Research Article

Adobe Photoshop Express Application Enhances the Diagnosis of X-Ray Thorax of Covid-19 Patient

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Article history:

Submission December 2020

Revised December 2020

Accepted December 2020

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ABSTRACT

Covid-19 is a new infectious viral illness. The first one appeared in Wuhan, and within two months, it became a pandemic. Medical diagnosis is confirmed by fever, cough, shortness of breath, combined with neutrophil ratio lymphocyte analysis and chest x-ray or chest - C.T. radiology imaging, with a ground-glass appearance. C.T. scans are not widely available in hospitals in Indonesia. Many hospitals only own x-ray for covid-19 as radiologic diagnostic imaging. With digital imaging capabilities, Due to the similarity of applications such as the radiological workstation, Adobe Photoshop Express will improve the capacity to diagnose Covid-19 from a chest x-ray. Adobe Photoshop Express has outstanding digital processing capabilities to enhance the presentation of images so that the efficiency of diagnosing plain x-ray thorax image cases with Covid-19 becomes easier and more manageable.

Keywords: *Photoshop, Covid-19, Plain x-ray thorax, Diagnosis, Image, PACS Workstation*

Background

The Covid-19 case, which started in Wuhan, China, continues to increase the number of cases and deaths. Indonesia, especially now, has not yet reached the peak of its cases. Resources that are needed are very much and require substantial funds (Waldometer, 2020) (Anas, 2020) (Anas, 2020) (Anas, 2020) (Anas, 2020) (Njoto & Anas, 2020).

Clinical diagnosis of Covid-19 is fever, cough, breathlessness. It is supported by a

complete blood ratio of neutrophils to lymphocytes and radiological examination of chest radiographs or C.T. scan of the lungs with a characteristic picture of a ground-glass appearance. Only a few large hospitals have C.T. scan facilities. The rest had only plain chest radiograph imaging modality (Anas, 2020) (Anas, 2020) (CDC and Prevention, 2020) (Song et al., 2020) (Jamil et al., 2020).

This paper will present an article that can help radiologists or clinicians in many hospitals

How to cite:

Jamil, A. M., Putra, M. A. & Anas, M. (2020). Adobe Photoshop Express Application Enhances the Diagnosis of X-Ray Thorax of Covid-19 Patient. *Indonesian Journal of Medical Sciences and Public Health*. 1 (2), 54 – 61. doi: 10.11594/ijmp.01.02.05

that only have X-Ray / Plain Thorax imaging modalities to improve the quality of plain x-ray thorax diagnosis in cases of covid-19 using the Adobe Photoshop Express application (Adobe, 2020).

Epidemiology Covid-19

Covid-19 is a new disease that attacks the lungs because the Coronavirus first occurred in China's Wuhan area. The Covid-19 disease began to develop at the end of 2019, and the cases continued to increase until March. Moreover, a lockdown was carried out in the Wuhan area so that it would not spread. However, some are not completely inhibited. This virus spreads throughout the world, and the most prevalent incidence is in the northern hemisphere so that the number of cases that were initially globally was not too many. However, with the spread of this case throughout the world, there was a very high increase in cases from mid-March to the present (Waldometer, 2020) (Anas, 2020) (Anas, 2020) (Anas, 2020).

The death cases related to Covid-19 were initially only small when compared to events that occurred globally. However, with this spread, the cases have increased, especially in areas of the northern hemisphere in the United States in Italy, Spain, France, England and in In the past month, Wuhan itself has seen an increase in the number of cases of death that had previously been declared nearly zero. Likewise, what happened in our country, Indonesia, was also affected by the impact of the Coronavirus case called Covid-19, which was declared a pandemic by WHO (Waldometer, 2020) (Anas, 2020) (CDC and Prevention, 2020).

According to the Minister of Health, there are several categories of sufferers, namely people who have experienced travel in transmission areas (P.P.). Then OTG, people were infected with Covid-19 but without symptoms and did not have close contact. ODP, people, are infected with Covid-19 and have close contact

with Covid-19 sufferers so that the risk of contracting is very high, people under monitoring have complaints of heat and other symptoms that appear but do not get pneumonia, there is a travel history of transmission, and there is contact with Covid-19 sufferers. PDP, patients in this monitoring, have fever symptoms appearing, and there is pneumonia ranging from mild to severe. People in this monitoring have a fever and other symptoms that appear, but no pneumonia is found. There is a history of travel from the transmission, and there is contact with Covid-19 sufferers. Patients under monitoring have symptoms that appear, and there is pneumonia ranging from mild to severe. There is a history from the local transmission area that there is contact with Covid-19 sufferers. No other causes have been found that caused the case, and people declared Corona Covid-19 when PCR had been examined positively (Anas, 2020) (CDC and Prevention, 2020).

Image Display

The PACS workstation (picture drawing and communication system workstation) is a radiologist device to process digital X-ray image data (Weiss, 2008). The following description will explain invert color, window width (W.W.), and window level (W.L.).

Invert Color

Invert color, a facility that can change the appearance of a radiological plain photo image from white (positive) to black (negative). This discoloration will make it easier for the radiologist to detect any abnormalities present on a plain chest radiograph. Even a small abnormality in the lung in Figure 1a following a plain x-ray thorax in positive white mode is shown in the negative mode for black in Figure 1b. These abnormalities in the negative mode are more pronounced than in the positive mode (Lawrence, 2020).

Figure 1. *Invert Image, Positive-Negative Mode. a. Picture of positive mode with yellow arrow lesion, b. Negative mode image (inverse mode) with the lesion in yellow arrow*(Lawrence, 2020)

Low Window Width (W.W.) and Window Level (W.L.)

