Thesis/Final Project Registration Form

Student(s) Personal Details:

First Name	***Last Name***	***Father Name***	***Year***	***Semester***	***Supervisor***	***Project Duration***	***No of Students***
Hamidullah	*Jaffari*	*Mohammad Zahir*	*1401*	*Spring*	*Ziaullah Mommand*	*30 weeks*	*2*
Nawrooz	*Bunyadi*	*Fazlullah*					

Thesis/Final Project Details:

Start of project (year-month-day)	*1401-2-3*	*Expected date for completion*	*1401-9-1*

Topic	*Diagnosis of Measles Disease Using Image Processing in children under 5 Afghan Children*
Problem	*Measles is a highly contagious infectious disease caused by measles virus. This is an endemic in Afghanistan, with almost all provinces reporting suspected cases every year. From 1 January 2021 to 29 January 2022, 35319 suspected measles cases were reported in Afghanistan [1]. There is not any system that clears how many people are infected to the disease or which region has the highest amount of infection to the disease. It is critical that we must be completely aware of the outbreak of the disease to prevent this*

	from spreading. To accomplish that we must provide a system, that people can easily register themselves to the system if they are infected. *The most common symptoms of measles include high fever, tiredness, cough, runny nose, red rash, which increase the similarity of measles to other contagious disease and make it hard to diagnose it. As well as there is not any online system in the world to diagnose it. Because of high similarity of measles to other diseases people spend every kind of drugs and tablets to cure it. Unfortunately, instead of curing that disease they cause for another diseases. We have to search about this and find the natural drugs which is affordable and accessible to them to cure it. We must guide them efficiently what they must do if they are infected to the disease.* *As we know that measles is a highly contagious disease, for example the discovery shows that from ten people in one home which one of them is infected to measles will infect the nine of them [2]. As well as we know it is hard to diagnose it through laboratory-confirmation due to a very high degree of lack of resources in Afghanistan.*
Impact of the problem	*WHO spokesman declared six months ago that thousands of children were infected to measles and hundreds of them were killed by this disease in this year [3].*

	Common measles complications include ear infection, diarrhea, pneumonia (infection of the lungs) and encephalitis (swelling of the brain). They may need to be hospitalized and could die. For example if a pregnant women is infected to the disease would give birth prematurely, or have a low-birth-weight baby.
Goals	1. *Toc conduct a comparative study reporting on diagnosis of measles* 2. *Making of dataset from real data in Afghanistan and evaluate the situation* 3. *To develop machine learning models and deploy them onto the real application.* 4. *To Facilitates the precise diagnosis of the disease without any pay and propose to be quarantined if it needs.*
Research questions	1. *Which approach is the most efficient and accurate approach to diagnose the disease?* 2. *Which machine learning approach other people used to diagnose the disease?* 3. *Who has the highest risk of the complication to the disease?*
Literature Review	***Introduction to Measles*** *Measles is a highly contagious, serious disease caused by a virus. Before the introduction of measles vaccine in 1963 and widespread vaccination, major epidemics occurred approximately every 2–3 years*

and measles caused an estimated 2.6 million deaths each year. More than 140 000 people died from measles in 2018 – mostly children under the age of 5 years, despite the availability of a safe and effective vaccine.

Measles is caused by a virus in the paramyxovirus family and it is normally passed through direct contact and through the air. The virus infects the respiratory tract, then spreads throughout the body. Measles is a human disease and is not known to occur in animals [4].

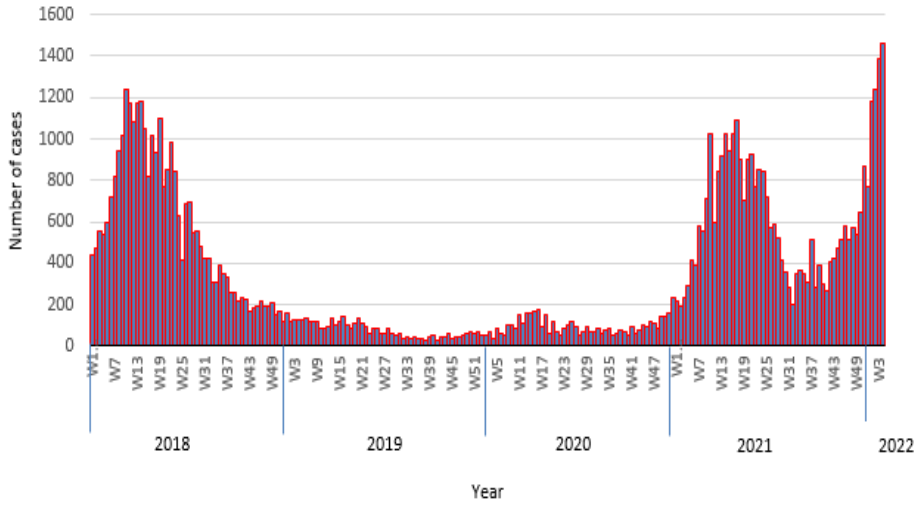
Common measles symptoms

Symptoms of measles generally first appear within 10 to 12 days of exposure to the virus. They include:

1. *cough*
2. *fever*
3. *runny nose*
4. *red eyes*
5. *sore throat*
6. *white spots inside the mouth*

A widespread skin rash is a classic sign of measles. This rash can last up to 7 days and generally appears within 14 days of exposure to the virus. It commonly develops on the head and slowly spreads to other parts of the body [5].

	People in high risk of complication *Common complications from measles include otitis media, bronchopneumonia, laryngotracheobronchitis, and diarrhea. People at high risk for complication are infant or children under the age of five, adult above the age of 20, pregnant women and people with compromised immune systems [6].* ***Measles in Afghanistan*** *Measles is endemic in Afghanistan, with almost all provinces reporting suspected cases every year. Following periods of lower transmission in 2019 and 2020, and amid the humanitarian crisis in Afghanistan, weekly notifications of suspected measles cases have been increasing in all provinces since the end of July 2021, with the highest weekly toll observed in the last four weeks in January 2022 (Figure 1). The number of cases and deaths increased by 18% and 40% respectively from week 4, 2022 (week commencing January 24) to week 5, 2022 (week commencing January 31).* ***Figure 1.*** *Weekly number of reported suspected measles cases in Afghanistan. Week 1, 2018 to week 4, 2022. Source: WHO Country Office in Afghanistan, WHO Regional Office for the Eastern Mediterranean.*



Approach and techniques

Laboratory approach

Laboratory confirmation of measles is based on the detection of anti-MeV IgM antibodies or detection of MeV RNA by reverse transcription PCR (RT-PCR) in clinical samples. The most commonly used method for laboratory confirmation is detection of IgM, usually by enzyme inmmunoassay, in serum samples collected at first contact with a suspected case [7].

RT-PCR, which is having an increasing role in case confirmation, has the highest sensitivity if samples are collected as early as possible after the onset of rash. In addition to throat or nasal swabs, other

clinical specimens that can be used for RT-PCR include oral fluid, urine and peripheral blood mononuclear cells [8], [9].

Consequently, laboratory confirmation is a very hard, expensive and time-consuming approach for diagnosing the measles, we consider a machine learning approach that the patient can easily, freely and accurately can diagnose and prevent from infection of that timely.

Machine learning Approaches

In today's era artificial intelligence (AI) is rapidly growing in medical fields. Different machine learning and deep learning algorithms are used for diagnostic purpose. These methods drastically improve the diagnosis process and speed up the process. In both processes, three different and popular algorithms are used. For machine learning process Bagged Tree Ensemble, K-Nearest Neighbor and Support Vector Machine were used. For deep learning process three pre-trained deep neural network models Resnet50, VGG16, and GoogleNet were used [13].

Related works

Few researchers have proposed image processing-based techniques to detect the measles diseases. Here we briefly review some of the techniques as reported in the literature.

	As there are not public resources available that contain an extensive library of measles library of measles images specifically, they collected the data for their study using the Bing Web Search API (part of the Microsoft Azure package) to parse image from the web. The dataset that they have collected contains rash images of 11 different disease contains Bowens, chickenpox, chigger, bites, dermatofibroma, eczema, enterovirus, keratosis, measles, psoriasis, ringworm and scabies. Additionally, image of normal skin is also included in the dataset. They used transfer learning to develop their CNN model to detect measles rash through skin images. They also tried oversampling and image augmentation techniques using the keras library because the two image classes in their dataset i.e., measles vs. non-measles, are highly imbalanced. *In the initial phase of model training, they kept all the convolutional layers, i.e. the backbone of ResNet-50, with their pretrained weights and trained only the last few layers of the model. A stratified 5-fold cross validation was conducted to train and evaluate the model. After the 5 iterations, the average performances of the models were computed that the average accuracy, sensitivity, and specificity of the model are 94.8%, 74.1% and 97.6%, respectively [10].* *The second study proposed a novel automatic deep learning* *based classifier (CNN) to distinguish the distinctive HFMD rash from various other skin conditions. Their research showed that deep*

	learning solution could perform on par and even better method on the task than classifier to pick the color, texture manually, and shape features, even provided a minimal number of labeled images. Moreover, an advantage of their proposed method is that it does not need manual pre-processing of images. They have tested three pre-trained CNN models, ResNet (34, 50) and inception v3 on 2079 clinical images. In the experiment stage, we analyzed the performance or ResNet 50, 34, and inception v3, which ResNet50 shows better performances than others. Their proposed model achieved the classification average accuracy of 0.954 and average sensitivity of 0.833 on validation dataset [11]. *In another research, which was about skin disease detection in Saudi Arabia, the method of detection was designed by using pre-trained convolutional neural network (AlexNet) and SWM. Their proposed system achieved the accuracy of 95% [12].* *Another system proposed ins a skin disease detection system. This system uses images of skin captured with camera to detect if it is healthy or not; if not, then classified as Melanoma, Eczema or leprosy.* *The proposed system uses image processing and machine learning techniques. The process begins with pre-processing an input image using contrast enhancement and grayscale conversion. Global value thresholding techniques is used to segment the pre-processed images through which the actual affected region is obtained. They have used decision trees to classify the image.*

Current issues and challenges

Measles is an endemic disease in many third world countries like Afghanistan and there are a few systems for diagnosing it. As well as those systems have a lot of challenges or disadvantages because they have diagnosed the measles just by rash detection but we know that rash is just one of the symptoms of measles, which starts about 5-7 days after start of symptoms. So, if the system is not able to diagnose the measles by other symptoms and waiting for start of rash, the infected people will infect all the people who are not infected.

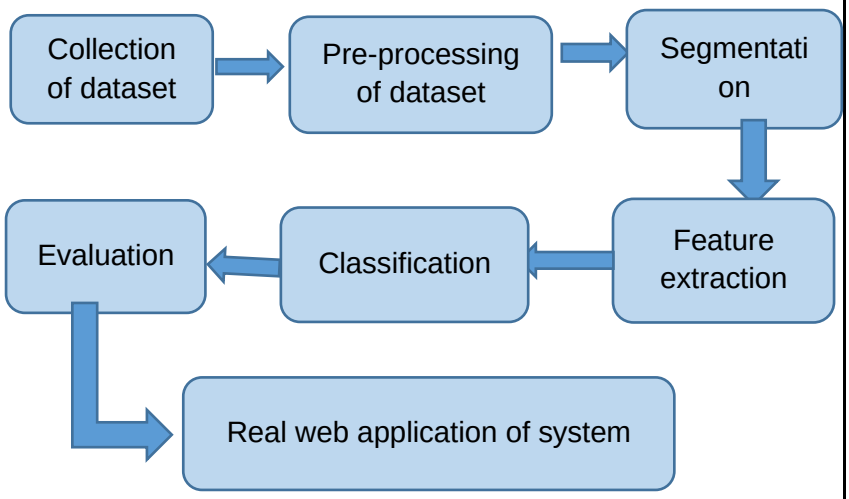
They made the models but they didn't deploy that to a real application, even if they deployed that is not available for all and that is just in a specific language. As we know it is hard to diagnose it by laboratory confirmation in our country due to some reason such as lack or resource, expert, money etc.

What we are going to do?

We are going to make a real application of diagnosis of measles weather it is tabular dataset which contains the initial symptoms or image dataset which contains a red flat rash on face and body and white spot in the mouth.

We are going to guide them what to do if they are infected to the disease as much as possible.

	This application will be free, available and affordable for all, those who want to know whether they are infected or not.
Methodology	***Research Methodology**:* *First, we used literature review and see the other research paper of scientists in the domain of Diagnosing measles with rash detection, which has made already. Second, we compare the models that is made by other researchers with our own model for better sustainability and performance. In addition, we compare the strength and weakness of those models who is made by other researchers.*
	***Implementation Methodology**: The method that we are going to go through for making this project is shown clearly in the following flowchart.*



Collection of Dataset

Our dataset is not a tabular dataset it will be an image dataset.

The image of dataset will be a real dataset, which will be collected form those place that they register suspected case of measles in Afghanistan. We will try to make a tabular dataset too if we find the real material about the tabular dataset in Afghanistan.

Pre-processing of Dataset

In this phase we are going to remove some parameters such as glare, shadow to identify texture, color, size and shape in an efficient way. We are going to work on image enhancement and restoration.

