

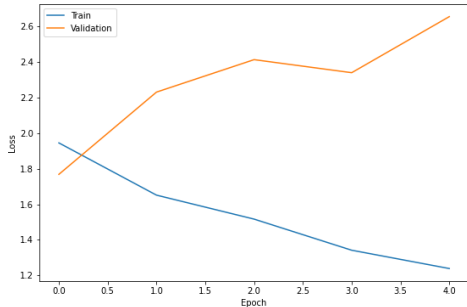
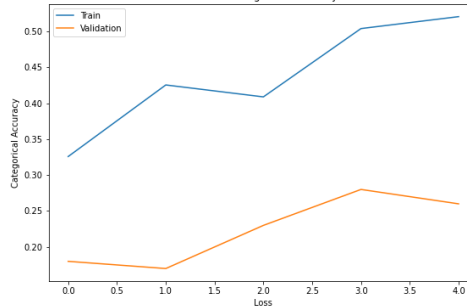
Neural Networks Project Gesture Recognition Write-Up

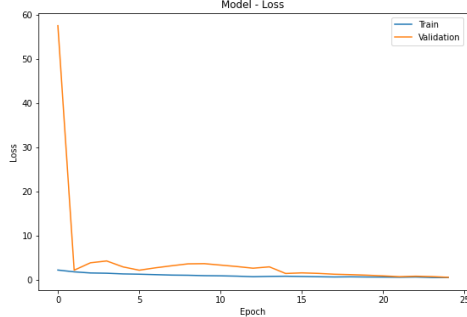
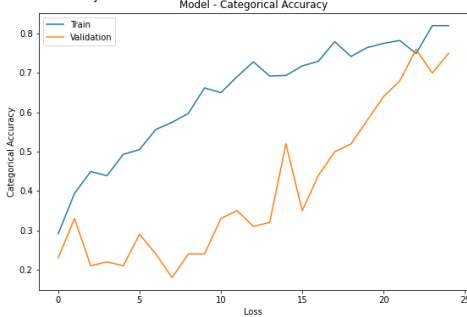
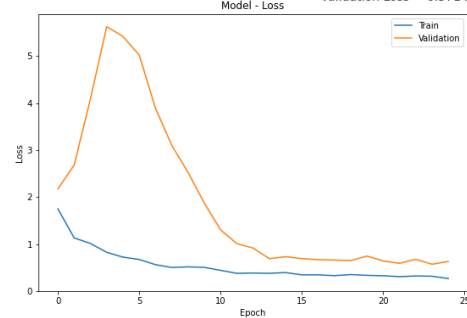
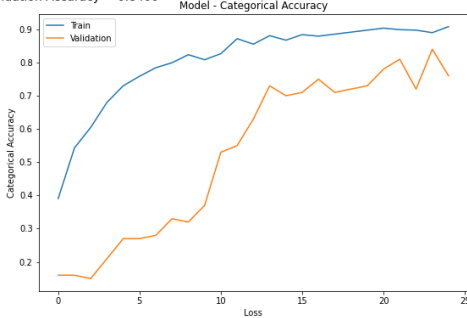
Author: Tom Mathews

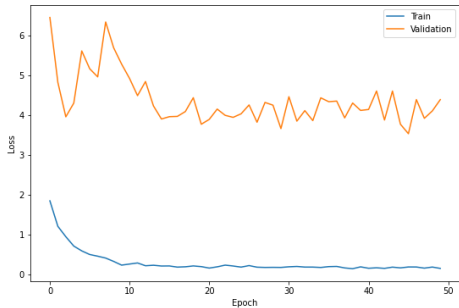
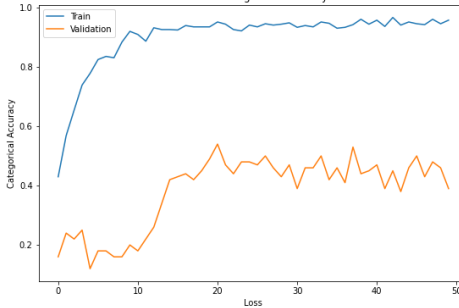
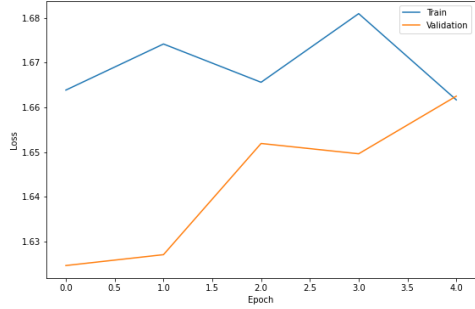
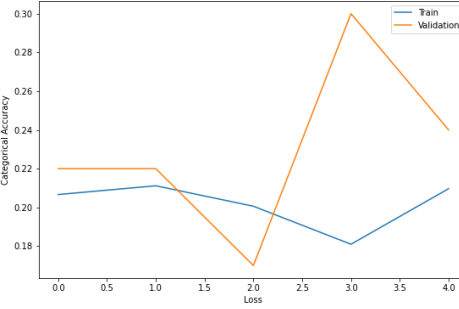
For this problem, we are going to be using a ImageGenerator to generate the images in batches as per parameters like number of frames to use and the batch size.

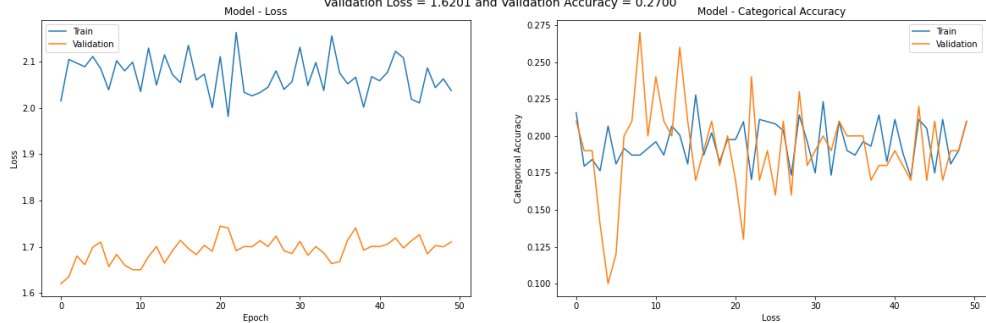
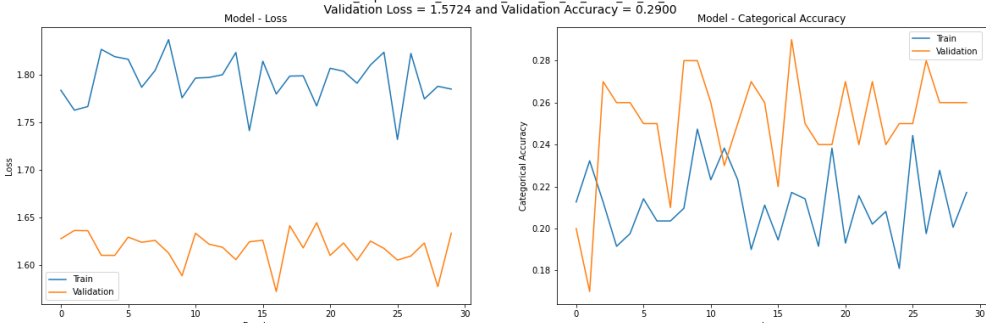
For the modelling experiments, we are going to use the following broad algorithms.

- Conv3D Layering
- TimeDistributed Conv2D Layering
 - LSTM
 - GRU
- TransferLearning
 - MobileNet - Training only the top layers
 - MobileNet - Training all the layers
 - ResNet50 - Training all the layers

| Experiment Number | Model | Result | Decision + Explanation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|---|-------|------------|-----------------|---|------|------|----|------|------|----|------|------|----|------|------|----|------|------|-------|----------------|---------------------|---|------|------|----|------|------|----|------|------|----|------|------|----|------|------|
| 1 | Conv3D <ul style="list-style-type: none">filtersize = (3, 3, 3)dense_neurons = 64dropout = 0.5frames_to_sample = 25batch_size = 34num_epochs = 5enable_augmentation = False | <ul style="list-style-type: none">Validation Loss = 1.7690Validation Categorical Accuracy = 0.2800 | Model is definitely learning. Trying to increase the parameters layers. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <div>model_Experiment1_Conv3D_03_12_2022_08_25_46 Validation Loss = 1.7690 and Validation Accuracy = 0.2800</div> <div><div>Model - Loss</div><table><caption>Model - Loss Data</caption><tr><th>Epoch</th><th>Train Loss</th><th>Validation Loss</th></tr><tr><td>0</td><td>1.95</td><td>1.77</td></tr><tr><td>10</td><td>1.65</td><td>2.25</td></tr><tr><td>20</td><td>1.55</td><td>2.42</td></tr><tr><td>30</td><td>1.35</td><td>2.35</td></tr><tr><td>40</td><td>1.25</td><td>2.65</td></tr></table></div> <div><div>Model - Categorical Accuracy</div><table><caption>Model - Categorical Accuracy Data</caption><tr><th>Epoch</th><th>Train Accuracy</th><th>Validation Accuracy</th></tr><tr><td>0</td><td>0.32</td><td>0.18</td></tr><tr><td>10</td><td>0.43</td><td>0.15</td></tr><tr><td>20</td><td>0.41</td><td>0.24</td></tr><tr><td>30</td><td>0.50</td><td>0.28</td></tr><tr><td>40</td><td>0.52</td><td>0.26</td></tr></table></div> | | | | Epoch | Train Loss | Validation Loss | 0 | 1.95 | 1.77 | 10 | 1.65 | 2.25 | 20 | 1.55 | 2.42 | 30 | 1.35 | 2.35 | 40 | 1.25 | 2.65 | Epoch | Train Accuracy | Validation Accuracy | 0 | 0.32 | 0.18 | 10 | 0.43 | 0.15 | 20 | 0.41 | 0.24 | 30 | 0.50 | 0.28 | 40 | 0.52 | 0.26 |
| Epoch | Train Loss | Validation Loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1.95 | 1.77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 1.65 | 2.25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 1.55 | 2.42 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 1.35 | 2.35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 1.25 | 2.65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Epoch | Train Accuracy | Validation Accuracy | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0.32 | 0.18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 0.43 | 0.15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 0.41 | 0.24 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 0.50 | 0.28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 0.52 | 0.26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Conv3D <ul style="list-style-type: none">filtersize = (3, 3, 3)dense_neurons = 256 | <ul style="list-style-type: none">Validation Loss = 0.5175Validation Categorical Accuracy = 0.7600 | Model is performing good. Will try to modify the parameters | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | <ul style="list-style-type: none"> dropout = 0.5 frames_to_sample = 20 batch_size = 26 num_epochs = 25 enable_augmentation = False | | |
| | <p>model_Experiment2_Conv3D_03_12_2022_08_36_40 Validation Loss = 0.5175 and Validation Accuracy = 0.7600</p> <div>   </div> | | |
| 3 | Conv3D <ul style="list-style-type: none"> dense_neurons = 64 dropout = 0.3 frames_to_sample = 20 batch_size = 13 num_epochs = 25 enable_augmentation = False | <ul style="list-style-type: none"> Validation Loss = 0.5714 Validation Categorical Accuracy = 0.8400 | Modifying the number of hyperparameters again. |
| | <p>model_Experiment3_Conv3D_03_12_2022_09_18_29 Validation Loss = 0.5714 and Validation Accuracy = 0.8400</p> <div>   </div> | | |
| 4 | Conv3D <ul style="list-style-type: none"> dense_neurons = 256 dropout = 0.5 frames_to_sample = 20 batch_size = 13 num_epochs = 50 enable_augmentation = False | <ul style="list-style-type: none"> Validation Loss = 3.5349 Validation Categorical Accuracy = 0.5400 | Changing the parameters this time has made the network overfit. Going to try a different network. |

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| <div> <div> <div>model Experiment4_Conv3D_03_12_2022_09_59_53</div> <div>Validation Loss = 3.5349 and Validation Accuracy = 0.5400</div> </div> <div> <div>Model - Loss</div>  </div> <div> <div>Model - Categorical Accuracy</div>  </div> </div> | | | |
| 5 | CNN - LSTM <ul style="list-style-type: none"> lstm_cells = 128 dense_neurons = 256 dropout = 0.25 frames_to_sample = 20 batch_size = 26 num_epochs = 5 enable_augmentation = False | <ul style="list-style-type: none"> Validation Loss = 1.6247 Validation Categorical Accuracy = 0.3000 | |
| <div> <div> <div>model Experiment5_CNN_LSTM_03_12_2022_11_22_24</div> <div>Validation Loss = 1.6247 and Validation Accuracy = 0.3000</div> </div> <div> <div>Model - Loss</div>  </div> <div> <div>Model - Categorical Accuracy</div>  </div> </div> | | | |
| 6 | CNN - LSTM with GRU <ul style="list-style-type: none"> lstm_cells = 128 dense_neurons = 256 dropout = 0.3 frames_to_sample = 20 batch_size = 13 num_epochs = 50 enable_augmentation = False | <ul style="list-style-type: none"> Validation Loss = 1.6201 Validation Categorical Accuracy = 0.2700 | Performance does not look promising. The network seems to be not learning. Going to try Transfer Learning. |

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| | <p>model_Experiment6_CNN_LSTM_GRU_03_12_2022_11_31_03 Validation Loss = 1.6201 and Validation Accuracy = 0.2700</p>  | | |
| 7 | <p>Transfer Learning with ImageNet and LSTM</p> <ul style="list-style-type: none"> • lstm_cells = 128 • dense_neurons = 128 • dropout = 0.5 • frames_to_sample = 20 • batch_size = 17 • num_epochs = 30 • enable_augmentation = False | <ul style="list-style-type: none"> • Validation Loss = • Validation Categorical Accuracy = | <p>Performance does not look promising. The network seems to be not learning. Going to try training all the layers of the base model</p> |
| | <p>model_Experiment7_MobileNet_LSTM_03_12_2022_12_54_00 Validation Loss = 1.5724 and Validation Accuracy = 0.2900</p>  | | |
| 8 | <p>Transfer Learning with ImageNet and GRU and training all weights</p> <ul style="list-style-type: none"> • gru_cells = 128 • dense_neurons = 128 • dropout = 0.5 • frames_to_sample = 20 • batch_size = 13 • num_epochs = 50 • enable_augmentation = False | <ul style="list-style-type: none"> • Validation Loss = 0.3291 • Validation Categorical Accuracy = 0.9200 | <p>The performance is excellent, and the network seems to be providing good results. Going to try another base model for transfer learning.</p> |

