**Progress Report Draft | 23 February 2024**

1. draw a diagram of the 3D-CNN architecture which you used

2. provide training and testing results on all the plots.

4. describe the datasets which you used. Is it the unbalanced raw dataset? what is the resolution of an input image?

1. **Neural Network Architecture**
   1. **3D CNN Model (ReLU)**

The architecture of the 3D CNN model follows the same architecture as the 2D CNN model with 2D layers being changed to 3D layers.

* **3D Convolutional Layers for Feature Extraction:**

Layer 1 consisting of 128 convolution filters with a kernel size of 3 x 3 x 3.

Layer 2 consisting of 128 convolution filters with a kernel size of 3 x 3 x 3.

Layer 3 consisting of 64 convolution filters with a kernel size of 3 x 3 x 3.

* **Max-Pooling Layers:**

3D max-pooling layers are used after each convolutional layer to reduce spatial dimensions.

* **Fully Connected Layers for Fall Detection**

Layer 1 consisting of 64 ReLU units.

Layer 2 consisting of 128 ReLU units.

Layer 3 consisting of 254 ReLU units.

* **Output Layer:**

2D SoftMax layer with a single binary output:

* Fall (represented as 1)
* No fall (represented as 0)
  1. **3D CNN Model (Gaussian Error Linear Unit - GeLU)**

The architecture of this model follows the same architecture as the previous 3D CNN model with the ReLU units swapped for GeLU.

* **3D Convolutional Layers for Feature Extraction:**

Layer 1 consisting of 128 convolution filters with a kernel size of 3 x 3 x 3.

Layer 2 consisting of 128 convolution filters with a kernel size of 3 x 3 x 3.

Layer 3 consisting of 64 convolution filters with a kernel size of 3 x 3 x 3.

* **Max-Pooling Layers:**

3D max-pooling layers are used after each convolutional layer to reduce spatial dimensions.

* **Fully Connected Layers for Fall Detection**

Layer 1 consisting of 64 GeLU units.

Layer 2 consisting of 128 GeLU units.

Layer 3 consisting of 254 GeLU units.

* **Output Layer:**

2D SoftMax layer with a single binary output:

* Fall (represented as 1)
* No fall (represented as 0)

1. **Results**
   1. **Metrics**

The metrics used to evaluate the model were Accuracy, Precision, Recall, Specificity, and F1-Score as shown in the descriptions below.

* **Accuracy**

The ratio of correctly predicted instances to the total instances

* **Precision**

The ratio of correctly predicted positives observations to the total predicted positives

* **Recall (Sensitivity)**

The ratio of correctly predicted positives observations to all the actual positives

* **Specificity**

The ratio of correctly predicted negative observations to all the actual negatives.

* **F1-Score**

The weighted average of Precision and Recall

1. **Results and Evaluation** 
   1. **Comparative Analysis**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Data** | **Accuracy** | **Precision** | **Recall** | **Specificity** | **F1-Score** | **Loss** |
| **Research** | **95.64** | **96.91** | **97.95** | **83.08** | **97.43** |  |
| **Replication** | **98.98** | **84.14** | **81.94** | **99.51** | **83.02** |  |
| **3D CNN BGS Canny**  **LR (0.0001)**  **Ep (50)** | **94.50** | **35.64** | **98.85** | **94.37** | **52.39** | **57.72** |
| **BGS findcon()**  **LR (0.0001)**  **Ep (50)** | 93.63 | 32.33 | 99.01 | 93.46 | 48.75 | 73.02 |
| **BGS findcon()**  **LR (0.0001)**  **Ep (100)** | 93.96 | 33.46 | 98.59 | 93.81 | 49.96 | 35.76 |
| **BGS findcon()**  **LR (0.00001)**  **Ep (50)** | 94.36 | 34.97 | 98.28 | 94.23 | 51.59 | 35.04 |
| **BGS findcon() LR (0.0001)**  **Ep (50) GeLU** | 93.62 | 32.28 | 98.85 | 93.45 | 48.66 | 69.69 |

Test Loss: 0.7302, Test Accuracy: 0.9363, Test Precision: 0.3233, Test Recall: 0.9901, Test Specificity: 0.9346, Test F1-Score: 0.4875 // Time taken: 745.568273599 seconds [12.42 min]

Test Loss: 0.3576, Test Accuracy: 0.9396, Test Precision: 0.3346, Test Recall: 0.9859, Test Specificity: 0.9381, Test F1-Score: 0.4996 // Time taken: 1333.7722436999975 seconds [ 22.22 min]

Test Loss: 0.3504, Test Accuracy: 0.9436, Test Precision: 0.3497, Test Recall: 0.9828, Test Specificity: 0.9423, Test F1-Score: 0.5159 // Time taken: 741.4168626000028 seconds [12.35 min]

Test Loss: 0.6969, Test Accuracy: 0.9362, Test Precision: 0.3228, Test Recall: 0.9885, Test Specificity: 0.9345, Test F1-Score: 0.4866 // Total Time taken: 743.8618334999992 seconds [12.39 min]

* 1. **Graphs**

A blue and white graph

Description automatically generated

Figure Confusion Matrix - BGS findcon() LR[0.0001] E[50]

A group of graphs on a white background

Description automatically generated

Figure Results - BGS findcon() LR[0.0001] E[50]

A blue and white graph

Description automatically generated

Figure Confusion Matrix - BGS findcon() LR[0.0001] E[100]

A graph of a graph

Description automatically generated with medium confidence

Figure Results - BGS findcon() LR[0.0001] E[100]

A blue and white graph

Description automatically generated

Figure Confusion Matrix - BGS findcon() LR[0.00001] E[50]

A graph of a graph

Description automatically generated with medium confidence

Figure Results - BGS findcon() LR[0.00001] E[50]

A blue and white graph

Description automatically generated

Figure Confusion Matrix - BGS findcon() LR[0.0001] E[50] GeLU

A graph of a graph

Description automatically generated with medium confidence

Figure Results - BGS findcon() LR[0.0001] E[50] GeLU