



Activity Monitoring Systems for Children with Cancer Using the Convolutional Neural Network (CNN) Method

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Abstract. Cancer is one of the killing diseases. Cancer is a condition triggered by the uncontrolled division of abnormal cells in a specific body part. Childhood cancer is a diagnosis of cancer that occurs in children up to the age of 18 years, including children who are still in the womb. Community Care for Child Cancer and Chronic Diseases (KPKAPK) which provides psychological assistance services for families and children, providing services informal education and mentoring of children, providing activities education and recreation for children with cancer, as well as fundraising to help children's medical expenses from the underprivileged family. The effects of cancer treatment carried out by children with cancer can be in the form of diarrhea, nausea, vomiting and fatigue. Cancer-Related Fatigue (CRF) is a common side effect in cancer patients in those experiencing cytotoxic chemotherapy, radiation therapy, bone marrow transplantation, or biologic response modifier Cancer-Related Fatigue (CRF) is a common side effect experienced by cancer patients undergoing cytotoxic chemotherapy, radiation treatment, bone marrow transplantation, or biologic response clarifier therapies. The urgency of this research emerged as a form of social care and support for children with cancer who take shelter in halfway houses, support patients in handling this distressing condition and remaining as active in life as possible, also support for the volunteers involved in the shelter. Researcher have designed a technology that will help the volunteers in monitoring the activities of children with cancer patients at shelter, utilizing intelligent system technology that can identify image recorded by the camera and processes it with Image Processing based on Machine Learning embedded in it Convolutional Neural Network (CNN) Algorithm.

Keywords: Childhood Cancer · Cancer Related Fatigue · Image Processing · Machine Learning · Convolutional Neural Network (CNN)

1 Preliminary

Cancer is one of the biggest killer diseases in the world. Cancer is a disease marked by the presence of malicious cells/tissues that grow rapidly and abnormally and can extend to other areas of the person's body [1]. Childhood cancer is a cancer diagnosis

that occurs in children under the age of 18, including children still in the womb, where WHO data states that childhood cancer cases reach 2–4% of all children incidence of cancer in humans [2, 3].

Community Care for Child Cancer and Chronic Diseases (KPKAPK) which provides psychological assistance services for families and children, providing services informal education and mentoring of children, providing activities education and recreation for children with cancer, as well as fundraising to help children's medical expenses from the underprivileged family [3]. The South Sumatra Children's Cancer Foundation as part of the KPKAK noted that: the number of children diagnosed with cancer in South Sumatra is increasing between 60 to 80 percent in the last eight years with 36 to 40 new cases every year [4].

The effects of cancer treatment carried out by children with cancer can be in the form of diarrhea, nausea, vomiting and fatigue. Cancer-Related Fatigue (CRF) is a common side effect experienced by cancer patients undergoing cytotoxic chemotherapy, radiation treatment, bone marrow transplantation, or biologic response modifier treatment [5].

The urgency of this research emerged as a form of social care and support for children with cancer who take shelter in halfway houses, assist the patient in managing this difficult condition and remaining as active in life as possible, also support for the volunteers involved in the shelter. Patients' quality of life (QOL) decreases as a result of sustained cancer-related fatigue because they are too tired to fully participate in the roles and activities that make their lives valuable [5].

Researcher have designed a technology that will help the volunteers in monitoring the activities of children with cancer at shelter, utilizing intelligent system technology that can identify image recorded by the camera and processes it with Image Processing based on Machine Learning embedded in it Convolutional Neural Network (CNN) Algorithm.

2 Overview

The Monitoring systems built using Camera Sensors (Web Cam and CCTV), Arduino, MiniPC, Speaker, WIFI Router, and LCD Display Screen. By implementing Artificial Intelligence built into this activity monitoring devices children with cancer, movement classification, Image Processing and Convolutional Neural network (CNN) algorithm.

2.1 Image Processing

Image processing is the conversion of images to digital form for a particular aim. Initially, image processing was used to correct and improve the quality of an image; however, as technology advanced and computational sciences emerged, humans were able to retrieve information from images. The input is an image and the output is an improved image. The activity of analyzing an image in order to generate useful information for decision making (typically using Artificial Intelligence or AI for Pattern Recognition using Artificial Neural Networks, Fuzzy Logic, and others) [6, 7].

