/usr/bin/python3.6 "/home/aimove/Desktop/AIMove AGV Project/AIMove-AGV-Project/cross\_validation.py"

------------------------------- Start HMM Training and Testing of 8020 validation, diag covariance -------------------------------

Start of epoch 0

80%-20% Train dataset's recording number 112

80%-20% Test dataset's recording number 32

80%-20% Test label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

80%-20% Gesture 1 Train data shape: (851, 21)

80%-20% Gesture 2 Train data shape: (680, 21)

80%-20% Gesture 3 Train data shape: (644, 21)

80%-20% Gesture 4 Train data shape: (653, 21)

80%-20% Gesture 5 Train data shape: (729, 21)

80%-20% Gesture 6 Train data shape: (639, 21)

80%-20% Gesture 7 Train data shape: (743, 21)

80%-20% Gesture 8 Train data shape: (681, 21)

80%-20% Gesture 1 Train sequence lengths: [61 49 54 55 63 62 61 72 78 61 61 62 56 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 38 37 36 48 55 57 59 50 42 42]

80%-20% Gesture 3 Train sequence lengths: [61 60 38 38 39 35 36 39 50 55 59 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 39 40 42 39 40 47 54 61 63 56 43 44]

80%-20% Gesture 5 Train sequence lengths: [47 52 54 52 55 51 53 60 63 61 59 63 59]

80%-20% Gesture 6 Train sequence lengths: [43 43 45 46 47 42 52 46 61 64 51 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 50 45 42 60 55 44 41 43 52 51 52 51 55 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 46 47 47 45 48 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.906, Run time = 0.003

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 5 5 4 5 4 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 0.969, Run time = 0.003

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 5 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 13, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 15, Accuracy = 1.000, Run time = 0.006

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 17, Accuracy = 1.000, Run time = 0.007

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 19, Accuracy = 1.000, Run time = 0.008

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 21, Accuracy = 1.000, Run time = 0.009

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 23, Accuracy = 1.000, Run time = 0.010

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.906, Run time = 0.010

Label: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 6 6 6 6 6 7 7 7 7 5 5]

End of epoch 0 Best accuracy = 1.000, HMM state of best accuracy = [ 5 7 9 11 13 15 17 19 21 23]

Start of epoch 1

80%-20% Train dataset's recording number 114

80%-20% Test dataset's recording number 30

80%-20% Test label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

80%-20% Gesture 1 Train data shape: (945, 21)

80%-20% Gesture 2 Train data shape: (572, 21)

80%-20% Gesture 3 Train data shape: (650, 21)

80%-20% Gesture 4 Train data shape: (632, 21)

80%-20% Gesture 5 Train data shape: (957, 21)

80%-20% Gesture 6 Train data shape: (679, 21)

80%-20% Gesture 7 Train data shape: (704, 21)

80%-20% Gesture 8 Train data shape: (634, 21)

80%-20% Gesture 1 Train sequence lengths: [61 62 69 54 55 63 62 61 72 78 73 61 62 56 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 38 38 37 36 48 55 57 59 50 42]

80%-20% Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 48 45 55 45 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 43 39 40 40 42 45 40 54 61 56 43 44]

80%-20% Gesture 5 Train sequence lengths: [47 52 50 54 55 52 51 53 60 63 61 59 63 63 59 57 58]

80%-20% Gesture 6 Train sequence lengths: [42 43 45 46 43 47 42 44 52 61 64 51 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 50 47 45 59 60 55 44 41 43 52 51 55 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 45 46 47 44 48 47 45 44 46 44 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 11, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 13, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 15, Accuracy = 1.000, Run time = 0.006

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 17, Accuracy = 1.000, Run time = 0.007

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

HMM state = 19, Accuracy = 1.000, Run time = 0.007

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.867, Run time = 0.007

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 5 5 3 3]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.867, Run time = 0.008

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 5 5 2 4]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.867, Run time = 0.010

Label: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 1 1 2 2 2 2 2 2 3 3 3 3 4 4 4 4 5 6 6 6 6 7 7 7 7 5 5 4 4]

End of epoch 1 Best accuracy = 1.000, HMM state of best accuracy = [ 1 3 5 7 9 11 13 15 17 19]

Start of epoch 2

80%-20% Train dataset's recording number 115

80%-20% Test dataset's recording number 29

80%-20% Test label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

80%-20% Gesture 1 Train data shape: (880, 21)

80%-20% Gesture 2 Train data shape: (766, 21)

