Styloid Process Classification

Aim: AI model that will detect elongations automatically classify the X-ray images into Normal, Right side elongated (RS), Left side elongated (LS), and Both sides elongated (RLS) directly

```
To enable the following instructions: SSE3 SSE4.1 SSE4.2 AVX AVX2
propriate compiler flags.
Found 400 files belonging to 4 classes.
Using 80 files for validation.
Classes found: ['LS - 100', 'N - 100', 'RLS - 100', 'RS - 100']
```

Dataset Splitting

Objective 2. To design and implement a convolutional neural network (CNN) for automated feature extraction and classification.

Model: "sequential"

| Layer (type)	Output Shape	Param #
rescaling (Rescaling)	(None, 224, 224, 3)	0
conv2d (Conv2D)	(None, 222, 222, 32)	896
max_pooling2d (MaxPooling2D)	(None, 111, 111, 32)	0
conv2d_1 (Conv2D)	(None, 109, 109, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 54, 54, 64)	0
conv2d_2 (Conv2D)	(None, 52, 52, 128)	73,856
max_pooling2d_2 (MaxPooling2D)	(None, 26, 26, 128)	0
flatten (Flatten)	(None, 86528)	0
dense (Dense)	(None, 128)	11,075,712
dropout (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 4)	516

CNN Model Layers

Objective 3. To evaluate the CNN model performance using classification accuracy, precision, recall, F1-score, and confusion matrix.

```
Classification Report:
                precision    recall  f1-score   support

   LS - 100         0.90      0.86      0.88        22
    N - 100         0.85      0.69      0.76        16
  RLS - 100         0.72      0.81      0.76        16
   RS - 100         0.79      0.85      0.81        26

   accuracy                            0.81        80
  macro avg         0.81      0.80      0.81        80
weighted avg        0.82      0.81      0.81        80
```

CNN Classification Report
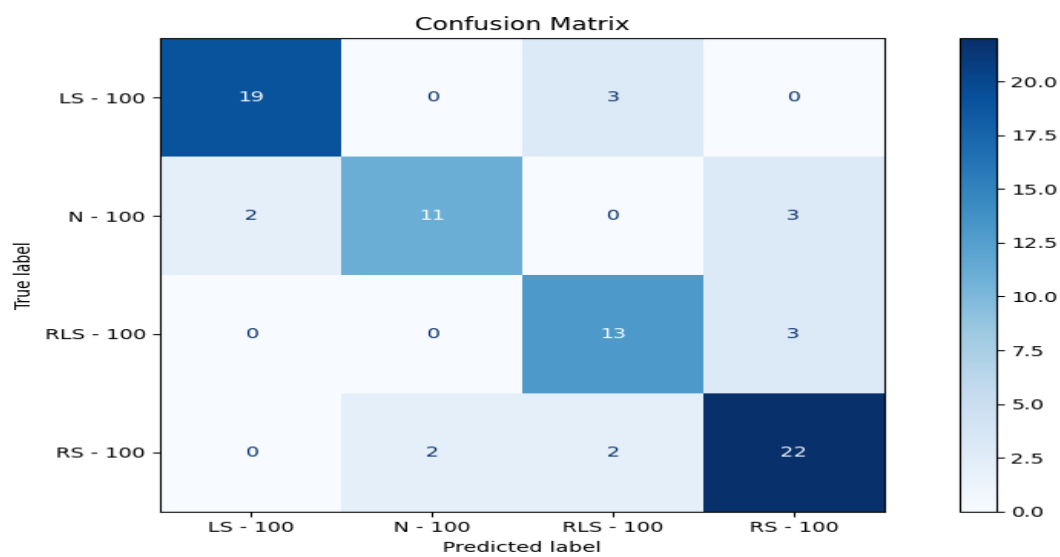
CNN Confusion Matrix
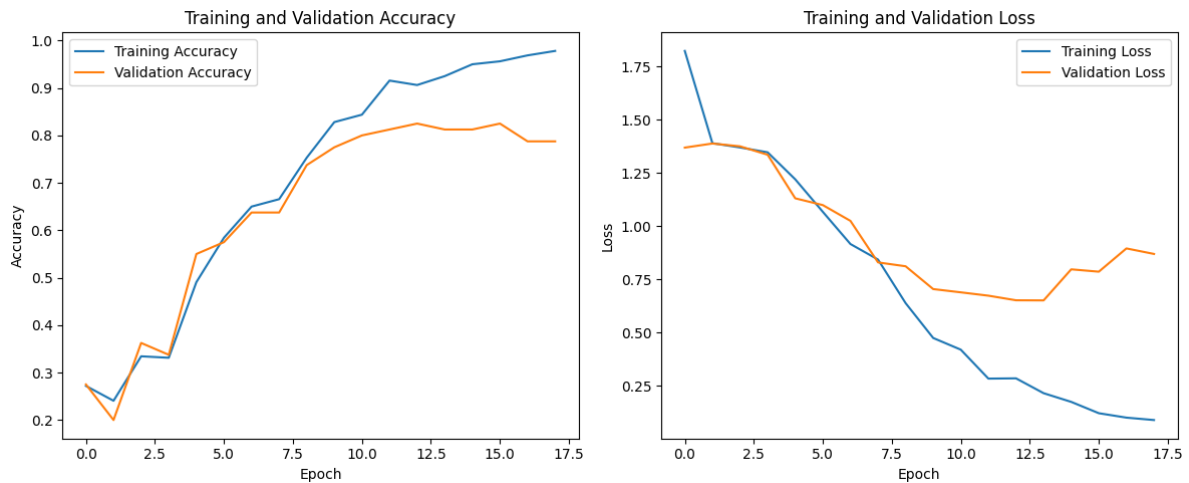
CNN training and Validation Accuracy

Objective 4. To compare the performance of a custom-built CNN with transfer learning models such as ResNet18, EfficientNetB0, and MobileNetV2.

	Model	Validation Accuracy
0	Custom_CNN	0.725
1	ResNet18	0.775
2	EfficientNetB0	0.200
3	MobileNetV2	0.750

Comparism of the four models

Objective 5. To explore the impact of data augmentation techniques on improving model generalizability.

```
Model Performance Before vs After Augmentation:
Model              Before      After
-----------------------------------------
CustomCNN          0.7750      0.3875
ResNet50V2         0.6250      0.2750
EfficientNetB0     0.2250      0.2750
MobileNetV2        0.3250      0.2875
```

Model Accuracy Before vs After Data Augmentation