

**AI-BASED LOCALIZATION AND
CLASSIFICATION OF SKIN
DISEASE WITH ERYTHEMA**

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INTRODUCTION

1.1 Overview

Erythema is the redness of the skin or mucous membranes, caused by hyperaemia in the superficial capillaries. If these diseases are not treated at an early stage, they can cause complications in the body, including the spread of infection from one person to another. The skin diseases can be prevented by investigating the infected region at an early stage. The characteristics of the skin images are diversified, so it is a challenging job to devise an efficient and robust algorithm for the automatic detection of skin disease and its severity. Skin tone and skin colour play an important role in skin disease detection. The colour and coarseness of skin are visually different. Automatic processing of such images for skin analysis requires a quantitative discriminator to differentiate the diseases.

1.2 Purpose

To overcome the above problem, we are building an AI-based model that is used for the prevention and early detection of erythema. Basically, skin disease diagnosis depends on different characteristics like colour, shape, texture, etc. Here, the user can capture images of their skin, which are then sent to the trained model, where the information is processed using image processing techniques and then extracted for machine interpretation. The pixels in the image can be manipulated to achieve any desired density and contrast. Finally, the model generates a result and determines whether or not the person has skin disease. Image processing technologies significantly reduce the time spent on a specific activity by the customer. Hence, it is a time- and money-saving process.

LITRATURE SURVEY

2.1 Existing Problem

The Yolo v3 detector is the primary method for pre-screening skin lesions and detecting erythema. YOLO is an algorithm that detects and recognizes various objects in real-time pictures. Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images. The YOLO algorithm employs convolutional neural networks (CNN) to detect objects in real-time. The algorithm requires only a single forward propagation through a neural network to detect objects. This means that prediction for the entire image is done in a single algorithm run. The CNN is used to predict various class probabilities and bounding boxes simultaneously. Yolo-V3 boasts good performance over a wide range of input resolutions.

2.2 References

<https://link.springer.com/article/10.1007/s11042-021-11823-x>

https://link.springer.com/chapter/10.1007/978-981-19-0863-7_10

<https://iopscience.iop.org/article/10.1088/1757-899X/1076/1/012045>

<https://onlinelibrary.wiley.com/doi/full/10.1002/ski2.81>

<https://www.sciencedirect.com/science/article/pii/S1877050919321295>

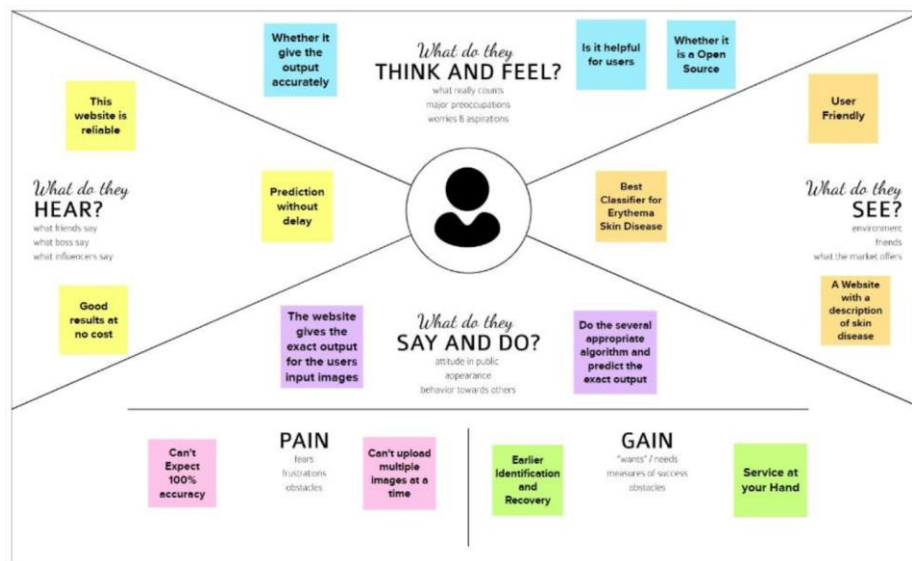
2.3 Problem Statement Definition

To build a model that predicts skin diseases that can be prevented by investigating the infected region. Here, the skin tone and skin colour play an important role in skin disease detection. The person can capture images of their skin, and then the image will be sent to a trained model, which analyses the image and detects whether the person has a skin disease or not.

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

Empathy Map Canvas: An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 Ideation & Brainstorming

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Step-1: Team Gathering, Collaboration and Select the Problem Statement



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 🕒 10 minutes to prepare
- 🕒 1 hour to collaborate
- 👤 2-8 people recommended



Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕒 10 minutes



A Team gathering

Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.



B Set the goal

Think about the problem you'll be focusing on solving in the brainstorming session.



C Learn how to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) →



1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

PROBLEM

How to predict the given image belongs to erythema or not?



Key rules of brainstorming

To run a smooth and productive session



Stay in topic.



Encourage wild ideas.



Defer judgment.



Listen to others.



Go for volume.



If possible, be visual.

Step-2: Brainstorm, Idea Listing and Grouping

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

TIP

You can select a sticky note and hit the pencil (switch to sketch) icon to start drawing!

Padma Priya S

Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.

Renuka Devi D

Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.

Radeem Emima K

Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.

Subarathna B

Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.

Aisagammai S

Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.
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Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.	Use a mobile app to track and monitor the health of the patient.

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

🕒 20 minutes

Technical Aspects

For the results to be accurate, dataset need to be accurate.

Don't rely only on one source of data.

Image processing techniques help to make accurate diagnosis.

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

Social Impacts

It is important to have a good understanding of the patient's social context.

Early identification and recovery.

The model can be used to identify patients at risk of readmission.

Availability of Resources

We should be able to access the data from the hospital.

Electronic data is available for analysis.

People emotions

It is very user friendly and gives accurate results to the user.

The system is easy to use and gives accurate results to the user.

Step-3: Idea Prioritization



3.3 Proposed Solution

To overcome the problems due to Erythema, we are building an AI- model that is used for the early detection and prevention of Erythema by investigating the infected region.

S.No.	Parameter	Description
1	Problem Statement (Problem to be solved)	AI-Based Localization and Classification of Skin Disease with Erythema
2	Idea / Solution description	To overcome the above problem, we are building a model that is used for the prevention and early detection of Erythema.
3	Novelty / Uniqueness	The model analyses the image and detects whether the person is having a skin disease or not, and if detected, gives a detailed description of the disease and treatment suggestions.
4	Social Impact / Customer Satisfaction	Image processing technologies significantly reduce the time spent on a specific activity by the customer. Hence, it is a time and money-saving process.
5	Business Model (Revenue Model)	Medical sectors are using image recognition to improve image analysis for identifying diseases and predicting the possibilities of health problems.
6	Scalability of the Solution	Image processing technology has enabled more efficient and accurate treatment plans.