80%-20% Gesture 3 Train data shape: (746, 21)

80%-20% Gesture 4 Train data shape: (746, 21)

80%-20% Gesture 5 Train data shape: (669, 21)

80%-20% Gesture 6 Train data shape: (729, 21)

80%-20% Gesture 7 Train data shape: (710, 21)

80%-20% Gesture 8 Train data shape: (589, 21)

80%-20% Gesture 1 Train sequence lengths: [61 62 54 55 63 62 61 72 78 73 61 62 56 60]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 38 38 37 36 48 55 57 57 59 42 42 41]

80%-20% Gesture 3 Train sequence lengths: [61 60 63 38 39 36 39 48 50 64 55 59 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 45 40 47 54 61 63 56 43]

80%-20% Gesture 5 Train sequence lengths: [47 52 50 52 52 53 63 59 63 63 57 58]

80%-20% Gesture 6 Train sequence lengths: [42 43 45 46 43 47 42 44 46 61 56 64 51 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 48 50 45 59 60 55 44 41 52 51 52 51 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 46 47 45 47 45 44 46 46 45 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 3, Accuracy = 0.966, Run time = 0.003

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 6 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 9, Accuracy = 0.966, Run time = 0.004

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 6 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 11, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 13, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 15, Accuracy = 1.000, Run time = 0.006

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

HMM state = 17, Accuracy = 1.000, Run time = 0.006

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 19, Accuracy = 0.828, Run time = 0.007

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 7 2 5 5 7]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.828, Run time = 0.008

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 7 6 5 5 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.828, Run time = 0.009

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 2 5 5 5 7]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.897, Run time = 0.010

Label: [1 1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 7 7 7 4 4 5 5 5 5 5 5 6 6 6 7 7 7 7 8 8 8 8 8]

End of epoch 2 Best accuracy = 1.000, HMM state of best accuracy = [ 1 5 7 11 13 15 17]

Start of epoch 3

80%-20% Train dataset's recording number 110

80%-20% Test dataset's recording number 34

80%-20% Test label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

80%-20% Gesture 1 Train data shape: (851, 21)

80%-20% Gesture 2 Train data shape: (632, 21)

80%-20% Gesture 3 Train data shape: (828, 21)

80%-20% Gesture 4 Train data shape: (580, 21)

80%-20% Gesture 5 Train data shape: (542, 21)

80%-20% Gesture 6 Train data shape: (732, 21)

80%-20% Gesture 7 Train data shape: (806, 21)

80%-20% Gesture 8 Train data shape: (587, 21)

80%-20% Gesture 1 Train sequence lengths: [61 62 49 54 55 63 61 78 73 61 62 56 60 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 55 57 59 50 42 41]

80%-20% Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 39 48 50 45 64 55 59 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [39 48 43 39 42 45 47 54 61 63 56 43]

80%-20% Gesture 5 Train sequence lengths: [47 52 54 52 55 52 51 59 63 57]

80%-20% Gesture 6 Train sequence lengths: [42 43 45 46 44 43 47 44 52 46 61 56 64 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 48 50 45 42 59 60 55 41 43 52 51 52 51 55 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 46 47 45 44 47 45 46 45 44 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 3, Accuracy = 0.971, Run time = 0.003

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 7 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 11, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 13, Accuracy = 0.971, Run time = 0.005

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 6 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 15, Accuracy = 0.971, Run time = 0.006

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 6 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

HMM state = 17, Accuracy = 1.000, Run time = 0.007

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 19, Accuracy = 0.853, Run time = 0.007

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 7 5 5 1 6]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.824, Run time = 0.008

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 6 5 5 5 5 6 6 6 7 7 7 5 5 1 3]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.853, Run time = 0.009

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 7 5 5 1 3]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.824, Run time = 0.010

Label: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 5 5 5 5 5 6 6 6 7 7 8 8 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 2 3 4 4 4 4 4 4 5 5 5 6 5 5 5 5 6 6 6 7 7 7 5 5 1 6]

End of epoch 3 Best accuracy = 1.000, HMM state of best accuracy = [ 1 5 7 9 11 17]

Start of epoch 4

80%-20% Train dataset's recording number 120

80%-20% Test dataset's recording number 24

80%-20% Test label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

80%-20% Gesture 1 Train data shape: (1000, 21)

80%-20% Gesture 2 Train data shape: (722, 21)

80%-20% Gesture 3 Train data shape: (652, 21)

