Design The Cervical Cancer Detector Use The Artificial Neural Network

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Abstract. Cancer is one of the contagious diseases that become a public health issue, both in the world and in Indonesia. In the world, 12% of all deaths caused by cancer and is the second killer after cardiovascular disease. Early detection using the IVA is a practical and inexpensive (only requiring acetic acid). However, the accuracy of the method is quite low, as it can not detect the stage of the cancer. While other methods have a better sensitivity than the IVA method, is a method of PAP smear. However, this method is relatively expensive, and requires an experienced pathologist-cytologist. According to the case above, Considered important to make the cancer cervics detector that is used to detect the abnormality and cervical cancer stage and consists of a digital microscope, as well as a computer application based on artificial neural network. The use of cervical cancer detector software and hardware are integrated each other. After the specifications met, the steps to design the cervical cancer detection are: Modifying a conventional microscope by adding a lens, image recording, and the lights, Programming the tools, designing computer applications, Programming features abnormality detection and staging of cancer.

1. Introduction

Cancer is one of the non-infectious disease which become a public health issue not only in Indonesia but also in the world. In the world, 12% of the deaths is caused by the cancer, and it has become the second position in cause of death after the cardiovascular disease. In Indonesia, the prevalence number of cancer and tumor is 4.3 of each 1000 people. (Risksdas, 2007)

According to Prof. Tjandra Yoga, the Director General of P2PL, Ministry of Public, the cervical and breast cancer control sample project had been done in order to detect immediately the cervical cancer. This action used the Visual Inspection method using Acetic acid (IVA). This method was done by rubbing the cervical area with an acetic acid solution. After that, there would be a color change within which shown whether there was an abnormality in the cervical cell or not.

This such early detection method is really practical and cheap. But, it has a low detection accuracy for it can't detect the cancer stage. There's another method which has better detection rather than IVA method, called PAP Smear method. The disadvantage of this PAP Smear method is expensive and needs a well-experienced pathology-citologist, so this method can't be applied widely.

The information technology has developed more and more and it creates smarter and easier-to-use software for many purposes. Some software is used to detect the cervical cancer stage, as well as its abnormality. This software uses the artificial neural network technology. It is able to detect the cancer stage and abnormality through the microscopical image of cervical tissue sample.
The Food and Drug Administration (FDA) has acknowledged the software due to the procedure of the cervical cancer detection. Even more, some researchs show that the cancer stage and abnormality detection through this application software has better accuracy rather than the conventional PAP smear one. (WebMD2002, HTAC 2002)

According to the case above, considered important to make the cancer cervics detector that is used to detect the cervical cancer stage and abnormality and consists of a digital microscope, as well as a computer application based on artificial neural network.

The women's knowledge about this disease are still low. According to the survey which involved 5,423 Asian women within 9 countries--including Indonesia, it has been proven that only 2 percents of the women who have the knowledge about HPV infection. (Emilia, 2010)

The women's knowledge level about the cervical cancer also affects to the less women that take a cervical examination. In fact, it's necessary to determine whether the cervical cells is normal or not. If there's an abnormality, it can be detected earlier, so it becomes easier to both prevent and to cure. (Diananda, 2008)

Therefore, it needs a tool that is able to detect properly and practical. In other words, the women can easily check their cervical condition.

1. Material And Method

   The cervical cancer detector uses software and hardware integrated each other. Below is the explanation about the specifications of the required hardware and software.

   • Hardware
     a. desktop computer/ notebook is used to make subsystem of computer application and to do programming when subsystem acquired image.
     b. Microcontroller ATMega 32 as a controller in digital microscope.
     c. Lens and image recording to capture the cervix tissue
     d. Microcontroller Digital Signal Processing (DSP) for image processing results of capturing a digital format (image acquisition subsystem)
     e. Serial communication module to transmit the results of image capturing to the computer

   • Software
     a. AVRStudio 4, to do programming on the controller, DSP microcontroller and serial communication module
     b. NetBeans, to make the application interface
     c. Plug-in NeurophStudio, to make detection feature on an application made

   After the specifications met, the followings are the step to design the cervical cancer detection:
   a. Modifying a conventional microscope by adding a lens, image recording, and the lights
   b. Programming the controller lens
   c. Programming the serial communication modules between the microscope – computer
   d. Designing computer applications
   e. Programming features abnormality detection and staging of cancer
   f. Do training to the application in order to identify abnormalities and the stage of cancer
   g. Testing the tool

   Below is the steps in flowchart:
Figure 1. The flowchart to design system

Early step Modifying a conventional microscope by adding a lens, image recording, and the lights. This is done in order to obtain clear images and easy process. Additional lenses are used in order to correct the image acquisition. And image recording needed for a microscope capable of recording images captured. The lamp used to illuminate the object in order to be seen clearly.

Figure 2. Modifying a microscope

The next step is to control the lens. This used to wear can be adjusted as needed. After that, it needs special programming so that the serial communication modules between the microscope – computer can be connected. It is that image in the microscope can be directly sent to a computer and image processing will be done next.

Figure 3. Connect a microscope and computer
Design of computer applications is done using the artificial neural networks. The artificial neural network is an information processor system which imitates the characteristics of biological network. This network is made by generalizing the mathematical function of some biological tissues, and has the following characteristics:

- The information processing occurs in many simple element, that is neuron
- The signal is being delivered between the neurons through the connectors
- The connector between neurons has a value which can strengthen or weaken the signals
- The given value can be done through a training or learning algorithm
- To determine the outputs, each neuron uses the activation function which imposed on the number of the received inputs. The outputs value is being compared with the threshold 

(Siang, 2009)

From analysis or the artificial neural network can be in the program if the image is a regular cell or cancer cells. If you find any differences in cell (found cervical cancer), it can be programmed cancer cell is in what stage.

The next , do training to the application in order to identify abnormalities and the stage of cancer the artificial neural network is used in order to understand the pattern of input that result in the appropriate output.

Testing is done by collecting a tissue sample screening results. The results of screening are then processed in the image acquisition subsystem in order to become a digital format and can be read by a computer. Furthermore, the image will be processed by the software and are classified into the categories of normal, low-grade squamous intraepithelial lesion (LSIL), or high-grade squamous intraepithelial lesion (HSIL).

3. Conclusion

1. The use of such software in a cervical cancer detection procedure has better accuracy than the conventional Pap smears. The conventional pap smears method needs an experienced pathologist to detect cervical cancer. But, the number of them bit in order the detection of cervical cancer use pap smears make accuracy is not good.

2. Synchronization between hardware and software is necessary to obtain the optimal system function. It is caused tranferred image from the microscope to the software will not be done if the synchronization between the hardware (microscope) and the software is not good.

3. Neural network that works like the expert experts hail obtained optimal

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