3.4 Problem Solution Fit

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) <p>The Person who is having Erythema Skin disease</p> <p>CS</p>	6. CUSTOMER CONSTRAINTS <p>What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.</p> <p>Internet Connection, Camera Quality, Resolution</p> <p>CC</p>	5. AVAILABLE SOLUTIONS <p>Which solutions are available to the customers when they face the problem</p> <p>or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking</p> <p>Already available solutions are not open source and user friendly</p> <p>AS</p>	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS <p>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.</p> <p>Cleared the Confusion whether having erythema or not</p> <p>J&P</p>	9. PROBLEM ROOT CAUSE <p>What is the real reason that this problem exists? What is the back</p> <p>Viral Infection or Triggered by infections or medicines</p> <p>RC</p>	7. BEHAVIOUR <p>What does your customer do to address the problem and get the job done?</p> <p>i.e. directly related: find the right solar panel installer, calculate usage</p> <p>After checking the results in our website they have to again confirm with the doctors</p> <p>BE</p>	
Focus on J&P, tap into BE, understand RC	3. TRIGGERS <p>What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</p> <p>Accuracy of our model make the customers to trust us</p> <p>TR</p>	10. YOUR SOLUTION <p>If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</p> <p>Nowadays, everyone has a smartphone. So ,they can use the website and find out the results</p> <p>SL</p>	8. CHANNELS of BEHAVIOUR <p>8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7</p> <p>Upload the photos and check the results</p> <p>8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</p> <p>Confirm the result with the doctors</p> <p>CH</p>	Identify strong TR & EM
	4. EMOTIONS: BEFORE / AFTER <p>How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design.</p> <p>Dilemma, Insecurity > Clear State, Get the proper Treatment</p> <p>EM</p>			

REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR.No.	Functional Requirement (Epic)	Sub Requirement (Story /Sub-Task)
1	User Registration	Registration through Form Registration through Gmail
2	User Confirmation	Confirmation via Email Confirmation via OTP
3	User Profile	Users provides their medical history.
4	User Uploads Images(Input)	Upload Images as jpeg Upload Images as png
5	Output Analysis	Output analysed through trained model
6	Provides Description	Gives the detailed description of the skin disease found

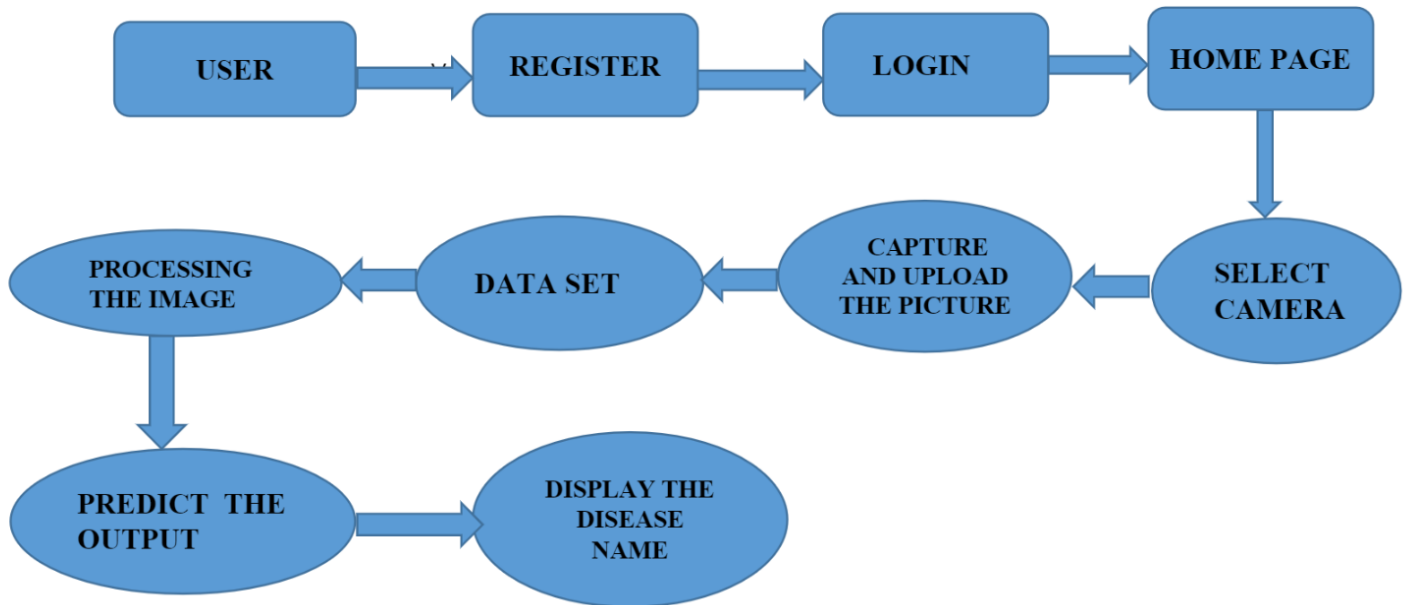
4.2 Non-functional Requirements

NFR No.	Non-Functional Requirement	Description
1	Usability	Used to classify skin disease with erythema
2	Security	It offers greater security and prevents unauthorized individuals from accessing user's data.
3	Reliability	Even with more users, there will be a good performance without failure.
4	Performance	With greater accuracy, the performance is high.
5	Availability	With a good system, all authorized users can access it.
6	Scalability	Performance will be good even with the higher user traffic.

