University of Sri Jayewardenepura

# MEDICAL PRESCRIPTION RECOGNITION AND PHARMACY RECOMMENDATION SYSTEM

ICT 334 2.0 Group Project

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# 1. Abstract

A Doctor's prescription is a handwritten document written by doctors in the form of instructions that describes list of drugs for patients in time sickness, injuries and other disability problems. While we receiving a new prescription from doctor, it is unable to understand what drug name is prescribed on it. In most cases, however, we wouldn't be able to read it anyway because doctors use different abbreviations and medical terminologies on prescriptions that are not understandable by the general persons which make reading it very difficult. According to the National Academy of Sciences estimates that at least 1.5 million peoples are sickened, injured or killed each year by errors while reading prescription. In this project we proposed Smart phone application that uses Conventional Neural Network (CNN) to recognize handwritten medicine names and return readable digital text. This mobile application uses Fastai as the machine learning library. This makes the ordinary persons to understand what doctor is prescribed in the prescription and also help for pharmacists.

# 2. Introduction

This research project is figure out from the medical use of the CNN. We are trying to recognize the prescription written by the doctors. As we all know how difficult is this to read the actual prescription written by doctor own hand or doctor handwriting. Since the hand writing of doctors is difficult to read out, we are trying to do this by the means of handwriting recognition using the CNN techniques. Since most of the words are again unrecognizable to most humans therefore it will also be very hard for machine to do so. Thus, we here want the most probable matching word to the ease for the human to guess the exact medicine. Our main motive is to use handwriting recognition method for medical purpose and its possibilities and future scope. After capturing image of the prescription, application feature extraction, processing, classification and knowledge acquisition from training data. For this the training and test images are used to train and test the neural network respectively. For any system to recognize well, it is very important to train it very well. As we all know the difference between the real-life input and the training data provided to the system is very large, thus it is very well understood that the system may not behave well. Thus, we have to give a diverse training data to the system.

# 3. Motivation

Misinterpreted drug names in medical prescriptions cause severe and lethal effects to patients. This is caused by either illegible handwriting or inability of pharmacists to recognize medicine names in medical prescription. This proposed project resolves the problems in medical prescriptions through a mobile application. This will help pharmacists minimize their doubts in selling the wrong medicine to patients. This will also be a handful to the patients because it will provide a way to know more about the medicine they are about to take.

# 4. Aim and Objectives

Project follows up mainly with three divisions to answer the given problem.

- Training a machine learning model to recognize handwritten prescription by doctors.

- Development of a mobile application where users can take a photo of the subscribed prescription and find the pharmacies where the relevant drugs are available.

- Development of a web application where pharmacists can index available drugs.

# 5. Proposed System

The system will be mainly composed of two parts,

1. Mobile application for the patients
2. Web application for the pharmacists

Mobile application for the patients:

Objective of the mobile application is to scan prescriptions and suggest available pharmacies with the particular drugs, where patient is the end user of the application. Through the trained model app will suggest the name of the prescribed medicine where patients get informed about given drugs. Mobile application will send the photo to the web application where end users are pharmacists, which will act as proof for prescription only drugs and pharmacists will be able verify suggested drugs the model which will minimize selling wrong drugs to the patients.

Web application for the pharmacists:

Web application is provided to facilitate the pharmacists to manage and update the available drugs. Pharmacists will get photos of the prescribed medicines of the patient through mobile application with the recognized medicines by the model where pharmacist can verify the requests.

## 5.1   Personal Contribution

To predict hand written we have to trainee deep learning model. For that we use **Fastai(Backend-PyTorch)** frame work with transfer learning method.

Transfer learning (TL) is a research problem in Machine Learning (ML) that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem. The models have to be rebuilt from scratch once the feature-space distribution changes. Transfer learning is the idea of overcoming the isolated learning paradigm and utilizing knowledge acquired for one task to solve related ones the key motivation, especially considering the context of deep learning is the fact that most models which solve complex problems need a whole lot of data, and getting vast amounts of labeled data for supervised models can be really difficult, considering the time and effort it takes to label data points. The first thing to remember here is that, transfer learning, is not a new concept which is very specific to deep learning. There is a stark

difference between the traditional approach of building and training machine learning models, and using a methodology following transfer learning principles

