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The Application of Drug Recognition Based on Image Processing for Visually Impaired Individuals

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ABSTRACT
Visually impaired individuals face many problems throughout their lives.Insufficient education and inadequate facilities affect the lives of the visually impaired people. With today's technology, there are many studies that can facilitate the daily life of visually impaired people and continue their lives without the need of any relatives. In this study, by using smart phone camera, it was aimed to detect the drug shown to the camera and to introduce the drug to the visually impaired person by voice.
Keywords– machine learning, image classification, neural networks, optimization algorithm, medicine detection

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I. INTRODUCTION

People who cannot perceive the light or cannot detect enough light to count the fingers of a hand with a distance of 3 meters with two eyes are considered visually impaired [1]. According to the Ministry of Family, Labor and Social Services, The ratio of impaired vision in Turkey is %1.4 [2]. In 2015, 36 million visually impaired individuals were reported to be living worldwide [3].

Artificial neural networks offer new solutions in many areas such as image processing, health, defense, biology, astronomy and so on [4]. In order to process the image, the image must be transferred to a computer and digitized. The digitized image is made meaningful by means of artificial neural networks. Artificial neural networks were inspired by the human brain and a layered network structure was created by simulating the operation of the nerve cells. In this study, multilayer back propagation artificial neural network model is used. Multi-Layer Perceptron (MLP) is a feedforward back-propagation artificial neural network model consisting of a neuron input layer with a different number of inputs, one or more intermediate layers, and an output layer [5].

Deep learning is a class of machine learning. Feature extraction uses many non-linear processinglayer units. Each layer takes the output from the previous layer as input [6]. It is mainly based on learning from the representation of data. Deep learning made a big impact in the world of science in 2012 for the first time. ImageNet, a competition in the field of object identification, was won in 2012 by Convolutional Neural Networks (CNN), which is considered the basic architecture in deep learning [7].

The aim of this study is to help visually impaired people identify drugs with the help of a mobile application by using deep learning algorithms. A dataset of 1000 photographs was created with the images taken from the mobile phone.

II. IMPLEMENTATION AND METHODS

2.1 Performance Comparison of Optimization Algorithms

Optimization in deep learning applications is the method that finds the absolute minimum value of the error function in order for the application to yield a healthy result. The one used in the optimization of artificial neural networks is the Gradient Descent. There are several algorithms based on the Gradient Descent method. The most popular ones are; Root Mean Square Propagation (ADMS), Adaptive Moment Estimation (Adam), Stochastic Gradient Descent (SGD) [8]. The optimization algorithms applied in the selection of the optimization and performance evaluations are shown in Table 1.

Table 1: The algorithms that have been evaluated [9]

Optimizer	**Formula**
Rmsprop	$E[g^2]_t = 0.9E[g^2]_{t-1} + 0.1gt2$ $\theta_{t+1} = \theta_t - \frac{\eta}{\sqrt{E[g^2]_{t+\epsilon}}} g_t$ $g_t = \nabla_{\theta_t} J(\theta_t)$
Adam	$m_t = \beta_1 m_{t-1} + (1-\beta_1) g_t$ $v_t = \beta_2 v_{t-1} + (1-\beta_2) g_t^2$ $m'_t = \frac{m_t}{1-\beta 1t}$, $v'_t = \frac{v_t}{1-\beta 2t}$ $\theta_{t+1} = \theta_t - \frac{\eta}{\sqrt{vt' + \epsilon}} m'_t$
Adagrad	$g_{t,i} = \nabla_{\theta_t} J(\theta_{t,i})$ $\theta_{t+1,i} = \theta_{t,i} - \frac{n}{\sqrt{G_{t,ii} + \epsilon}} g_{t,i}$
Nadam	$\theta_{t+1} = \theta_t - \frac{\eta}{\sqrt{vt' + \epsilon}} (\beta_1 m'_t + \frac{(1-\beta_1) g_t}{1-\beta_1^t})$

In order to determine which optimization is better, prior to classification and training, classes created using PyCharm using the Keras and Tensorflow libraries in python have undergone performance evaluation. The performances of Rmsprop and Adam algorithms are shown in Table 2.

Table 2: Comparison of Rmsprop and Adam Algorithms

Optimizer	Number of Epochs	Accuracy (%)
Adam	60	%85.31
Rmsprop	60	%84.71
Nadam	60	%84.18
Adagrad	60	%72.41

As it is seen in the results, the best accuracy performance is given by Adam Algorithm. The accuracy and loss results of Adam and Rmsprop algorithms with 60 iterations are shown in Figure 1.