PROJECT DESIGN

5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

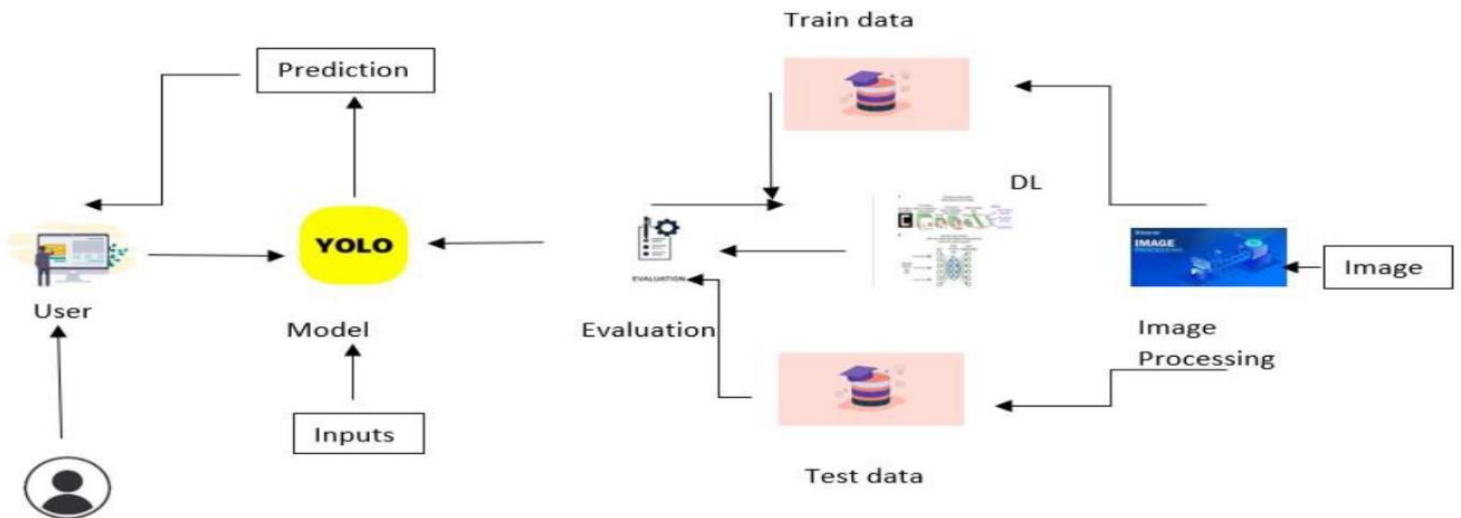


5.2 Solution Architecture

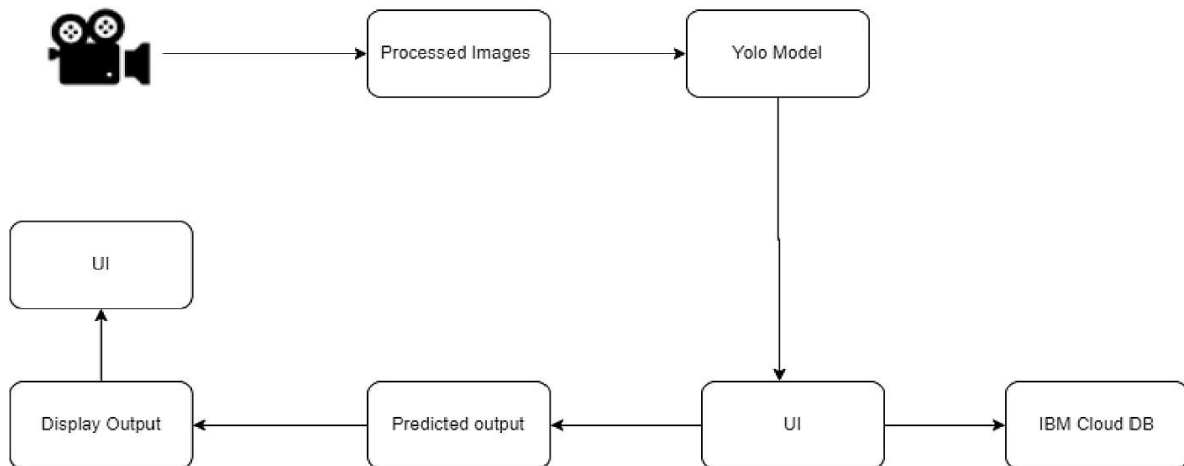
Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture Diagram:



Technical Architecture:



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account/ dashboard.	High	Sprint-1
	Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
	Login	USN-3	As a user, I can login for the application through Gmail	I can access my account/ dashboard	medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password	I can access my account/ dashboard	high	Sprint-1
	Dashboard	USN-5	As a user, I can see my profile, medical history, upload image, getting report services provided by the application	I can get into one of the services and use	medium	Sprint-2
	Data input	USN-6	As a user, I can upload the images of the affected skin area	I can submit it to the application	high	Sprint-2
Administrator	Train model	USN-7	As an administrator, I can train a model to compare the images uploaded with the images in the database to detect the disease	I can test the model whether it meets the criteria	high	Sprint-3
Trained model	Image processing	USN-8	By comparing the images the disease will be detected with the given datasets	All the necessary operation performed and information extracted.	high	Sprint-3
	Report generation	USN-9	Based on the detection of disease, report generated	The results will be shown on the screen to the patients.	high	Sprint-4

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation:

Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Renuka Devi. D
Sprint-1	Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Redeem Emima .K
Sprint-1	Login	USN-3	As a user, I can login for the application through Gmail	2	Medium	Subarathna. B
Sprint-1	Login	USN-4	As a user, I can log into the application by entering email & password	2	High	Alagammai .S
Sprint-2	Dashboard	USN-5	As a user, I can see my profile, medical history, upload image, getting report services provided by the application	1	Medium	Redeem Emima .K
Sprint-2	Data input	USN-6	As a user, I can upload the images of the affected skin area	1	High	Padma Priya.S
Sprint-3	Train model	USN-7	As an administrator, I can train a model to compare the images uploaded with the images in the database to detect the disease	2	High	Subarathna. B
Sprint-3	Image processing	USN-8	By comparing the images the disease will be detected with the given datasets	2	High	Padma Priya.S
Sprint-4	Report generation	USN-9	Based on the detection of disease, report generated	2	High	Alagammai .S

6.2 Sprint Delivery Schedule

Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	07 Nov 2022	20	19 Nov 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	19 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	19 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

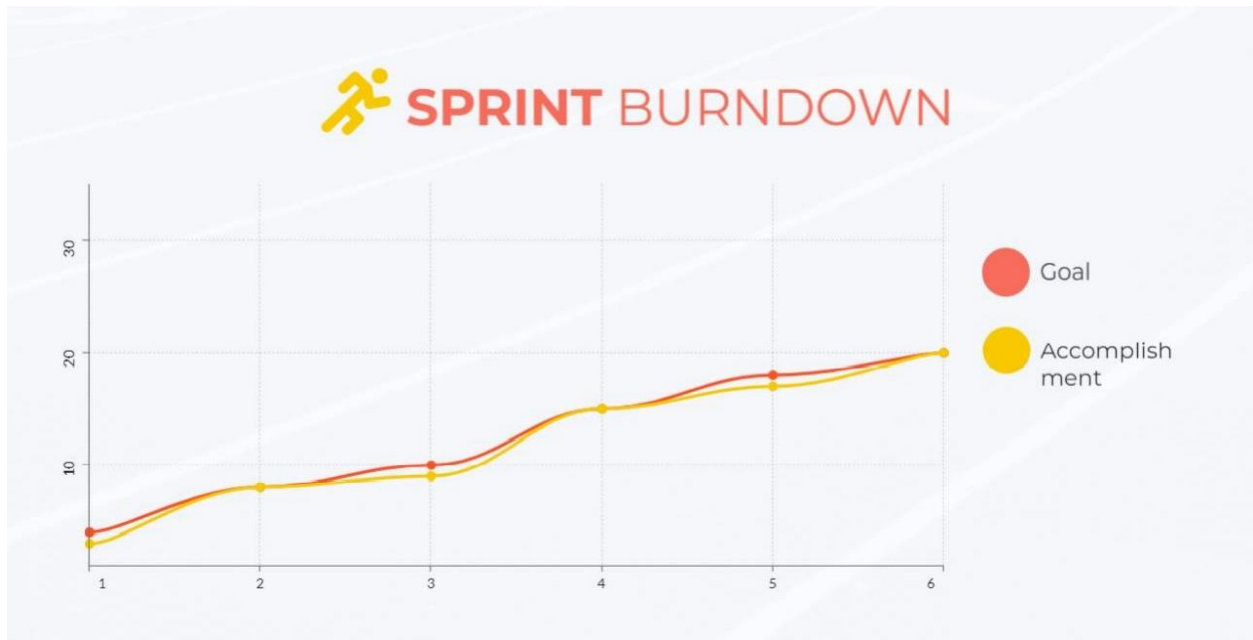
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{\text{sprint duration}}{\text{velocity}} = \frac{20}{10} = 2$$