For implementation of faster learning we use Resnet-18 pretrained model

ResNet-18 a pre-trained deep learning model consisting of 18 layers — because it has a high accuracy level for classifying handwriting. Within the neural network are layers that are used to identify outlines, curves, lines and other identifying features of these animals. The layers required a lot of labeled training data, so using them saves a lot of time.ResNet-18 is a deep residual network. The "18" refers to the number of layers it has. It's a subclass of convolutional neural networks, with ResNet most popularly used for
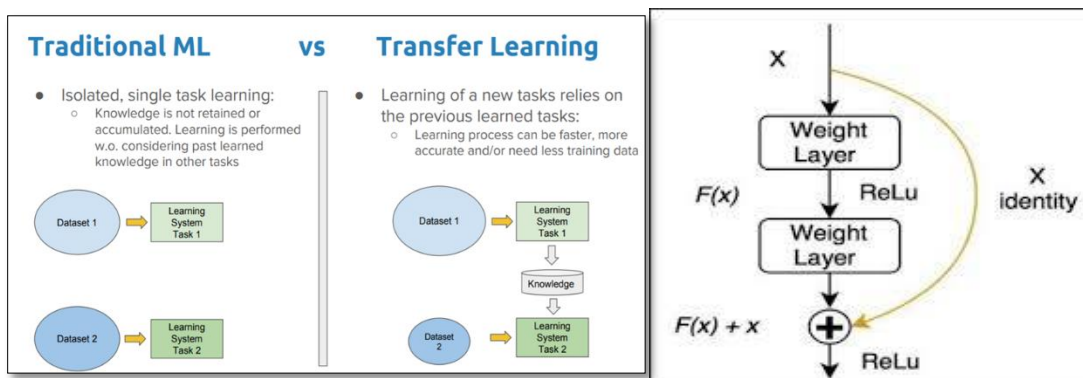


image classification. The main innovation of ResNet is the skip connection.

As you know, without adjustments, deep networks often suffer from vanishing gradients, ie: as the model backpropagates, the gradient gets smaller and smaller. Tiny gradients can make learning intractable. The skip connection in the diagram below is labeled "identity." It allows the network to learn the identity function, which allows it pass the input through the block without passing through the other weight layers

The fastai library simplifies training fast and accurate neural nets using modern best practices. An example of this is the differential learning rates feature, which allows us to perform transfer learning with less code and time by giving us the ability to set different learning rates for different parts in the network

**Backend,** receive image through RESTapi and predict the word and gives the response in Json format. For creating backend, we use python programming language.

# 6. Discussion



Confusion matrix
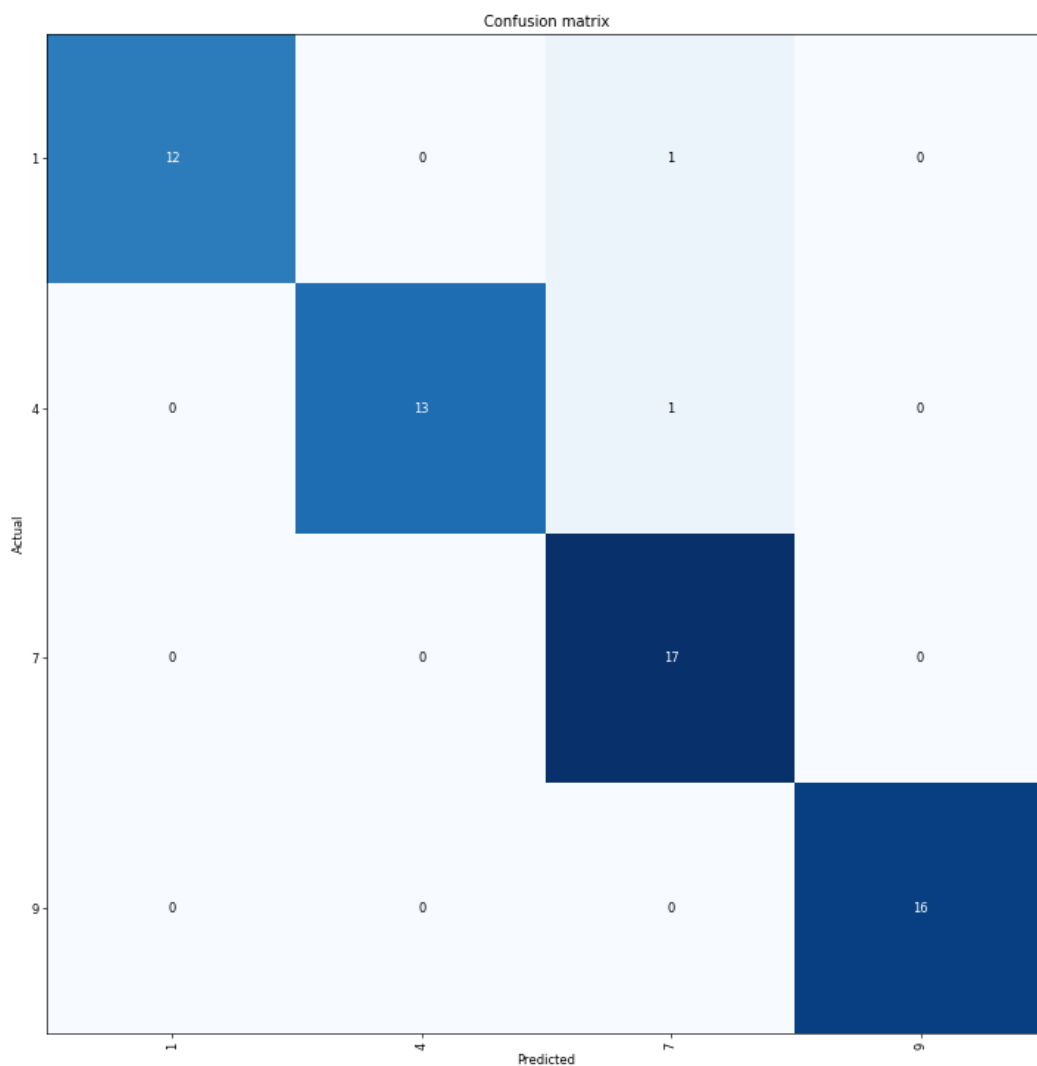
| train_loss | valid_loss | accuracy |
|------------|------------|----------|
| 0.050655 | 0.091052 | 0.966667 |