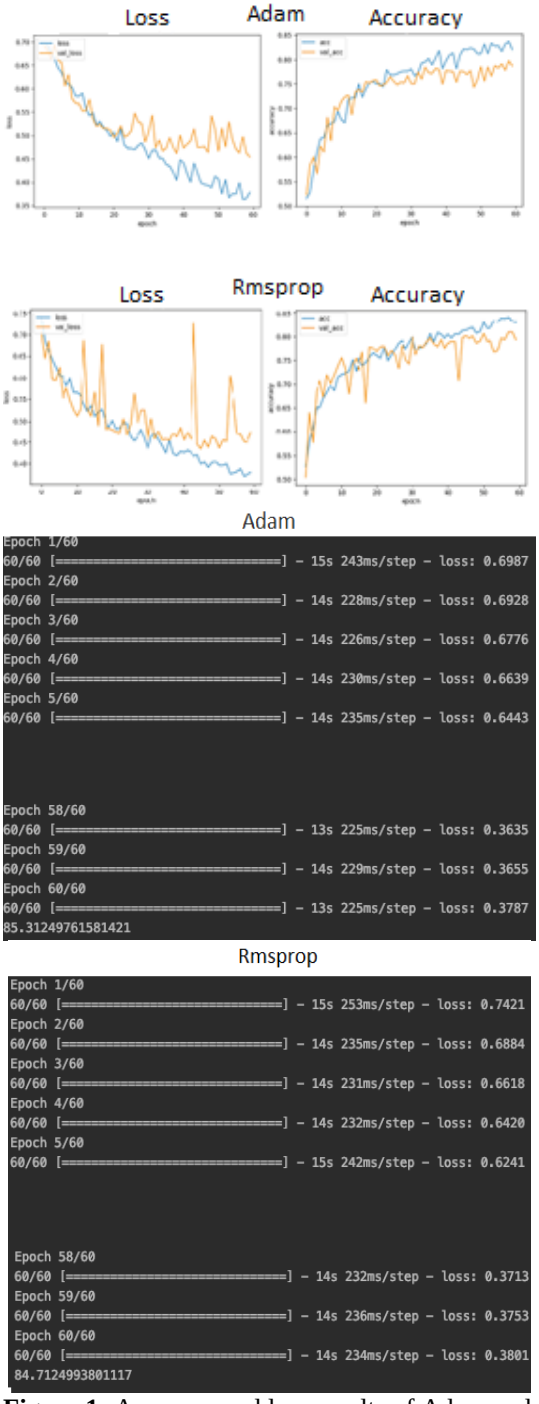

Figure 1: Accuracy and loss results of Adam and Rmsprop algorithms with 60 iterations

As a result of the performance evaluation, the Adam optimization algorithm was found to be more stable and has more performance than Rmsprop. It was decided to use Adam algorithm in this application.

2.1 Dataset Creation and Training

In this study, a total of 1000 medicine boxes were taken with different angles and different backgrounds. Image processing and the

use of artificial neural networks were made with Core ML 3 and PyCharm software. Figure 2 shows a picture of drug boxes taken with different backgrounds and angles.

Figure 2: Medicine box photos at different angles

Figure 3 shows the result of histogram equalization to the gray-tone image used for image enhancement.

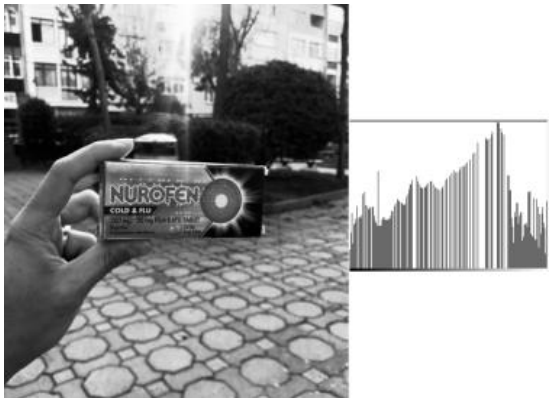

Figure 3: Histogram equalization applied to medicine box photos

Histogram synchronization is a method used to correct color distribution distortion. It distributes the value of pixels in the range 0-255, allowing the spacing of the pixel values. This results in a noticeable improvement in the image [10]. The histogram of the sample photograph after histogram equalization with the gray histogram is shown in Figure 4.

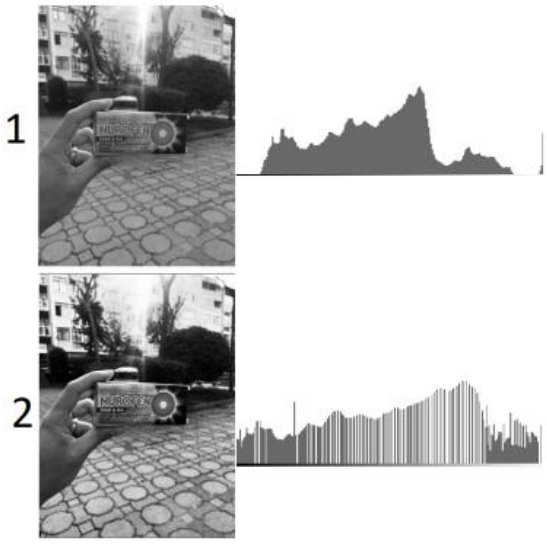

Figure 4: 1) Gray Histogram 2)Histogram sync after application

In the study, artificial neural networks were used to classify drug photographs taken from different angles. Core ML 3 shown in Figure 5 was used for image classification.