80%-20% Gesture 4 Train data shape: (517, 21)

80%-20% Gesture 5 Train data shape: (847, 21)

80%-20% Gesture 6 Train data shape: (825, 21)

80%-20% Gesture 7 Train data shape: (688, 21)

80%-20% Gesture 8 Train data shape: (817, 21)

80%-20% Gesture 1 Train sequence lengths: [62 69 49 55 63 62 61 72 78 73 61 61 62 56 60 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 48 55 57 59 50 42 42 41]

80%-20% Gesture 3 Train sequence lengths: [63 38 38 39 35 39 48 50 45 64 59 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [39 43 40 40 39 45 47 61 63 56 44]

80%-20% Gesture 5 Train sequence lengths: [47 52 50 54 52 55 53 60 63 61 63 63 59 57 58]

80%-20% Gesture 6 Train sequence lengths: [42 43 45 46 44 43 47 42 44 52 46 61 56 64 51 51 48]

80%-20% Gesture 7 Train sequence lengths: [48 50 47 45 42 59 60 44 41 43 51 52 51 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 47 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.917, Run time = 0.003

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 5 4 4 4 4 4 5 5 6 7 7 7 7]

HMM state = 3, Accuracy = 1.000, Run time = 0.003

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 5, Accuracy = 1.000, Run time = 0.003

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 7, Accuracy = 1.000, Run time = 0.004

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 11, Accuracy = 1.000, Run time = 0.005

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 13, Accuracy = 1.000, Run time = 0.005

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 15, Accuracy = 1.000, Run time = 0.006

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 17, Accuracy = 0.958, Run time = 0.007

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 7 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 19, Accuracy = 0.958, Run time = 0.008

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 7 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

HMM state = 21, Accuracy = 1.000, Run time = 0.009

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.750, Run time = 0.007

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 7 7 7 3 3 3 3 4 4 4 4 4 4 4 6 6 6 6 7 7 7 7]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.875, Run time = 0.009

Label: [1 1 2 2 2 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

Prediction: [1 1 7 7 7 3 3 3 3 4 4 4 4 4 4 4 5 5 5 6 7 7 7 7]

End of epoch 4 Best accuracy = 1.000, HMM state of best accuracy = [ 3 5 7 9 11 13 15 21]

Start of epoch 5

80%-20% Train dataset's recording number 120

80%-20% Test dataset's recording number 24

80%-20% Test label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

80%-20% Gesture 1 Train data shape: (924, 21)

80%-20% Gesture 2 Train data shape: (795, 21)

80%-20% Gesture 3 Train data shape: (639, 21)

80%-20% Gesture 4 Train data shape: (620, 21)

80%-20% Gesture 5 Train data shape: (1009, 21)

80%-20% Gesture 6 Train data shape: (672, 21)

80%-20% Gesture 7 Train data shape: (704, 21)

80%-20% Gesture 8 Train data shape: (682, 21)

80%-20% Gesture 1 Train sequence lengths: [61 49 54 55 63 62 61 72 78 73 61 61 62 56 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 48 55 57 59 50 42 42 41]

80%-20% Gesture 3 Train sequence lengths: [61 60 63 38 39 35 50 45 55 59 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 40 61 56 43 44]

80%-20% Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 51 53 60 63 61 59 63 63 59 57 58]

80%-20% Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 42 44 61 56 64 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 50 47 45 42 59 60 55 44 41 52 52 55 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 47 47 45 44 48 47 45 44 46 46 45 45 43]

HMM state = 1, Accuracy = 0.917, Run time = 0.003

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 6 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 3 8 8 8]

HMM state = 3, Accuracy = 0.958, Run time = 0.003

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 7 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

HMM state = 11, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

HMM state = 13, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 15, Accuracy = 0.875, Run time = 0.005

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 7 7 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 17, Accuracy = 0.875, Run time = 0.006

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 7 7 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 19, Accuracy = 0.875, Run time = 0.007

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 7 7 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.875, Run time = 0.008

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 7 7 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.875, Run time = 0.009

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 7 7 3]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.875, Run time = 0.010

Label: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 8 8 8]

Prediction: [1 1 1 2 3 3 3 3 3 4 4 4 4 6 6 6 6 7 7 7 7 7 7 2]

End of epoch 5 Best accuracy = 1.000, HMM state of best accuracy = [ 5 7 9 11 13]

------------------------------- End HMM Training and Testing of **8020 validation, diag covariance** -------------------------------

HMM states = [ 1 3 **5** **7** 9 11 13 15 17 19 21 23 25]

Mean accuracy = [0.95659722 0.97719814 **1. 1.**  0.99425287 1.