| Encode number | Name |
|---------------|------|
| 1 | Paracetamol |
| 4 | Centralize |
| 7 | Domperidone |
| 9 | Corex |

Currently system is designed as such user must crop the photo and filter location through user input. This could be solved in future development where mobile application

automatically recognize the drugs in the prescription (Object detection) with user location where system automatically filter available pharmacies.

In the current pharmacy web application user must input drugs manually to the system, where this could be improved as such through automation. Current web application notifies new user requests, drug requirements by clients where this could be improved to online billing service.

# 7. Conclusion

In this project, we provide a smart way to recognize the doctor's prescription using machine learning. This application will help for those people who suffer while seeing the doctor's prescriptions. The key role of this project lies on data used for training purposes. The more accuracy of training data increases the performance of the mobile application which will minimize the risk of inaccurately identifying drugs by pharmacists.

In this paper, we provide a smart way to recognize the doctor's prescription using deep machine learning. By using the Convolutional Neural Network (CNN) neighborhood character is predicted. This application will help for those people who suffer while seeing the doctor's prescriptions. The key role of this paper lies on data used for training purpose. The more accuracy of training data increases the performance of the application. By training the large data with large iteration we can perform the application efficiently.

# 8. Acknowledgement

With a deep sense of gratitude, we wish to express my sincere thanks to our guides, Mr. Ravimal Bandara, Department of Computer Science for giving us the opportunity to work under him on the project. We truly appreciate and value esteemed guidance and encouragement by him for tireless effort to make this project a success. We want to thank to all our lecturers for providing a solid background for our studies and research thereafter. They have been great source of inspiration to us and we thank them from the bottom of our hearts. We also want to thank our parents, who taught us the value of hard work by their own example. We dedicate this work to our parents and all the lecturers and support staff of the Department of Computer Science, University of Sri Jayewardenepura, for their tireless and selfless efforts they have spared in making us who we are today.

# 9. References

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[4]    https://towardsdatascience.com/a-comprehensive-hands-on-guide-to-transfer-learning-with-real-world-applications-in-deep-learning-212bf3b2f27a

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# 10. Appendix

Search... 🔍

OSU APPLICATION

🏛 DASHBOARD

📑 INVENTORY

👤 PHARMACY

**Add Drugs**

Drug Name

⬜ Available!

| ADD |

| Name | Available | Remove |
|------|-----------|--------|
| zinco | false | 🗑 |
| b complex | true | 🗑 |
| panadol | true | 🗑 |
| asd | true | 🗑 |
| citrazine | false | 🗑 |
| vicodin | true | 🗑 |

LOG OUT

Dashboard

Search... 🔍

OSU APPLICATION

🏛 DASHBOARD

📑 INVENTORY

👤 PHARMACY

**Order List**

| Order ID | Drug ID | Drug Name | Count | Remove |
|----------|---------|-----------|-------|--------|
| add | 301abf | Vitamin | 2 | 🗑 |

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