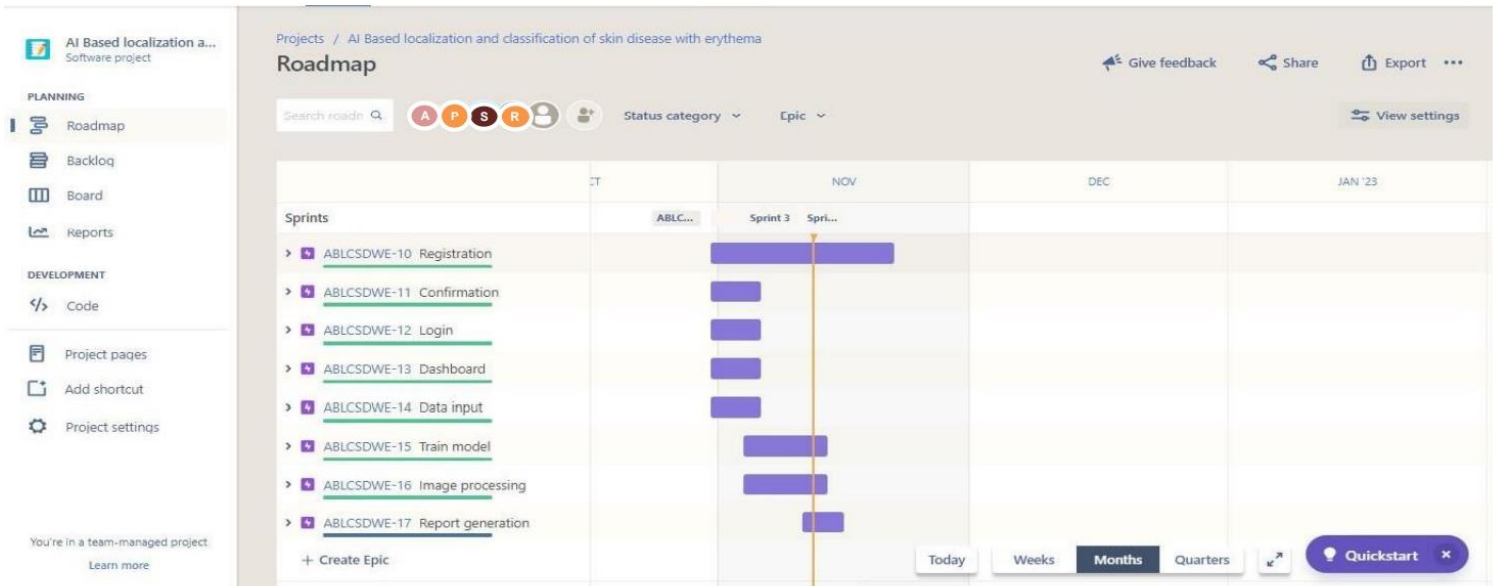
Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



6.4 Reports from JIRA

Roadmap:



Backlog:

AI Based localization a...
Software project

PLANNING

Roadmap

Backlog

Board

Reports

DEVELOPMENT

Code

Project pages

Add shortcut

You're in a team-managed project
Learn more

Projects / AI Based localization and classification of skin disease with erythema

Backlog

Search backlog

P R

Epic

Insights

Sprint 3 4 Nov – 13 Nov (2 issues)

0 0 32 Complete sprint

ABLCSDWE-7 As a administrator , I can train a model to compare the images uploa... TRAIN MODEL 12 DONE P

ABLCSDWE-8 By comparing the images the disease will be detected with the given ... IMAGE PROCESSING 20 DONE P

+ Create issue

Sprint 4 11 Nov – 15 Nov (1 issue)

0 20 0 Complete sprint

ABLCSDWE-9 Based on the detection of disease, report generated REPORT GENERATION 20 IN PROGRESS R

+ Create issue

Quickstart

Board:

AI Based localization a...
Software project

PLANNING

Roadmap

Backlog

Board

Reports

DEVELOPMENT

Code

Project pages

Add shortcut

Project settings

You're in a team-managed project
Learn more

Projects / AI Based localization and classification of skin disease with erythema

All sprints

Search this b

P R

Epic Sprint

GROUP BY None Insights

TO DO

IN PROGRESS 1 ISSUE

DONE 2 ISSUES

Based on the detection of disease, report generated
REPORT GENERATION
ABLCSDWE-9 20 R

As a administrator , I can train a model to compare the images uploaded with the images in the database to detect the disease
TRAIN MODEL
ABLCSDWE-7 12 P

By comparing the images the disease will be detected with the given datasets
IMAGE PROCESSING
ABLCSDWE-8 20 P

Quickstart

CODING & SOLUTIONING

7.1 Feature 1

Annotate Images Our detector needs some high-quality training examples before it can start learning. The images in our training folder are manually labelled using Microsoft's Visual Object Tagging Tool (VoTT). At least 100 images should be annotated for each category to get respectable results. The VoTT csv formatted annotation data is converted to YOLOv3 format by `Convert_to_YOLO_format.py` file.

Code:

```
from PIL import Image
from is import path, makedirs
import os
import re
import pandas as pd
import sys
import argparse

def get_parent_dir(n=1):
    """ returns the n-the parent directory of the current
    working directory """
    current_path = os.path.dirname(os.path.abspath(__file__))
    for k in range(n):
        current_path = os.path.dirname(current_path)
    return current_path

sys.path.append(os.path.join(get_parent_dir(1), "Utils"))
from Convert_Format import convert_vott_csv_to_yolo
```

```

Data_Folder = os.path.join(get_parent_dir(1), "Data")
VoTT_Folder = os.path.join(
    Data_Folder, "Source_Images", "Training_Images", "vott-csv-export"
)
VoTT_csv = os.path.join(VoTT_Folder, "Annotations-export.csv")
YOLO_filename = os.path.join(VoTT_Folder, "data_train.txt")

model_folder = os.path.join(Data_Folder, "Model_Weights")
classes_filename = os.path.join(model_folder, "data_classes.txt")

if __name__ == "__main__":
    # surpress any inhereted default values
    parser = argparse.ArgumentParser(argument_default=argparse.SUPPRESS)
    """
    Command line options
    """
    parser.add_argument(
        "--VoTT_Folder",
        type=str,

        default=VoTT_Folder,
        help="Absolute path to the exported files from the image tagging step with
VoTT. Default is "
        + VoTT_Folder,
    )