0.99509804 0.97426471 0.97222222 0.91897679 0.89879705 0.86203234

0.87383297]

------------------------------- Start HMM Training and Testing of 8020 validation, full covariance -------------------------------

Start of epoch 0

80%-20% Train dataset's recording number 118

80%-20% Test dataset's recording number 26

80%-20% Test label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

80%-20% Gesture 1 Train data shape: (1053, 21)

80%-20% Gesture 2 Train data shape: (698, 21)

80%-20% Gesture 3 Train data shape: (636, 21)

80%-20% Gesture 4 Train data shape: (636, 21)

80%-20% Gesture 5 Train data shape: (847, 21)

80%-20% Gesture 6 Train data shape: (772, 21)

80%-20% Gesture 7 Train data shape: (676, 21)

80%-20% Gesture 8 Train data shape: (633, 21)

80%-20% Gesture 1 Train sequence lengths: [61 69 49 54 55 63 62 61 72 78 73 61 61 62 56 60 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 48 57 59 50 42 41]

80%-20% Gesture 3 Train sequence lengths: [61 60 63 38 35 36 39 50 45 64 59 45 41]

80%-20% Gesture 4 Train sequence lengths: [39 48 43 39 40 40 42 39 45 47 54 61 56 43]

80%-20% Gesture 5 Train sequence lengths: [47 52 52 55 52 51 53 60 63 61 59 63 63 59 57]

80%-20% Gesture 6 Train sequence lengths: [42 43 43 46 44 43 47 42 44 52 46 61 56 64 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 48 50 47 45 42 59 44 41 43 52 52 51 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 46 47 45 44 48 47 45 44 45 44 45 43]

HMM state = 1, Accuracy = 0.962, Run time = 0.004

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 3 7 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.006

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

HMM state = 5, Accuracy = 0.962, Run time = 0.008

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 3 7 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

HMM state = 7, Accuracy = 0.846, Run time = 0.010

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 7 7 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 4 4]

HMM state = 9, Accuracy = 0.885, Run time = 0.013

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 3 7 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 4 4]

HMM state = 11, Accuracy = 0.846, Run time = 0.015

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 7 7 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 4 3]

HMM state = 13, Accuracy = 0.846, Run time = 0.018

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 3 7 3 7 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 1 3]

HMM state = 15, Accuracy = 0.846, Run time = 0.021

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 3 6 3 1 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 4 4]

HMM state = 17, Accuracy = 0.769, Run time = 0.024

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 6 6 3 1 3 4 5 4 4 5 5 5 6 6 7 7 7 7 8 8 6 3]

HMM state = 19, Accuracy = 0.769, Run time = 0.028

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 3 7 3 1 1 4 4 4 4 5 5 5 6 6 7 7 1 7 8 8 6 1]

HMM state = 21, Accuracy = 0.731, Run time = 0.032

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 6 1 3 1 1 4 4 4 4 5 5 5 6 6 7 7 7 7 8 1 6 6]

HMM state = 23, Accuracy = 0.654, Run time = 0.035

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 7 1 3 1 1 4 4 5 4 5 5 5 6 6 1 7 7 7 8 1 6 6]

HMM state = 25, Accuracy = 0.615, Run time = 0.038

Label: [1 2 2 2 3 3 3 3 3 4 4 4 4 5 5 5 6 6 7 7 7 7 8 8 8 8]

Prediction: [1 2 2 2 7 6 3 1 1 4 5 4 4 5 5 5 6 6 1 1 1 7 8 8 5 5]

End of epoch 0 Best accuracy = 1.000, HMM state of best accuracy = [3]

Start of epoch 1

80%-20% Train dataset's recording number 109

80%-20% Test dataset's recording number 35

80%-20% Test label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

80%-20% Gesture 1 Train data shape: (796, 21)

80%-20% Gesture 2 Train data shape: (721, 21)

80%-20% Gesture 3 Train data shape: (592, 21)

80%-20% Gesture 4 Train data shape: (675, 21)

80%-20% Gesture 5 Train data shape: (717, 21)

80%-20% Gesture 6 Train data shape: (545, 21)

80%-20% Gesture 7 Train data shape: (653, 21)

80%-20% Gesture 8 Train data shape: (723, 21)