Any digital image display requires a pixel value (the numbers used in the computer display range from 0 to the maximum number). The pixel values are allocated in the brightness values of the computer monitor. This condition is achieved using the lookup table (LUT); A simple LUT will be a linear translation of the pixel value against the monitor screen(Walter Huda er al., 2020).

Window Level (W.L.) correlates with the pixel value corresponding to the monitor's mid-gray brightness level. Increasing the window level will make the image darker while decreasing the window level value will brighter the image. We can see the brightness level of the image in the following three images (figure 2) from left to right, whose spectrum gets brighter to the left while getting darker to the right(Walter Huda er al., 2020).

Figure 2. *Window Level (W.L.). Left, appears lighter; Middle, original image; Right, appear darker* (Walter Huda er al., 2020)

Window width (W.W.) defines the range of pixel values used to determine the distance between pixels in the display width. Increasing W.W. will decrease the display contrast (see figure 3 left, center, right), while decreasing W.W. will increase the brightness interval

between two-pixel values(Walter Huda er al., 2020). The contrast in the image can be seen in the following three images with a spectrum of contracted levels. The more apparent it is to the left and the fainter it is to the right.

Figure 3. Window Width (W.W.). Left, contrast image. Middle, original image. Right, blurred image(Walter Huda et al., 2020)

Plain and Invert X-ray Thorax

Normal plain chest x-ray we take an example of a normal chest x-ray from a man 50 years old with a little hyperinflation in both lungs so that there is a flattening of the diaphragm. By

changing the plain x-ray thorax with the Invert mode from the positive x-ray thorax, the results look like in the following image (Figure 4). The lung condition becomes clearer(Gaillard, 2020).

Figure 4. Plain X-ray Thorax. a. Positive mode, b. Negative mode(Adobe., 2020) (Gaillard, 2020)

In the case of the Covid-19 Thorask photo, an example of a case with Covid-19 infection was taken in the right lower lung area. In the lower right lung, the patient's chest radiograph shows opacity, indicating an abnormality in that part of the lung. We see in Figure 5, Figure

5a (positive mode), which is marked with a green circle, shows opacity, and when compared to Figure 5b (negative mode), the opacities appear more apparent and more sensitive to look for lung lesions/abnormalities(Jamil et al., 2020) (Agarwal, 2020).

Figure 5. Covid-19 Lesion on the Right Lung. a. Positive mode, b. Negative mode (Jamil et al., 2020) (Adobe., 2020) (Agarwal, 2020)

Adobe Photoshop Express installation

Almost everyone has a gadget, and even they can have more than one gadget. In this gadget, there is a Playstore to get the Adobe Photoshop Express application. Type in the Playstore, as shown in Figure 6b, look for the

Photoshop Express application when Photoshop appears. Click the Photoshop Express icon and click install. The installation process will run. When it is finished, a display will appear, as shown in Figure 6c. Please click the open tab (Adobe., 2020).

Figure 6. Installing Adobe Photoshop Express on the gadget. a. Playstore, b. Search for applications and click for installation, c. Installed application, click open to start (Adobe., 2020)

Using the Adobe Photoshop Express Application for Diagnosis of Covid-19

When the Adobe Photoshop Express application opens, we can see some images to review for adjustments. First, we tried the invert Photoshop facility with slightly different terms. We took a plain x-ray thorax image, as shown in Figure 7a (Adobe., 2020).

We move the sliders to find the invert facility to change the plain x-ray thorax image to negative mode. When we find the invert button, we adjust our photo mode from positive to negative, as in Figure 7b (Adobe., 2020).

Figure 7. 1st Step Image Settings. a. Adobe Photoshop Express opens, b. Slide to find invert facilities, c. Click the correction button to find brightness and contrast features (Adobe., 2020) (Gaillard, 2020).

When the plain x-ray thorax image has changed to negative mode, then we switch to the next two modes, namely lighting (brightness) and contrast (contrast), by clicking on the correction button (as shown in Figure 7c) (Adobe., 2020).

Next, we look for lighting and contrast facilities by moving the sliders, as shown in Figure 8a. If we have found a contrast facility, as shown in Figure 8b, please move the slider to

select the most appropriate contrast level. In the last stage, we are looking for lighting facilities (brightness) to adjust the brightness level of a plain x-ray thorax image, as shown in Figure 8c. After we apply the 3 Adobe Photoshop Express facilities (invert, brightness, and contrast), the results will be very different from the original plain x-ray thorax image, making it easier to search for lesions/abnormalities in the lungs (Adobe., 2020).

Figure 8. 2nd Step Image Settings. a. Search for lighting and contrast facilities, b. Click the contrast facility to find the appropriate contrast level, c. Click a lighting facility to find the brightness level (Adobe., 2020) (Gaillard, 2020)

Figure 9. Comparing the Original X-ray Thorax with the Image shot of the Covid-19 lesion. a. The results of the invert, lighting, and contrast settings, b. original thorax photo, c. Send the adjustment result(Adobe., 2020)(Agarwal, 2020)

The best results for adjusting plain x-ray thorax images have been obtained. We compare the two plain x-rays thorax image as in Figures 9a and 9b, where the difference is clear. We can send the final plain x-ray thorax image through several facilities, as shown in Figure 9c, including via whatapps, email, instagram, and others(Adobe., 2020).

The addition of the Adobe Photoshop Express image processing application on the gadget will greatly help diagnose cases of Covid-19, which are currently pandemic, so that patients who are treated can get a better and earlier response, and can be done anywhere as long as we can connect to the Internet. Hopefully, the covid-19 pandemic that we have experienced so far can end quickly.

Conclusion

Adobe Photoshop Express has good digital processing capabilities to improve image display so that the quality of diagnosing Covid-19 cases with plain x-ray thorax image becomes better and more manageable.

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