```

```

parser.add_argument(
    "--VoTT_csv",
    type=str,
    default=VoTT_csv,
    help="Absolute path to the *.csv file exported from VoTT. Default is "
    + VoTT_csv,
)
parser.add_argument(
    "--YOLO_filename",
    type=str,
    default=YOLO_filename,
    help="Absolute path to the file where the annotations in YOLO format should be
saved. Default is "
    + YOLO_filename,
)

FLAGS = parser.parse_args()

# Prepare the dataset for YOLO
multi_df = pd.read_csv(FLAGS.VoTT_csv)
labels = multi_df["label"].unique()
labeldict = dict(zip(labels, range(len(labels))))
multi_df.drop_duplicates(subset=None, keep="first", inplace=True)
train_path = FLAGS.VoTT_Folder
convert_vott_csv_to_yolo(
    multi_df, labeldict, path=train_path, target_name=FLAGS.YOLO_filename

```



```
)
```

```
# Make classes file
```

```
file = open(classes_filename, "w")
```

```
# Sort Dict by Values
```

```
SortedLabelDict = sorted(labeldict.items(), key=lambda x: x[1])
```

```
for elem in SortedLabelDict:
```

```
    file.write(elem[0] + "\n")
```

```
file.close()
```

7.2 Feature 2

Training Yolo

To prepare for the training process, convert the YOLOv3 model to the Keras format. The YOLOv3 Detector can then be trained by Train_YOLO.py file.

Code:

```
import os
```

```
import sys
```

```
import argparse
```

```
import warnings
```

```
def get_parent_dir(n=1):
```

```
    """ returns the n-th parent directory of the current  
    working directory """
```

```
    current_path = os.path.dirname(os.path.abspath(__file__))
```

```
    for k in range(n):
```

```
        current_path = os.path.dirname(current_path)
```

```
    return current_path
```

```
src_path = os.path.join(get_parent_dir(0), "src")
sys.path.append(src_path)
```

```
utils_path = os.path.join(get_parent_dir(1), "Utils")
sys.path.append(utils_path)
```

```
import numpy as np
import keras.backend as K
from keras.layers import Input, Lambda
from keras.models import Model
from keras.optimizers import Adam
from keras.callbacks import (
    TensorBoard,
    ModelCheckpoint,
    ReduceLROnPlateau,
    EarlyStopping,
)
from keras_yolo3.yolo3.model import (
    preprocess_true_boxes,
    yolo_body,
    tiny_yolo_body,
    yolo_loss,
)
from keras_yolo3.yolo3.utils import get_random_data
from PIL import Image
from time import time
```

```
import tensorflow.compat.v1 as tf
import pickle
```

```
from Train_Utils import (
    get_classes,
    get_anchors,

    create_model,
    create_tiny_model,
    data_generator,
    data_generator_wrapper,
    ChangeToOtherMachine,
)
```

```
keras_path = os.path.join(src_path, "keras_yolo3")
Data_Folder = os.path.join(get_parent_dir(1), "Data")
Image_Folder = os.path.join(Data_Folder, "Source_Images", "Training_Images")
VoTT_Folder = os.path.join(Image_Folder, "vott-csv-export")
YOLO_filename = os.path.join(VoTT_Folder, "data_train.txt")
```

```
Model_Folder = os.path.join(Data_Folder, "Model_Weights")
YOLO_classname = os.path.join(Model_Folder, "data_classes.txt")
```

```
log_dir = Model_Folder
anchors_path = os.path.join(keras_path, "model_data", "yolo_anchors.txt")
weights_path = os.path.join(keras_path, "yolo.h5")
```

FLAGS = None

```
if __name__ == "__main__":
```

```
    # Delete all default flags
```

```
    parser = argparse.ArgumentParser(argument_default=argparse.SUPPRESS)
```

```
    """
```

```
    Command line options
```

```
    """
```

```
    parser.add_argument(
```

```
        "--annotation_file",
```

```
        type=str,
```

```
        default=YOLO_filename,
```

```
        help="Path to annotation file for Yolo. Default is " + YOLO_filename,
```

```
    )
```

```
    parser.add_argument(
```

```
        "--classes_file",
```

```
        type=str,
```

```
        default=YOLO_classname,
```

```
        help="Path to YOLO classnames. Default is " + YOLO_classname,
```

```
    )
```

```
    parser.add_argument(
```

```
        "--log_dir",
```

```
        type=str,
```

```
        default=log_dir,
```

```
        help="Folder to save training logs and trained weights to. Default is "
        + log_dir,
    )

    parser.add_argument(
        "--anchors_path",
        type=str,
        default=anchors_path,

        help="Path to YOLO anchors. Default is " + anchors_path,
    )

    parser.add_argument(
        "--weights_path",
        type=str,
        default=weights_path,
        help="Path to pre-trained YOLO weights. Default is " + weights_path,
    )

    parser.add_argument(
        "--val_split",
        type=float,
        default=0.1,
        help="Percentage of training set to be used for validation. Default is 10%.",
    )

    parser.add_argument(
        "--is_tiny",
        default=False,
```

```

        action="store_true",
        help="Use the tiny Yolo version for better performance and less accuracy.
Default is False.",
    )
    parser.add_argument(
        "--random_seed",
        type=float,
        default=None,
        help="Random seed value to make script deterministic. Default is 'None', i.e.
non-deterministic.",
    )
    parser.add_argument(
        "--epochs",
        type=float,
        default=51,
        help="Number of epochs for training last layers and number of epochs for fine-
tuning layers. Default is 51.",
    )
    parser.add_argument(
        "--warnings",
        default=False,
        action="store_true",
        help="Display warning messages. Default is False.",
    )

    FLAGS = parser.parse_args()

```

```

if not FLAGS.warnings:
    tf.logging.set_verbosity(tf.logging.ERROR)
    os.environ['TF_CPP_MIN_LOG_LEVEL']='3'
    warnings.filterwarnings("ignore")

np.random.seed(FLAGS.random_seed)

log_dir = FLAGS.log_dir

class_names = get_classes(FLAGS.classes_file)
num_classes = len(class_names)
anchors = get_anchors(FLAGS.anchors_path)
weights_path = FLAGS.weights_path

input_shape = (416, 416) # multiple of 32, height, width
epoch1, epoch2 = FLAGS.epochs, FLAGS.epochs

is_tiny_version = len(anchors) == 6 # default setting
if FLAGS.is_tiny:
    model = create_tiny_model(
        input_shape, anchors, num_classes, freeze_body=2,
weights_path=weights_path
    )
else:
    model = create_model(
        input_shape, anchors, num_classes, freeze_body=2,
weights_path=weights_path

```

```

    ) # make sure you know what you freeze

log_dir_time = os.path.join(log_dir, "{}".format(int(time())))
logging = TensorBoard(log_dir=log_dir_time)
checkpoint = ModelCheckpoint(
    os.path.join(log_dir, "checkpoint.h5"),
    monitor="val_loss",
    save_weights_only=True,
    save_best_only=True,
    period=5,
)
reduce_lr = ReduceLROnPlateau(monitor="val_loss", factor=0.1, patience=3,
verbose=1)
early_stopping = EarlyStopping(
    monitor="val_loss", min_delta=0, patience=10, verbose=1
)

val_split = FLAGS.val_split
with open(FLAGS.annotation_file) as f:
    lines = f.readlines()

# This step makes sure that the path names correspond to the local machine
# This is important if annotation and training are done on different machines (e.g.
training on AWS)
lines = ChangeToOtherMachine(lines, remote_machine="")
np.random.shuffle(lines)
num_val = int(len(lines) * val_split)

```



```
num_train = len(lines) - num_val
```

```
# Train with frozen layers first, to get a stable loss.
```

```
# Adjust num epochs to your dataset. This step is enough to obtain a decent model.
```

```
if True:
```

```
    model.compile(  
        optimizer=Adam(lr=1e-3),  
        loss={  
            # use custom yolo_loss Lambda layer.  
            "yolo_loss": lambda y_true, y_pred: y_pred  
        },  
    )
```

```
batch_size = 32
```

```
print(  
    "Train on { } samples, val on { } samples, with batch size { }".format(  
        num_train, num_val, batch_size  
    )  
)
```

```
history = model.fit_generator(  
    data_generator_wrapper(  
        lines[:num_train], batch_size, input_shape, anchors, num_classes  
    ),  
    steps_per_epoch=max(1, num_train // batch_size),  
    validation_data=data_generator_wrapper(  
        lines[num_train:], batch_size, input_shape, anchors, num_classes  
    ),
```

```
validation_steps=max(1, num_val // batch_size),
epochs=epoch1,
initial_epoch=0,
callbacks=[logging, checkpoint],
)
model.save_weights(os.path.join(log_dir, "trained_weights_stage_1.h5"))
```

```
step1_train_loss = history.history["loss"]
```

```
file = open(os.path.join(log_dir_time, "step1_loss.npy"), "w")
with open(os.path.join(log_dir_time, "step1_loss.npy"), "w") as f:
    for item in step1_train_loss:
        f.write("%s\n" % item)
file.close()
```

```
step1_val_loss = np.array(history.history["val_loss"])
```

```
file = open(os.path.join(log_dir_time, "step1_val_loss.npy"), "w")
with open(os.path.join(log_dir_time, "step1_val_loss.npy"), "w") as f:
    for item in step1_val_loss:
        f.write("%s\n" % item)
file.close()
```

```
# Unfreeze and continue training, to fine-tune.
```

```
# Train longer if the result is unsatisfactory.
```

```
if True:
```

```
    for i in range(len(model.layers)):
```

```

    model.layers[i].trainable = True
model.compile(
    optimizer=Adam(lr=1e-4), loss={"yolo_loss": lambda y_true, y_pred: y_pred}
) # recompile to apply the change
print("Unfreeze all layers.")

batch_size = (
    4 # note that more GPU memory is required after unfreezing the body
)
print(
    "Train on { } samples, val on { } samples, with batch size { }.".format(
        num_train, num_val, batch_size
    )
)
history = model.fit_generator(
    data_generator_wrapper(
        lines[:num_train], batch_size, input_shape, anchors, num_classes
    ),
    steps_per_epoch=max(1, num_train // batch_size),
    validation_data=data_generator_wrapper(
        lines[num_train:], batch_size, input_shape, anchors, num_classes
    ),
    validation_steps=max(1, num_val // batch_size),
    epochs=epoch1 + epoch2,
    initial_epoch=epoch1,
    callbacks=[logging, checkpoint, reduce_lr, early_stopping],
)

```

```
model.save_weights(os.path.join(log_dir, "trained_weights_final.h5"))
step2_train_loss = history.history["loss"]
```

```
file = open(os.path.join(log_dir_time, "step2_loss.npy"), "w")
with open(os.path.join(log_dir_time, "step2_loss.npy"), "w") as f:
    for item in step2_train_loss:
        f.write("%s\n" % item)
file.close()
```

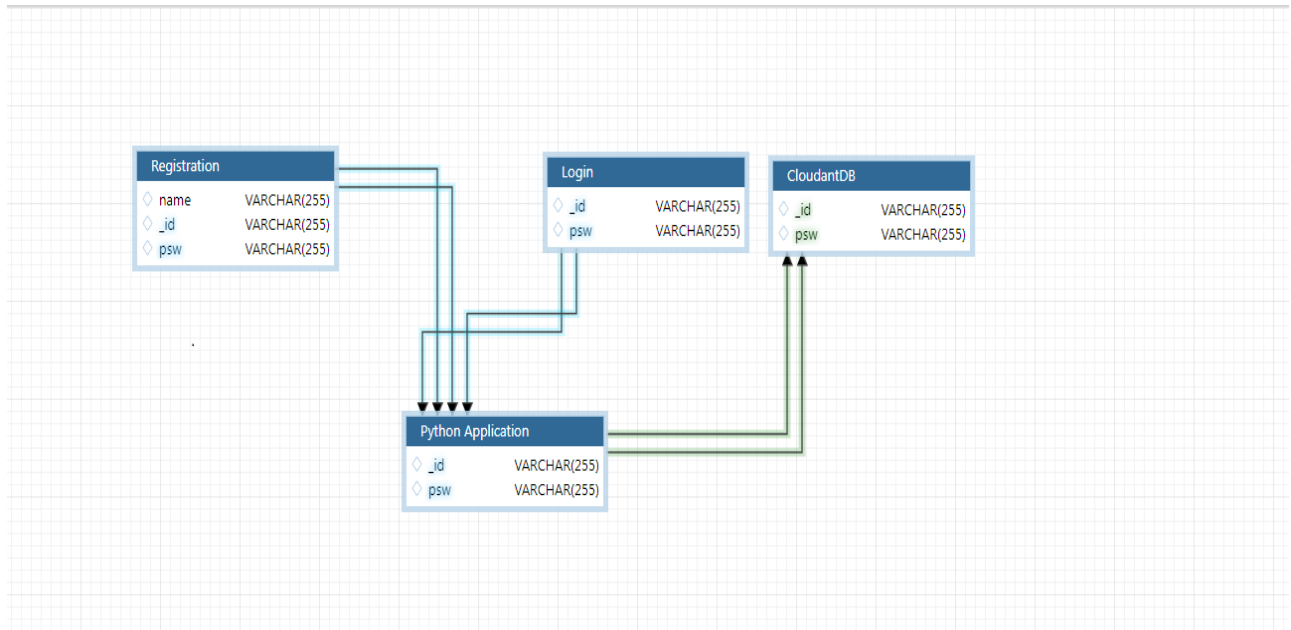
```
step2_val_loss = np.array(history.history["val_loss"])
```

```
file = open(os.path.join(log_dir_time, "step2_val_loss.npy"), "w")
with open(os.path.join(log_dir_time, "step2_val_loss.npy"), "w") as f:
    for item in step2_val_loss:
        f.write("%s\n" % item)
file.close()
```

