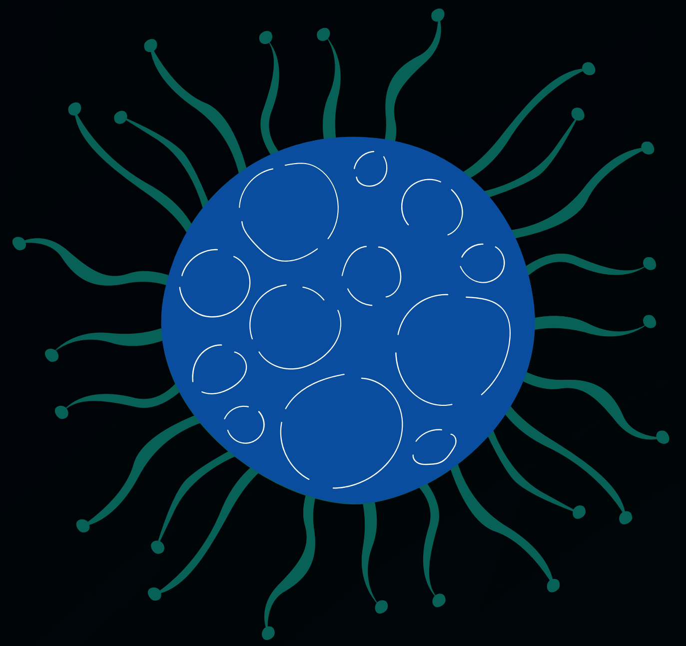
22AIE201 - Fundamentals of AI

Skin Cancer Detection: A Comparative Analysis of LSTM, RNN and CNN

TEAM MEMBERS-

JAINITHISSH S (CB.SC.U4AIE23129)
NITHESHKUMMAR C (CB.SC.U4AIE23155)
ABHAY ROHIT MURUGAIAH (CB.SC.U4AIE23173)
MANOBHIRAM (CB.SC.U4AIE23125)

PROBLEM STATEMENT



The project addresses the critical challenge of automating skin cancer detection using deep learning techniques. The goal is to develop an accurate classification system that can distinguish between benign and malignant skin lesions from dermoscopic images. This aids medical professionals in early detection and diagnosis, potentially reducing the need for invasive biopsies while improving screening efficiency and accessibility of skin cancer detection services.

Dataset: Skin Cancer - Malignant vs. Benign

Source

- Origin: ISIC Archive (International Skin Imaging Collaboration)
- Dataset Type: Balanced Medical Image Dataset
- Last Update: 5 years ago
- Format: Processed digital skin lesion images

Dataset Statistics

- Total Images: 3,600 images (1,800 per class)
  - Image Properties: Resolution: 224 x 224 pixels
  - Type: Colored dermoscopic images
  - Classes: Benign, Malignant

PROJECT APPROACH & METHODOLOGY

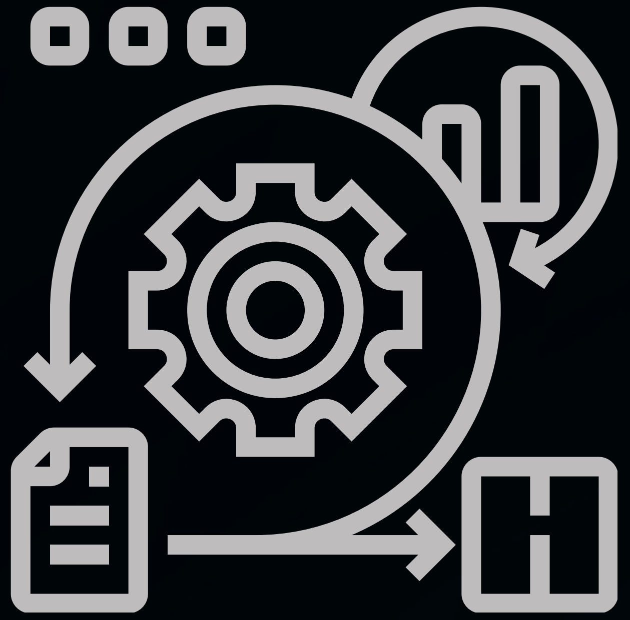
Data Collection & Setup

- Downloaded Kaggle dataset: "skin-cancer-malignant-vs-benign"
- Set up Kaggle API configuration
- Extracted dataset containing benign and malignant skin lesion images
- Organized data into train and test directories