80%-20% Gesture 1 Train sequence lengths: [61 69 49 54 55 63 61 72 73 61 62 60 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 38 37 36 48 55 57 59 50 42 42 41]

80%-20% Gesture 3 Train sequence lengths: [60 38 38 39 35 39 50 45 55 59 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 45 40 47 63 56 43 44]

80%-20% Gesture 5 Train sequence lengths: [47 52 50 52 52 51 53 60 59 63 63 57 58]

80%-20% Gesture 6 Train sequence lengths: [46 44 43 47 52 46 61 56 51 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 50 47 42 59 60 55 41 43 52 51 51 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 45 46 47 45 44 48 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.006

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 5, Accuracy = 0.971, Run time = 0.008

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 7 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.010

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.013

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 11, Accuracy = 1.000, Run time = 0.015

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 13, Accuracy = 0.943, Run time = 0.018

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 1 3 7 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 15, Accuracy = 1.000, Run time = 0.022

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

, HMM state = 17, Accuracy = 0.943, Run time = 0.025

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 5 5 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 19, Accuracy = 0.829, Run time = 0.029

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 5 5 5 5 5 5 5 1 1 1 1 6 6 6 7 7 7 7 7 8 8]

HMM state = 21, Accuracy = 0.914, Run time = 0.031

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 7 3 3 4 5 5 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

HMM state = 23, Accuracy = 0.771, Run time = 0.037

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 5 2 2 2 3 3 3 3 3 4 5 5 5 5 5 5 5 7 5 7 5 6 6 6 7 7 7 7 7 1 8]

HMM state = 25, Accuracy = 0.743, Run time = 0.039

Label: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 4 4 5 5 5 5 5 6 6 6 6 6 6 6 7 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 2 2 2 3 3 3 3 3 4 5 5 5 5 5 5 5 1 5 5 5 5 5 6 7 7 7 7 7 1 8]

End of epoch 1 Best accuracy = 1.000, HMM state of best accuracy = [ 1 3 7 9 11 15]

Start of epoch 2

80%-20% Train dataset's recording number 120

80%-20% Test dataset's recording number 24

80%-20% Test label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

80%-20% Gesture 1 Train data shape: (1060, 21)

80%-20% Gesture 2 Train data shape: (725, 21)

80%-20% Gesture 3 Train data shape: (591, 21)

80%-20% Gesture 4 Train data shape: (742, 21)

80%-20% Gesture 5 Train data shape: (779, 21)

80%-20% Gesture 6 Train data shape: (725, 21)

80%-20% Gesture 7 Train data shape: (688, 21)

80%-20% Gesture 8 Train data shape: (728, 21)

80%-20% Gesture 1 Train sequence lengths: [61 62 69 49 54 63 62 61 72 78 73 61 61 62 56 60 56]

80%-20% Gesture 2 Train sequence lengths: [63 68 36 38 38 37 36 48 55 57 57 59 50 42 41]

80%-20% Gesture 3 Train sequence lengths: [60 63 38 38 39 35 36 39 50 59 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 48 43 39 40 42 39 45 40 54 61 63 56 43 44]

80%-20% Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 60 63 61 59 59 57 58]

80%-20% Gesture 6 Train sequence lengths: [42 43 43 45 46 43 47 42 44 52 46 61 56 64 51]

80%-20% Gesture 7 Train sequence lengths: [48 50 47 45 42 59 60 44 41 43 52 51 51 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 47 45 44 46 46 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.004

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.006

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

HMM state = 5, Accuracy = 0.958, Run time = 0.008

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 7 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

HMM state = 7, Accuracy = 0.958, Run time = 0.010

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 7 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

HMM state = 9, Accuracy = 0.958, Run time = 0.013

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 1 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

HMM state = 11, Accuracy = 0.958, Run time = 0.015

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 1 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

HMM state = 13, Accuracy = 0.917, Run time = 0.018

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 1 4 4 5 5 5 5 6 6 6 7 7 7 7 8 7]

HMM state = 15, Accuracy = 0.917, Run time = 0.021

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 1 4 4 5 5 5 5 6 6 6 7 7 7 7 8 7]

HMM state = 17, Accuracy = 0.875, Run time = 0.025

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 1 4 4 5 5 5 5 6 6 6 7 7 7 7 1 1]

HMM state = 19, Accuracy = 0.875, Run time = 0.031

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 3 3 3 3 1 4 4 5 5 5 5 6 6 6 7 7 7 7 1 1]