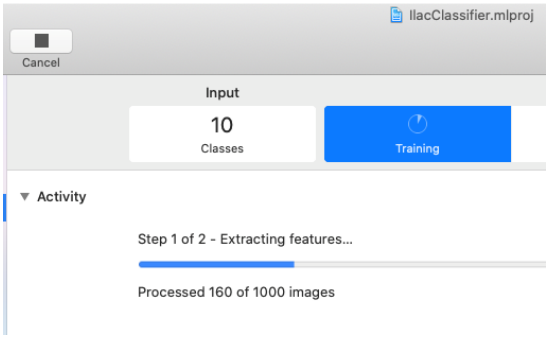

Figure 5: Image classification with Core ML 3

During the 2018 Worldwide Developers Conference introduces Create ML, which comes with Apple Core ML 3. Create ML was created with Swift, Apple's programming language. Classes from Create ML are shown in Table 3 [11].

Table 3: Classification in Create ML

Image	Image Classifier	Object Detector
Sound	Sound Classifier	
Motion	Activity Classifier	
Text	Text Classifier	Word Tagger
Table	Tabular Regressor	Tabular Classifier

With the Create ML application that comes with Core ML 3, the inputs and test data are shown and the training starts as shown in Figure 5.

Training time varies according to the number of data, CPU and GPU power. The result of the training is shown in Figure 6.

Figure 6: Performance of 10 class dataset

III. RESULT AND DISCUSSION

The model created with Core ML 3 was added to the application written in swift language and tests were performed on the smartphone. Tests are performed by showing the phone's camera to the medicine, as shown in Figure 7. The result obtained by the Google Text-to-Speech (gTTS) library is announced by voice command.

Figure 7: Drug image from phone camera

The results of 10 trials for each drug box are given in Table 4..

Table 4: The results of 10 trials

Drug	**Accuracy Performance**
Nurofen	100%
Majezik	80%
Buscopan	80%
Devit-3	80%
Lansor	70%
Parol	90%
Coraspin	70%
Nootropil	100%
Dolorex	80%
Voltaren	90%

The classification of 10 different drugs was achieved with a very low dataset number with an overall success rate of 84%. In order to achieve higher performances, it is possible to increase the number of neurons in each layer and add details such as filter properties. In further studies, it is predicted that with increasing the number of data set photographs, it can achieve more successful discrimination performance.

REFERENCES

[1]. Yücel, C.Y., &Acartürk, C., (2006). GörmeEngellileriçin Web SayfalarındaErişilebilirliğinSağlanması. 8. AkademikBilişimKonferansı, 2006, 09-11.
[2]. Aile, Çalışma ve SosyalHizmetlerBakanlığı, Engelli ve YaşlıİstatistikBülteni, 2019
[3]. World Health Organization, World Report on Vision, 2019.
[4]. ACHARYA, T. ve RAY, A.K., Image processing Principles and Applications, Wiley-Interscience, 2005.
[5]. Doğan, G., YapaySinirAğlarıKullanılarakTürkiye'dekiÖzelBirSigortaŞirketindePortföyDeğerlendirmesi, Hacettepe University, Ankara, Turkey, 2010.
[6]. L. Deng and D. Yu, Deep Learning: Methods and Applications, Found. Trends® Signal Process., vol. 7, no. 3–4, pp. 197–387, 2014.
[7]. Krizhevsky, A., I. Sutskever and G. Hinton (2012). ImageNet classification with deep convolutional neural networks, 2012
[8]. Kurt, F., EvrişimliSinirAğlarındaHiperParametrelerin EtkisininİncelenmesiHacettepeÜniversitesi, Fen BilimleriEnstitüsü, 2018
[9]. Ruder, S., An Overview of Gradient Descent Optimization Algorithms, (2016).
[10]. Yaman,K.,GörüntüişlemeyönteminiAnkara hızlıraylıulaşımsistemigüzergahındaseferaralıklarınınoptimizasyonunayönelikolarakincelenmesi. GaziÜniversitesi, Fen BilimleriEnstitüsü, 2000.
[11]. Apple Inc. Create ML. Secondary Create ML. Available at: https://developer.apple.com/documentation/createml Accessed September, 2018.

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