Data Preprocessing & Visualization

- Loaded and visualized sample images from both classes
- Created visualization grid showing benign and malignant samples
- Implemented image resizing to 224x224 pixels
- Applied normalization (rescaling pixel values to 1/255)
- Split training data: 75% training, 25% validation

PROJECT APPROACH & METHODOLOGY



Model Development-
Implemented three different approaches:

Approach 1: CNN

- Designed custom CNN architecture
- Multiple dense layers for classification
- Softmax activation for binary classification

Approach 2: LSTM

- Feature extraction using ResNet50
- Implemented dual LSTM layer
- Dense layers for final classification

Approach 3: RNN

- Implemented RNN architecture
- Added data augmentation technique

PROJECT APPROACH & METHODOLOGY

Training

- Batch size: 35 image
- Applied sparse categorical cross entropy loss
- Trained for multiple epochs (10-25)
- Monitored training and validation metrics

Evaluation & Analysis

- Plotted training and validation accuracy
- Plotted loss curves
- Evaluated models on test dataset
- Performed prediction visualizatioN

Project results for CNN Model

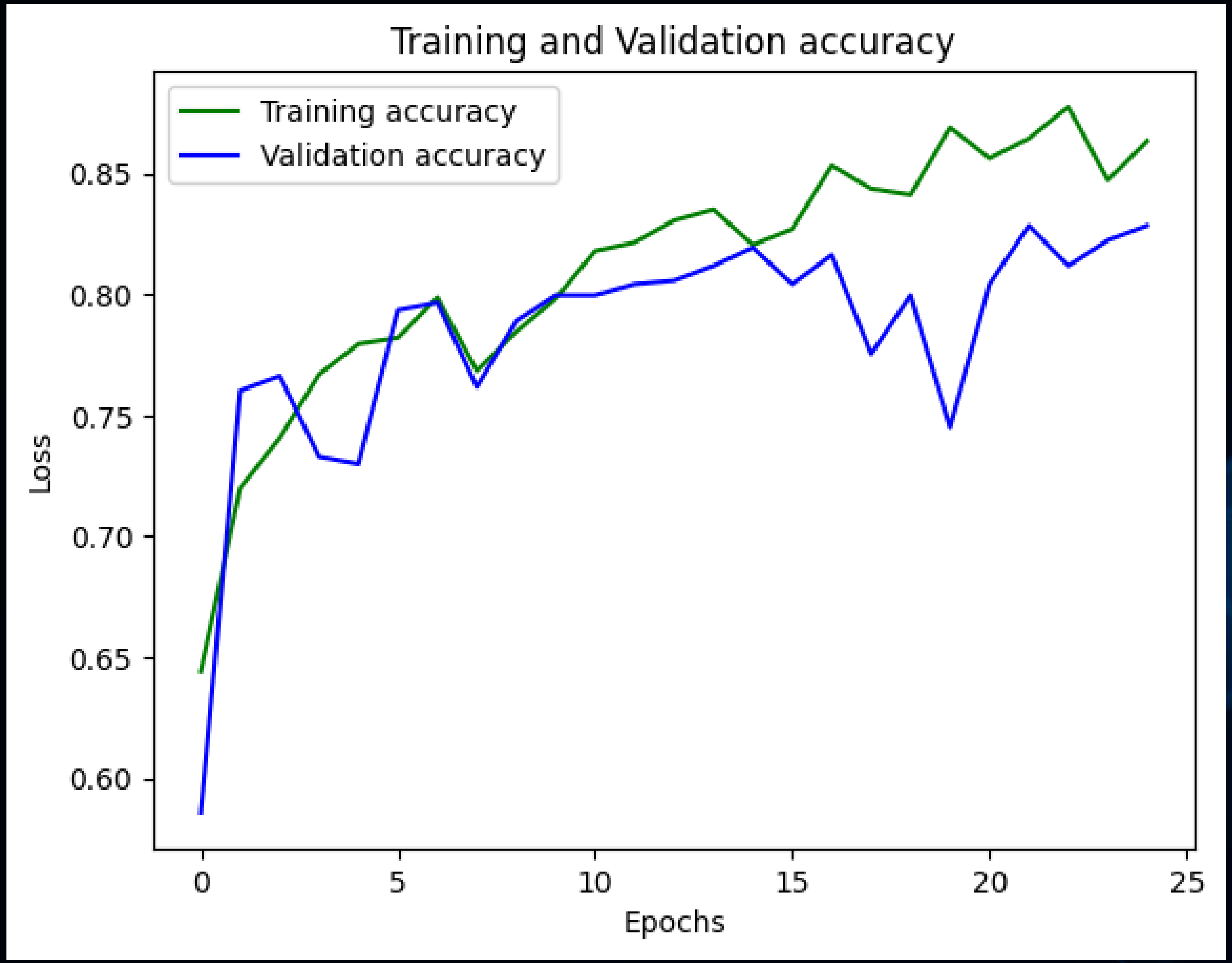
```
model.evaluate(val_data)
```

```
19/19 ━━━━━━━━━━━━━━━━━━━━ 1s 35ms/step - accuracy: 0.8553 - loss: 0.4094

[0.4888869822025299, 0.8285280466079712]
```

```
model.evaluate(test_data)
```

```
19/19 ━━━━━━━━━━━━━━━━━━━━ 1s 68ms/step - accuracy: 0.8273 - loss: 0.3881

[0.42630231380462646, 0.821212112903595]
```