HMM state = 21, Accuracy = 0.750, Run time = 0.034

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 2 2 2 6 1 1 3 1 4 4 5 5 5 5 6 6 6 7 7 7 7 1 7]

HMM state = 23, Accuracy = 0.792, Run time = 0.036

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [1 1 1 2 3 3 3 1 1 4 4 5 5 5 5 6 6 6 7 7 7 7 8 6]

HMM state = 25, Accuracy = 0.917, Run time = 0.046

Label: [1 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 8 8]

Prediction: [5 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 7 7 7 6 8]

End of epoch 2 Best accuracy = 1.000, HMM state of best accuracy = [1 3]

Start of epoch 3

80%-20% Train dataset's recording number 117

80%-20% Test dataset's recording number 27

80%-20% Test label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

80%-20% Gesture 1 Train data shape: (695, 21)

80%-20% Gesture 2 Train data shape: (709, 21)

80%-20% Gesture 3 Train data shape: (819, 21)

80%-20% Gesture 4 Train data shape: (672, 21)

80%-20% Gesture 5 Train data shape: (805, 21)

80%-20% Gesture 6 Train data shape: (718, 21)

80%-20% Gesture 7 Train data shape: (800, 21)

80%-20% Gesture 8 Train data shape: (635, 21)

80%-20% Gesture 1 Train sequence lengths: [61 62 54 62 61 72 78 73 56 60 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 38 38 37 36 48 55 57 59 42 42 41]

80%-20% Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 48 50 45 64 55 59 41 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 45 47 54 63 43 44]

80%-20% Gesture 5 Train sequence lengths: [50 54 52 55 51 60 63 61 59 63 63 59 57 58]

80%-20% Gesture 6 Train sequence lengths: [42 43 43 45 46 44 47 42 44 52 56 64 51 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 48 50 47 45 59 60 44 41 43 52 51 52 51 55 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 45 47 47 45 44 48 45 44 46 46 45 43]

HMM state = 1, Accuracy = 0.926, Run time = 0.004

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 6 1 6 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

HMM state = 3, Accuracy = 0.889, Run time = 0.006

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 6 6 6 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.008

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

HMM state = 7, Accuracy = 0.889, Run time = 0.010

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 6 6 6 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

HMM state = 9, Accuracy = 0.963, Run time = 0.013

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 7]

HMM state = 11, Accuracy = 0.926, Run time = 0.015

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 6 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 7]

HMM state = 13, Accuracy = 1.000, Run time = 0.018

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

HMM state = 15, Accuracy = 0.926, Run time = 0.021

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 1 1 1 2 2 2 3 4 4 5 5 5 5 5 6 6 6 7 7 8 8 8 7]

HMM state = 17, Accuracy = 0.815, Run time = 0.027

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 1 1 5 2 2 2 3 4 4 5 5 5 5 5 6 6 6 7 7 5 8 6 7]

HMM state = 19, Accuracy = 0.778, Run time = 0.030

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 5 5 5 2 2 2 3 4 4 5 5 5 5 5 6 6 6 7 7 8 8 3 7]

HMM state = 21, Accuracy = 0.667, Run time = 0.032

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 5 1 5 5 5 2 2 2 3 5 4 5 5 5 5 5 6 6 6 6 7 5 8 8 7]

HMM state = 23, Accuracy = 0.741, Run time = 0.036

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 1 1 5 5 5 2 2 2 3 4 4 5 5 5 5 5 6 6 6 7 7 5 8 3 7]

HMM state = 25, Accuracy = 0.778, Run time = 0.040

Label: [1 1 1 1 1 1 1 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 8 8 8 8]

Prediction: [1 1 5 1 5 5 5 2 2 2 3 4 4 4 5 5 5 5 6 6 6 7 7 5 8 3 8]

End of epoch 3 Best accuracy = 1.000, HMM state of best accuracy = [ 5 13]

Start of epoch 4

80%-20% Train dataset's recording number 117

80%-20% Test dataset's recording number 27

80%-20% Test label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

80%-20% Gesture 1 Train data shape: (871, 21)

80%-20% Gesture 2 Train data shape: (666, 21)

80%-20% Gesture 3 Train data shape: (729, 21)

80%-20% Gesture 4 Train data shape: (684, 21)

80%-20% Gesture 5 Train data shape: (734, 21)

80%-20% Gesture 6 Train data shape: (780, 21)

80%-20% Gesture 7 Train data shape: (746, 21)

80%-20% Gesture 8 Train data shape: (678, 21)

80%-20% