id Internet Source	<1 %
11	U Andayani, Erna B Nababan, Ilhammuddin Hasibuan, B Siregar, F Fahmi. "Simulation and Control of Clean Water Supply on Campus Toilets Using Passive Infrared Receiver Sensor Technology and Flow Liquid Meter", IOP Conference Series: Materials Science and Engineering, 2019 Publication	<1 %
12	sol.sbc.org.br Internet Source	<1 %

jtiulm.ti.ft.ulm.ac.id

13	Internet Source	<1%
14	Tambe Pragati, Tanpure Akshada, Wakchaure Asmita, Zaware Prachi, S.A. Bhosale. "COVID-19: Face Mask Detector with Open CV and CNN Algorithm", IOS Press, 2021 Publication	<1%
15	pdsmk.fk.undip.ac.id Internet Source	<1%
16	Brkic, Karla, Tomislav Hrkac, and Zoran Kalafatic. "Detecting humans in videos by combining heterogeneous detectors", 2015 38th International Convention on Information and Communication Technology Electronics and Microelectronics (MIPRO), 2015. Publication	<1%
17	ejournal.unisbablitar.ac.id Internet Source	<1%
18	ejurnal.swadharma.ac.id Internet Source	<1%
19	Saratu Yusuf Ilu, Rajesh Prasad. "Improved autoregressive integrated moving average model for COVID-19 prediction by using statistical significance and clustering techniques", Heliyon, 2023 Publication	<1%

20	ijcttjournal.org Internet Source	<1 %
21	internetworkingindonesia.org Internet Source	<1 %
22	journal.universitasbumigora.ac.id Internet Source	<1 %
23	jurnal.iaii.or.id Internet Source	<1 %
24	Rodolfo Castro, Marcelo Ribeiro-Alves, Valdilea G. Veloso, Hugo Perazzo. "Hepatitis of unknown etiology in children in Brazil: A new challenge or the usual scenario ?", The Brazilian Journal of Infectious Diseases, 2022 Publication	<1 %
25	Zhixian Chang, Wujun Yang, Juan Guo, Yifei Cheng. "Dynamic flow scheduling optimization based on intelligent control for digital twins", Transactions on Emerging Telecommunications Technologies, 2022 Publication	<1 %
26	www.citefactor.org Internet Source	<1 %
27	www.ejournal.unma.ac.id Internet Source	<1 %
28	www.mdpi.com Internet Source	<1 %

29	"Proceedings of the International Conference on Cognitive and Intelligent Computing", Springer Science and Business Media LLC, 2022 Publication	<1 %
30	B. Panthee, S. Dhungana, N. Panthee, A. Paudel, S. Gyawali, S. Panthee. "COVID-19: the current situation in Nepal", New Microbes and New Infections, 2020 Publication	<1 %
31	Delpiah Wahyuningsih, Chandra Kirana, Rahmat Sulaiman, Hamidah, Triwanto. "Comparison Of The Performance Of Eigenface And Fisherface Algorithm In The Face Recognition Process", 2019 7th International Conference on Cyber and IT Service Management (CITSM), 2019 Publication	<1 %
32	Irpan Ali Rahman, Dedi Supriadi, E. Khoridatul Fadilah, Rudi Kurniawan, Elis Noviati, Ima Sukmawaty, Heni Marliany. "Community Knowledge of and Attitudes Towards the Implementation of Health Protocols to Prevent COVID-19", KnE Life Sciences, 2022 Publication	<1 %
33	Laura Gutiérrez-Velasco, Cristina Liébana-Presa, Elena Abella-Santos, Vega Villar-Suárez et al. "Access to Information and Degree of	<1 %

Community Awareness of Preventive Health Measures in the Face of COVID-19 in Spain", Healthcare, 2021
Publication

---

34 Muhadam Labolo. "Implementation of the Public Sector New Normal Policy in The Post-COVID-19 Period", ijd-demos, 2022 <1%
Publication

---

35 Musfirah Musfirah, Ahmad Faizal Rangkuti, Fenni Nurul Khotimah. "Factors influencing hand washing with soap compliance level among beach tourism workers", International Journal of Public Health Science (IJPHS), 2022 <1%
Publication

---

36 Nenny Anggraini, Syarif Hilmi Ramadhani, Luh Kesuma Wardhani, Nashrul Hakiem, Imam Marzuki Shofi, M. Tabah Rosyadi. "Development of Face Mask Detection using SSDLite MobilenetV3 Small on Raspberry Pi 4", 2022 5th International Conference of Computer and Informatics Engineering (IC2IE), 2022 <1%
Publication

---

37 aammt.tmmu.edu.cn <1%
Internet Source

---

38 download.atlantis-press.com <1%
Internet Source

39	ejurnal.seminar-id.com Internet Source	<1 %
40	eudl.eu Internet Source	<1 %
41	jurnal.globalhealthsciencegroup.com Internet Source	<1 %
42	research-repository.griffith.edu.au Internet Source	<1 %
43	www.researchgate.net Internet Source	<1 %
44	"Digital Transformation and Emerging Technologies for Fighting COVID-19 Pandemic: Innovative Approaches", Springer Science and Business Media LLC, 2021 Publication	<1 %
45	Sumardi, Sugeng Hari Wisudo, Wazir Mawardi, Mulyono S Baskoro. "Light intensity design as a fishing tool on liftnet, with pulse width modulation system based on microcontroller", Journal of Physics: Conference Series, 2020 Publication	<1 %
46	Rudolfo Rizki Damanik, Delima Sitanggang, Hendra Pasaribu, Hendrik Siagian, Frisman Gulo. "An application of viola jones method for face recognition for absence process	<1 %

efficiency", Journal of Physics: Conference Series, 2018
Publication

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		