Project results for CNN Model



Project results for CNN Model

```
True_class: Benign
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 318ms/step
Predicted Image: Malignant
Predicted class: 1

True_class: Malignant
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 17ms/step
Predicted Image: Malignant
Predicted class: 1

True_class: Benign
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 17ms/step
Predicted Image: Benign
Predicted class: 0

True_class: Malignant
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 26ms/step
Predicted Image: Malignant
Predicted class: 1

True_class: Malignant
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 17ms/step
Predicted Image: Malignant
Predicted class: 1

...
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 17ms/step
Predicted Image: Malignant
Predicted class: 1
```

Project results for LSTM Model

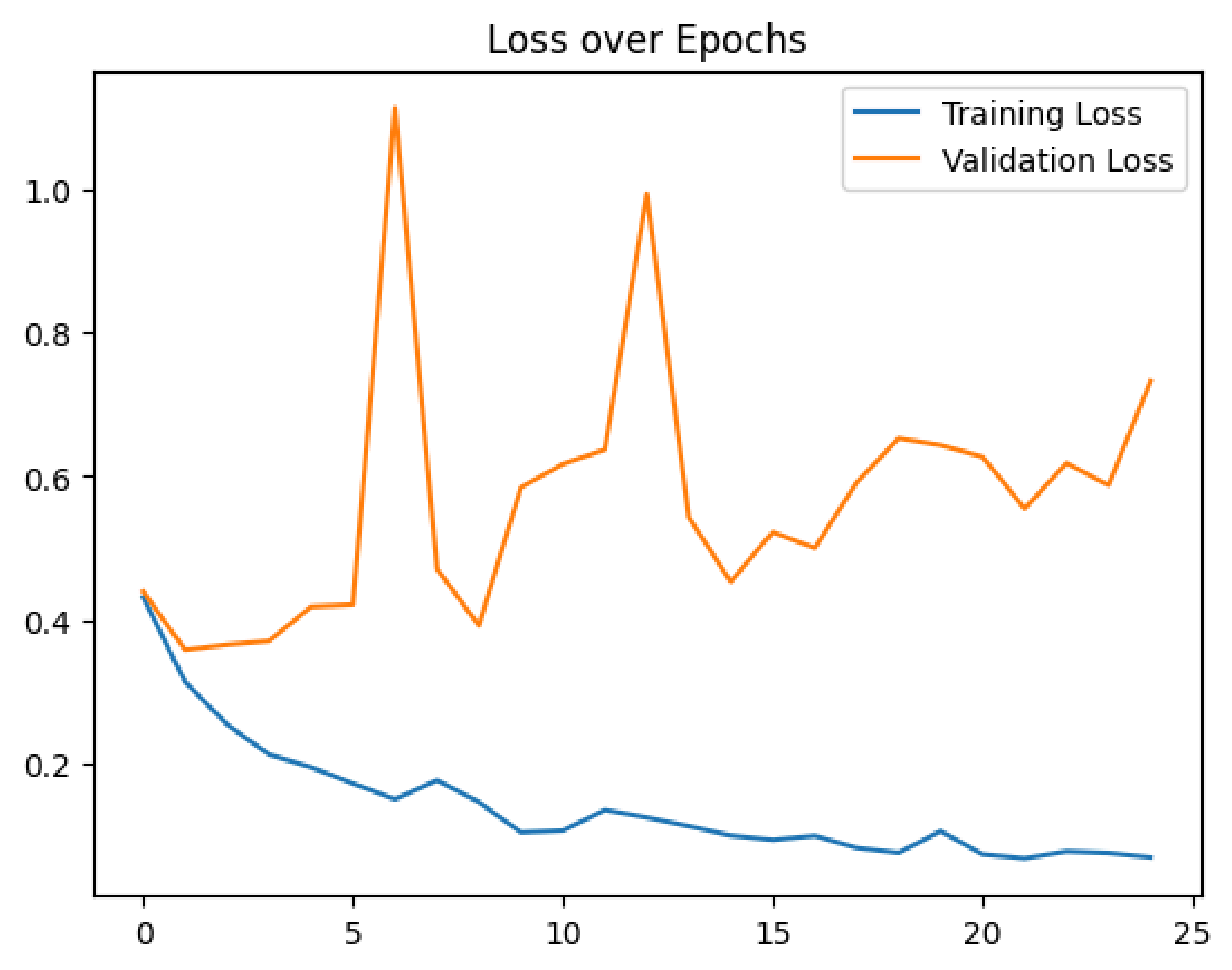
```
# Evaluate the model
val_loss, val_accuracy = model.evaluate(X_val, y_val)
print(f"Validation Accuracy: {val_accuracy:.2f}")
```

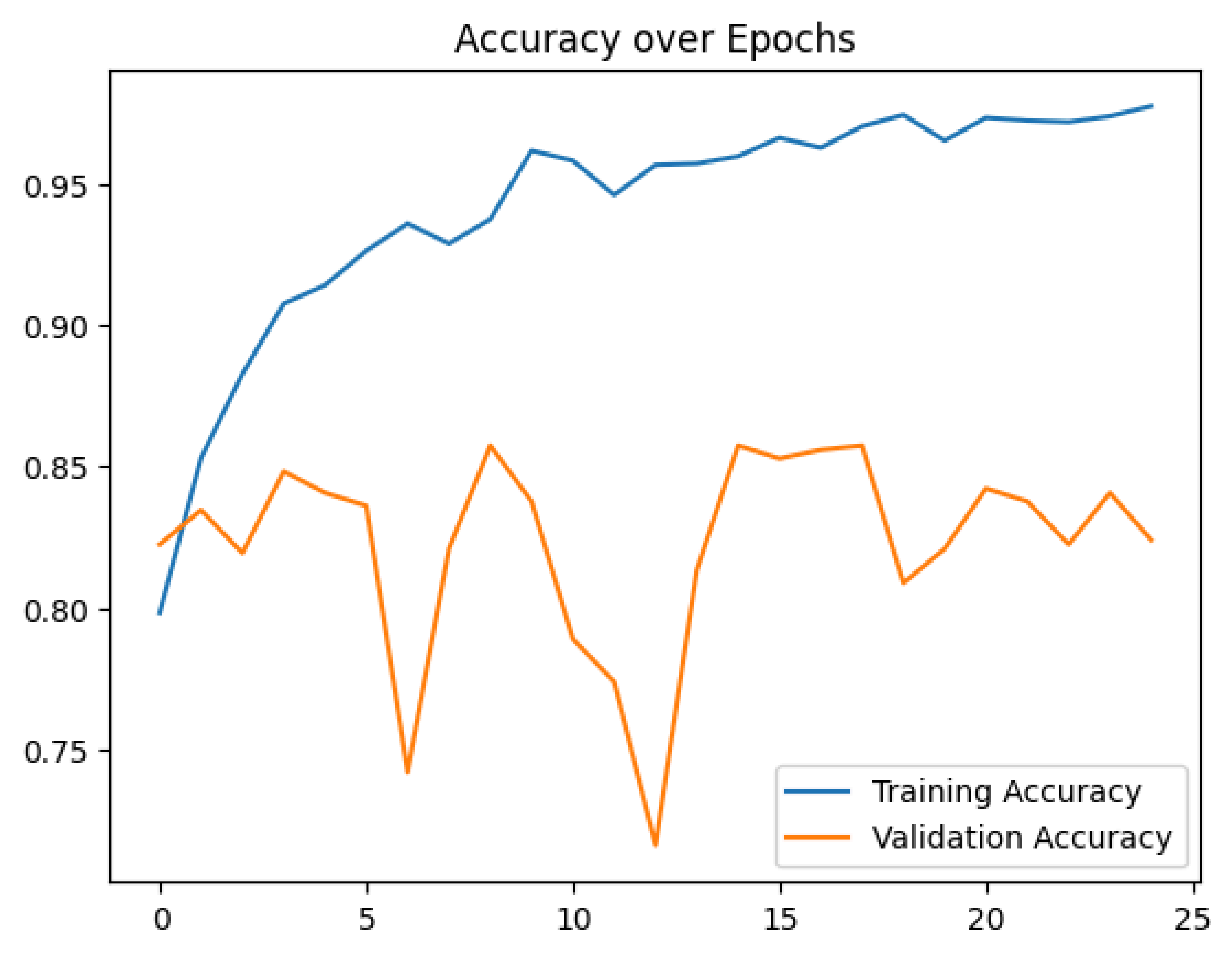
```
21/21 ━━━━━━━━━━━━━━━━━━━━ 0s 9ms/step - accuracy: 0.8138 - loss: 0.7669
Validation Accuracy: 0.82
```

```
test_loss, test_accuracy = model.evaluate(X_test, y_test)
print(f"Test Accuracy: {test_accuracy:.2f}")
```

```
21/21 ━━━━━━━━━━━━━━━━━━━━ 0s 10ms/step - accuracy: 0.8609 - loss: 0.5256
Test Accuracy: 0.85
```

Project results for LSTM Model





Project results for LSTM Model

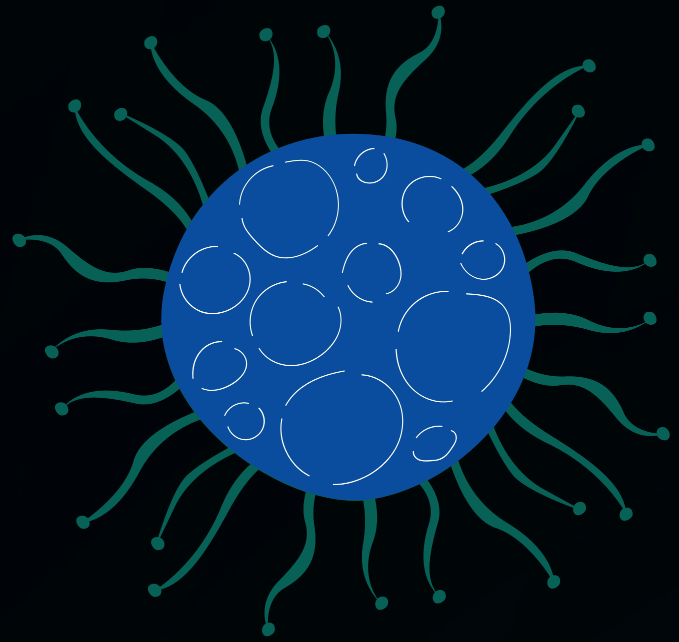
```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 313ms/step
True Class: Benign
Predicted Class: Benign

True Class: Malignant
Predicted Class: Malignant

True Class: Benign
Predicted Class: Benign

True Class: Malignant
Predicted Class: Malignant

True Class: Malignant
Predicted Class: Malignant

True Class: Benign
Predicted Class: Benign

True Class: Benign
Predicted Class: Benign

True Class: Malignant
Predicted Class: Malignant
...

True Class: Malignant
Predicted Class: Malignant
```

Project results for RNN Model

```
model_rnn.evaluate(val_data_flattened)
```

```
19/19 ━━━━━━━━━━━━━━━━━━━━ 13s 693ms/step - accuracy: 0.6745 - loss: 0.5994

[0.5838347673416138, 0.6874051690101624]
```

CONCLUSION



Our deep learning project successfully implemented three distinct approaches for skin cancer classification. The ResNet50+LSTM model achieved the highest accuracy, demonstrating the effectiveness of combining transfer learning with sequential processing. The system shows promising potential for assisting healthcare professionals in early skin cancer detection, though further clinical validation is recommended.

THANK YOU!