7.3 Database Schema

- **Registration:** When a new user registers, the backend connects to the IBM Cloudant and stores the user's credentials in the database.
- **Login:** To check if a user is already registered, the backend connects to Cloudant when they attempt to log in. They are an invalid user if they are not already registered.
- **IBM cloudant:** Stores the data which is registered.
- **app.py:** Connects both Frontend and the cloudant for the verification of user credentials

Diagram:



TESTING

8.1 Test Case

Test Case No.	Action	Expected Output	Actual Output	Result
1	Register for the website	Stores name, email, and password in Database	Stores name, email, and password in Database	Pass
2	Login to the website	Giving the right credentials, results in a successful login.	Giving the right credentials, results in a successful login.	Pass
3	Detecting the disease	It should predict the disease	It should predict the disease	Pass

8.2 User Acceptance Testing

Section	Total Cases	Not Tested	Fail	Pass
Registration	9	0	0	9
Login	40	0	0	40
Security	2	0	0	2
Disease Detection	10	0	0	10
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

RESULTS

9.1 Performance Metrics

S.No.	Parameter	Values
1.	Model Summary	To evaluate object detection models like R-CNN and YOLO, the mean average precision (mAP) is used. The mAP compares the ground-truth bounding box to the detected box and returns a score.
2.	Accuracy	Training Accuracy – 89% Validation Accuracy – 95%
3.	Confidence Score (Only Yolo Projects)	Class Detected – 93% Confidence Score – 90%

ADVANTAGES & DISADVANTAGES

Advantages:

- Image processing technology has enabled more efficient and accurate treatment plans.
- It is time and money-saving process.
- Performance of the model will be good even with the higher user traffic.
- In Image processing, the pixels in the image can be manipulated to any desired density and contrast.
- Since high pixel quality is generated, easy classification of skin disease is possible

Disadvantages:

- AI-Models are Susceptible to security risks.
- Inaccuracies are still possible.
- Although AI has come a long way, human surveillance is still essential.

CONCLUSION

Even without a large dataset and high-quality images, it is possible to achieve sufficient accuracy rates in this AI model. With accurate segmentation, we gain knowledge of the location of the disease, which is useful in the pre-processing of data used in classification as it allows the YOLO model to focus on the area of interest. Our method provides a solution to classifying multiple diseases with higher quality and a larger quantity of data. With the assistance of our AI-based methods, it saves time and money for patients.

FUTURE SCOPE

The future of AI in detecting skin diseases could include tasks that range from simple to complex—everything from answering the phone to medical record review, reading radiology images, making clinical diagnoses and treatment plans, and even talking with patients. AI is already at work, increasing convenience and efficiency, reducing costs and errors, and generally making it easier for more patients to receive the health care they need. While AI is being used in health care, it will become increasingly important for its potential to enhance patient engagement in their own care and streamline patient access to care.

APPENDIX

SOURCE CODE

```
import re
import numpy as np
import os
from flask import Flask, app,request,render_template
import sys
from flask import Flask, request, render_template, redirect, url_for
import argparse
from tensorflow import keras
from PIL import Image
from timeit import default_timer as timer
import test
import pandas as pd
import numpy as np
import random

def get_parent_dir(n=1):
    """ returns the n-th parent directory of the current
    working directory """
    current_path = os.path.dirname(os.path.abspath(__file__))
    for k in range(n):
        current_path = os.path.dirname(current_path)
    return current_path
```

```
src_path = r'C:\Users\MadhuVasanth1606\Desktop\yolo_structure\2_Training\src'
print(src_path)

utils_path = r'C:\Users\MadhuVasanth1606\Desktop\yolo_structure\Utils'
print(utils_path)


sys.path.append(src_path)
sys.path.append(utils_path)


import argparse
from keras_yolo3.yolo import YOLO, detect_video
from PIL import Image
from timeit import default_timer as timer
from utils import load_extractor_model, load_features, parse_input, detect_object
import test
import utils
import pandas as pd
import numpy as np
from Get_File_Paths import GetFileList
import random

os.environ["TF_CPP_MIN_LOG_LEVEL"] = "3"

# Set up folder names for default values
data_folder = os.path.join(get_parent_dir(n=1), "yolo_structure", "Data")
image_folder = os.path.join(data_folder, "Source_Images")
```

```
image_test_folder = os.path.join(image_folder, "Test_Images")

detection_results_folder = os.path.join(image_folder,
"Test_Image_Detection_Results")

detection_results_file = os.path.join(detection_results_folder,
"Detection_Results.csv")

model_folder = os.path.join(data_folder, "Model_Weights")


model_weights = os.path.join(model_folder, "trained_weights_final.h5")
model_classes = os.path.join(model_folder, "data_classes.txt")


anchors_path = os.path.join(src_path, "keras_yolo3", "model_data",
"yolo_anchors.txt")


FLAGS = None


from cloudant.client import Cloudant


# Authenticate using an IAM API key
client = Cloudant.iam('5b73f72f-2449-4298-88e8-3f887f8bbd2d-
bluemix','t3wXXORf8KoIMLzYFX2sk4e22uluSBKhM9-K4Q5b1zuK',
connect=True)


# Create a database using an initialized client
my_database = client.create_database('skindisease')
```

```
app=Flask(__name__)
```

```
#default home page or route
```

```
@app.route('/')
```

```
def index():
```

```
    return render_template('index.html')
```

```
@app.route('/index.html')
```

```
def home():
```

```
    return render_template("index.html")
```

```
#registration page
```

```
@app.route('/register')
```

```
def register():
```

```
    return render_template('register.html')
```

```
@app.route('/afterreg', methods=['POST'])
```

```
def afterreg():
```

```
    x = [x for x in request.form.values()]
```

```
    print(x)
```

```
    data = {
```

```
        '_id': x[1], # Setting _id is optional
```

```
'name': x[0],
```

```
'psw':x[2]
```

```
}
```

```
print(data)
```

```
query = {'_id': {'$eq': data['_id']}}}
```

```
docs = my_database.get_query_result(query)
```

```
print(docs)
```

```
print(len(docs.all()))
```

```
if(len(docs.all())==0):
```

```
    url = my_database.create_document(data)
```

```
    #response = requests.get(url)
```

```
    return render_template('register.html', pred="Registration Successful, please  
login using your details")
```

```
else:
```

```
    return render_template('register.html', pred="You are already a member, please  
login using your details")
```

```
#login page
```

```
@app.route('/login')
```

```
def login():
```

```
    return render_template('login.html')
```

```

@app.route('/afterlogin',methods=['POST'])
def afterlogin():
    user = request.form['_id']
    passwd = request.form['psw']
    print(user,passwd)

    query = {'_id': {'$eq': user}}

    docs = my_database.get_query_result(query)
    print(docs)

    print(len(docs.all()))

    if(len(docs.all())==0):
        return render_template('login.html', pred="The username is not found.")
    else:
        if((user==docs[0][0]['_id'] and passwd==docs[0][0]['psw'])):
            return redirect(url_for('prediction'))
        else:
            print('Invalid User')

@app.route('/logout')
def logout():

```



```
return render_template('logout.html')
```

```
@app.route('/prediction')
```

```
def prediction():
```

```
    return render_template('prediction.html')
```

```
@app.route('/result',methods=["GET","POST"])
```

```
def res():
```

```
    # Delete all default flags
```

```
    parser = argparse.ArgumentParser(argument_default=argparse.SUPPRESS)
```

```
    """
```

```
    Command line options
```

```
    """
```

```
    parser.add_argument(
```

```
        "--input_path",
```

```
        type=str,
```

```
        default=image_test_folder,
```

```
        help="Path to image/video directory. All subdirectories will be included. Default  
is "
```

```
        + image_test_folder,
```

```
    )
```

```
    parser.add_argument(
```

```
        "--output",
```

```
type=str,  
default=detection_results_folder,  
help="Output path for detection results. Default is "  
+ detection_results_folder,  
)
```

```
parser.add_argument(  
    "--no_save_img",  
    default=False,  
    action="store_true",  
    help="Only save bounding box coordinates but do not save output images with  
annotated boxes. Default is False.",  
)
```

```
parser.add_argument(  
    "--file_types",  
    "--names-list",  
    nargs="*",  
    default=[],  
    help="Specify list of file types to include. Default is --file_types .jpg .jpeg .png  
.mp4",  
)
```

```
parser.add_argument(  
    "--yolo_model",  
    type=str,
```

```
dest="model_path",  
default=model_weights,  
help="Path to pre-trained weight files. Default is " + model_weights,  
)
```

```
parser.add_argument(  
    "--anchors",  
    type=str,  
    dest="anchors_path",  
    default=anchors_path,  
    help="Path to YOLO anchors. Default is " + anchors_path,  
)
```

```
parser.add_argument(  
    "--classes",  
    type=str,  
    dest="classes_path",  
    default=model_classes,  
    help="Path to YOLO class specifications. Default is " + model_classes,  
)
```

```
parser.add_argument(  
    "--gpu_num", type=int, default=1, help="Number of GPU to use. Default is 1"  
)
```

```
parser.add_argument(
    "--confidence",
    type=float,
    dest="score",
    default=0.25,
    help="Threshold for YOLO object confidence score to show predictions. Default is 0.25.",
)
```

```
parser.add_argument(
    "--box_file",
    type=str,
    dest="box",
    default=detection_results_file,
    help="File to save bounding box results to. Default is "
    + detection_results_file,
)
```

```
parser.add_argument(
    "--postfix",
    type=str,
    dest="postfix",
    default="_disease",
    help='Specify the postfix for images with bounding boxes. Default is "_disease"',
)
```

```
FLAGS = parser.parse_args()
```

```
save_img = not FLAGS.no_save_img
```

```
file_types = FLAGS.file_types
```

```
#print(input_path)
```

```
if file_types:
```

```
    input_paths = GetFileList(FLAGS.input_path, endings=file_types)
```

```
    print(input_paths)
```

```
else:
```

```
    input_paths = GetFileList(FLAGS.input_path)
```

```
    print(input_paths)
```

```
# Split images and videos
```

```
img_endings = (".jpg", ".jpeg", ".png")
```

```
vid_endings = (".mp4", ".mpeg", ".mpg", ".avi")
```

```
input_image_paths = []
```

```
input_video_paths = []
```

```
for item in input_paths:
```

```
    if item.endswith(img_endings):
```

```
        input_image_paths.append(item)
```

```
    elif item.endswith(vid_endings):
```

```
        input_video_paths.append(item)
```

```

output_path = FLAGS.output
if not os.path.exists(output_path):
    os.makedirs(output_path)

# define YOLO detector
yolo = YOLO(
    **{
        "model_path": FLAGS.model_path,
        "anchors_path": FLAGS.anchors_path,
        "classes_path": FLAGS.classes_path,
        "score": FLAGS.score,
        "gpu_num": FLAGS.gpu_num,
        "model_image_size": (416, 416),
    }
)

# Make a dataframe for the prediction outputs
out_df = pd.DataFrame(
    columns=[
        "image",
        "image_path",
        "xmin",
        "ymin",
        "xmax",

```

```

        "ymax",
        "label",
        "confidence",
        "x_size",
        "y_size",
    ]
)

# labels to draw on images
class_file = open(FLAGS.classes_path, "r")
input_labels = [line.rstrip("\n") for line in class_file.readlines()]
print("Found { } input labels: { } ...".format(len(input_labels), input_labels))

if input_image_paths:
    print(
        "Found { } input images: { } ...".format(
            len(input_image_paths),
            [os.path.basename(f) for f in input_image_paths[:5]],
        )
    )
    start = timer()
    text_out = ""

# This is for images
for i, img_path in enumerate(input_image_paths):

```

```

print(img_path)
prediction, image,lat,lon= detect_object(
    yolo,
    img_path,
    save_img=save_img,
    save_img_path=FLAGS.output,
    postfix=FLAGS.postfix,
)
print(lat,lon)
y_size, x_size, _ = np.array(image).shape
for single_prediction in prediction:
    out_df = out_df.append(
        pd.DataFrame(
            [
                [
                    os.path.basename(img_path.rstrip("\n")),
                    img_path.rstrip("\n"),
                ]
                + single_prediction
                + [x_size, y_size]
            ],
            columns=[
                "image",
                "image_path",
                "xmin",

```



```

        "ymin",
        "xmax",
        "ymax",
        "label",
        "confidence",
        "x_size",
        "y_size",
    ],
)
)
end = timer()
print(
    "Processed {} images in {:.1f}sec - {:.1f}FPS".format(
        len(input_image_paths),
        end - start,
        len(input_image_paths) / (end - start),
    )
)
out_df.to_csv(FLAGS.box, index=False)

# This is for videos
if input_video_paths:
    print(
        "Found {} input videos: {}".format(
            len(input_video_paths),

```

```

        [os.path.basename(f) for f in input_video_paths[:5]],
    )
)
start = timer()
for i, vid_path in enumerate(input_video_paths):
    output_path = os.path.join(
        FLAGS.output,
        os.path.basename(vid_path).replace(".", FLAGS.postfix + "."),
    )
    detect_video(yolo, vid_path, output_path=output_path)

end = timer()
print(
    "Processed {} videos in {:.1f}sec".format(
        len(input_video_paths), end - start
    )
)
# Close the current yolo session
yolo.close_session()
return render_template('prediction.html')

""" Running our application """
if __name__ == "__main__":
    app.run(debug=True)

```

GitHub Link:

<https://github.com/IBM-EPBL/IBM-Project-1611-1658402438>