Segmentation

In this section we are going to subdivide and image into its constituent regions or objects. Segmentation should

	stop when the objects of interest in an application have been isolated. There are many methods for segmentation such as watershed based, split an image, region growing, threshold based segmentation etc. ***Feature extraction*** *In this section the features which have been used to characterize the measles rash are described.* ***Classification*** *Once features are extracted, a classifier can be trained to classify a test sample as a member of one of the most known classes. For our experimentation we use two well-known classifiers namely SVM and CNN.* ***Evaluation*** *The performance of the classification is evaluated in terms of classification accuracy, precision, and recall from confusion matrix of classification.*
Expected Outcomes	*A measles diagnosis web application which is diagnosing measles via rash, white spot, and other symptoms efficiently, accurately and timely.*

Work Plan:

Semester 1:

Activities	*Weeks*														
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Scope															
Literature Review															
Preparing of dataset															
Preprocessing of dataset															
Train Model 1															

Work Plan:

Semester 2:

Activities	*Weeks*														
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Scope															
Literature Review															

Train Model 2															
Evaluation															
Compare Model 1 and Model 2															
Deploy our model to a real application															

References	*[1]. World Health Organization, Measles-Afghanistan, 10 February 2022* https://www.who.int/emergencies/disease-outbreak-news/item/measles-afghanistan *[2]. Wikipedia Measles,* https://en.wikipedia.org/wiki/Measles#:~:text=Measles%20is%20a%20highly%20contagious,runny%20nose%2C%20and%20inflamed%20eyes. *[3]. World Health Organization, Measles-Afghanistan, 10 February 2022* https://www.who.int/emergencies/disease-outbreak-news/item/measles-afghanistan *[4]. World Health Organization, Measles, 5 December 2019* https://www.who.int/news-room/fact-sheets/detail/measles?gclid=EAIaIQobChMIh9j_v_CI-AIVEJBoCR2cXgvUEAAYASAAEgJ5D_D_BwE *[5]. Healthline, Measles Symptoms,*

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[9]. Van Binnendijk, R. S. et al. Evaluation of serological and virological tests in the diagnosis of clinical and subclinical measles virus infections during an outbreak of measles in the Netherlands. J. Infect. Dis. 188, 898–903 (2003).

[10]. Kimberly Glock1+, Charlie Napier1+, Andre Louie1, Todd Gary1, Joseph Gigante2, William Schaffner3 , Qingguo Wang1*. Measles Rash Identification Using Residual Deep Convolutional Neural Network. 2021

[11]. Naqibullah Vakili, Jonathan H. Chan, Worarat Krathu, Nipat Phattarakijtham, Kazuya Hirata. Hand Foot and Mouth Rash Detection Using Deep Convolution Neural Network. 2021. P.4

[12]. Nawal Soliman ALKolifi ALEnezi. A Method of Skin Disease Detection Using Image Processing and Machine Learning. Procedia Computer Science 163 (2019) 85–92. P.91

	[13] . Payal Bose, Prof. Samir K. Bandyopadhyay, Prof. Amiya Bhaumik, Dr. Sandeep Poddar. *Lincoln University College, Kota Bharu, Kelantan, Malaysia. Skin Disease Detection: Machine Learning vs Deep Learning. doi:10.20944/preprints202109.0209.v1. Posted September-13-2021* *[14] Amruta D. Joshi1, Shreya S. Manerkar2, Vinita U. Nagvekar3, Kalpita P. Naik4, Chinmay G. Palekar5, Prof. V. Pugazhenthi6, Prof. Sagar K. Naik7 .* *1 Department of Computer Engineering, Agnel Institute of Technology and Design, Assagao, Bardez-Goa . Skin Disease Detection and Classification* *Font type : Helvetica Neue*

Declaration and Approval:

<table>
<tr><td rowspan="3">Student(s)</td><td colspan="4">By signing this form I confirm that
all the statements above are correct
I have read and fully understand the examination regulations
I am not in the process of writing another thesis/final project in the same subject at another university/organization.</td></tr>
<tr><td>Date:</td><td>Place:</td><td rowspan="2">Name(s) and Signature(s):</td><td>Hamid Jaffari</td></tr>
<tr><td></td><td></td><td>Nawrooz Bunyadi</td></tr>
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<table>
<tr><td rowspan="3">Supervisor</td><td colspan="4">I hereby confirm that I will serve as supervisor for the below named thesis/final project:</td></tr>
<tr><td>Date:</td><td>Place:</td><td>Signature:</td><td rowspan="2"></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Department</td><td colspan="4">The prerequisites have been assessed and the student(s) can be registered for the thesis/final project described above.</td></tr>
<tr><td>Date:</td><td>Place:</td><td>Signature:</td><td rowspan="2"></td></tr>
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Receipt Date: *Sign: _____*