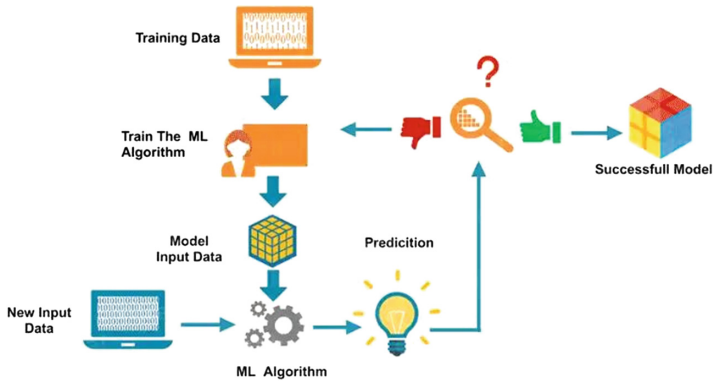


Fig. 1. Machine Learning Concepts

2.2 Machine Learning

Machine learning is a branch of artificial intelligence (AI) that implements statistical methods to create an automated model of a dataset in order to provide computers with the capability to “learn.” Machine learning, also known as deep learning, allows a computer to learn from data and create a model to perform the input-output process (Fig. 1).

2.3 Convolutional Neural Network (CNN)

CNN (Convolutional Neural Network) is a machine learning algorithm derived from the expansion of Multi Layer Perceptron (MLP) that is devised to process two-dimensional data. CNN is categorized as a Deep Neural Network due to the depth of its network and various applications in image data. CNN employs two methods: feedforward classification and backpropagation stage learning.

Several studies have combined Image Processing and Convolutional Algorithm Neural Network (CNN) in the recognition/recognition of human activities, including “ Identification of image processing operations using a convolutional neural network” [8], “ Image processing with CNN for medical diagnosis” [9], and “ Convolutional Neural Networks for recognizing human activity using mobile sensors”[10].

The design that will be built employs several hardware components, as shown in the block diagram in Fig. 2, consist of Camera Sensors (Web Cam and CCTV), Arduino, MiniPC, Speaker, WIFI Router, and LCD Display Screen.

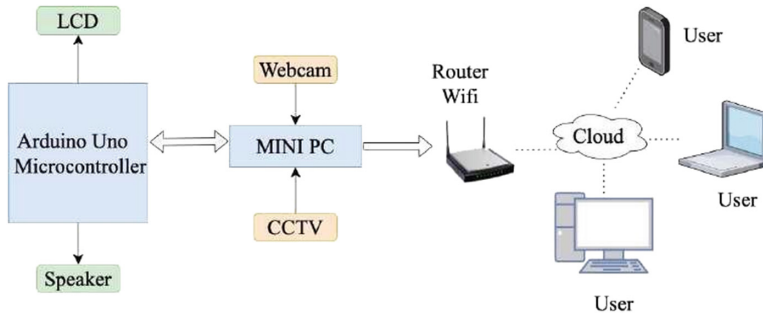


Fig. 2. Hardware Block Diagram of Monitoring Systems

3 Methodology

3.1 Systems Design

System design is an After-analysis stages of the system development cycle, functional requirements definition and preparation for design and implementation, describe how a system is formed (Fig. 3).

The first step is to collect data in the form of a video dataset, where machine learning must have prior knowledge about the activity in order to recognize each movement of children's activities. This information is derived from the video dataset, which is fed into the processor, which serves as the monitoring device's brain.

When the camera captures the child's activity, the Processor processes the data by comparing the captured activity to the dataset that becomes the device system's knowledge base, and produces a classification child activity.

The input data in the form of video will be extracted into an image, which will then be displayed. At layer 1, 5x5 kernel, 16 filters were used, followed by maxpooling 2x2 and proceeding to the second layer with 5x5 kernel, 32 filters, and maxpooling 2x2.

3.2 Testing and Analyzing

System testing is the process of determining whether a software system conforms to specifications and is running in the desired environment. As for Testing focused on the system's dependability in classifying the type of activity performed, as well as communication between hardware and software to the device used by the user to monitor.

Training and Testing Data

At this point, the training and testing methods are carried out on the collected dataset. The dataset consists of approximately 100 records of video captures and activity photos. The process of training and testing the data is carried out using the Convolutional Neural Network (CNN) method, which includes 2 parts, namely feature learning and classification. The training's outcomes can be seen in the following (Fig. 4).

Following training on the dataset, the next step is to test the dataset using a camera to demonstrate the monitoring system's ability to detect correctly or incorrectly in accordance with the dataset that has been provided. In the process of retrieving child activity

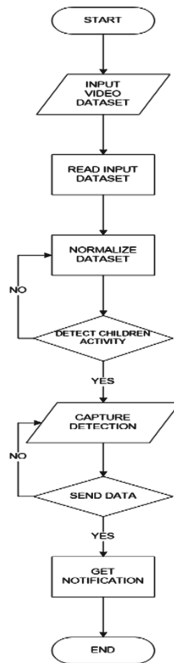


Fig. 3. Flowchart of a Child Activity Monitoring System

```

1 import os
2 data_gambar = list()
3 data_label= list()
4
5
6 from PIL import Image
7 from numpy import asarray
8 # load the image
9
10
11
12 def listdirs(rootdir):
13     for file in os.listdir(rootdir):
14         d = os.path.join(rootdir, file)
15         if os.path.isfile(d):
16             #baca gambar
  
```

Run: training -

2022-07-26 23:44:31.437708: W tensorflow/python/util/util.cc:348] Sets are not currently considered sequences, but this may change in the future. See https://www.tensorflow.org/api_guides/python/sets

4/4 - 1s - loss: 3.9529e-06 - accuracy: 1.0000

Process finished with exit code 0

Fig. 4. Training Dataset

detection data using a webcam camera, data retrieval is done by placing the camera position based on the location and the intended object where the distance between the camera and the object is determined to get a clear object in carrying out the activity. The majority of the activities were carried out in the common room of the Sumsel Children's Cancer Foundation shelter.

Overall, the monitoring system built has been successful in monitoring activities in the room, as long as the object is not too far away from the monitoring camera, with a

maximum distance of 20 cm - 100 cm. If the object is too far away, the activity monitoring that is read will encounter detection errors.

Website Design Outcomes

The website created for this system is used to track its performance and can be accessed remotely with the aid of an internet connection, making it simpler to learn how the system is performing. When accessing a website, an account login will be visible on the home page, as shown in the following (Fig. 5).

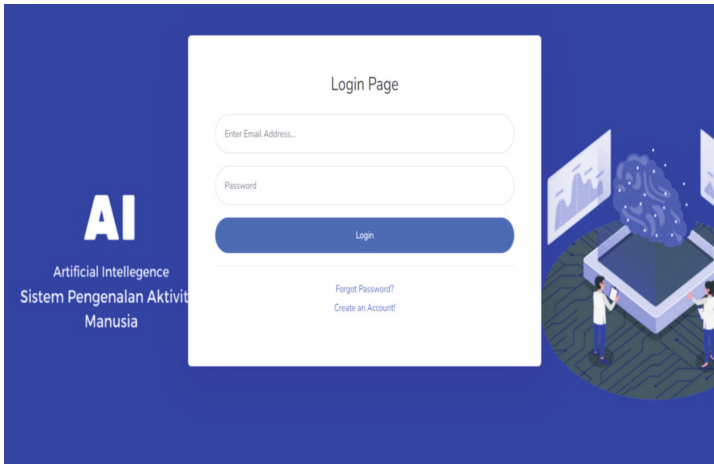


Fig. 5. Website Account Login Display

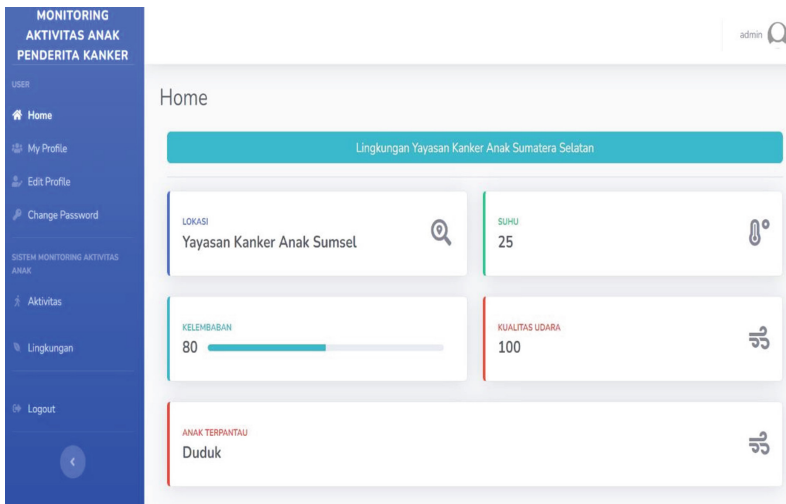


Fig. 6. Home Page Display

The website will display the results of activity monitoring and assessment of the sensors used on the tool after logging in to the account on the start page, as shown in (Fig. 6).

4 Conclusions

Activity monitoring system for children with cancer that uses intelligent system technology to identify images captured by cameras and process them with Machine Learning-based Image Processing embedded in the Convolutional Neural Network (CNN) Algorithm, capable of detecting expressions of fatigue and stress tendencies experienced by children with cancer in a shelter. The built-in monitoring system has been successful in monitoring activities in the room, as long as the object is not too far away from the monitoring camera, with a maximum distance of 20 cm - 100 cm. If the object is too far away, the activity monitoring that is read will have detection errors rather than precision.

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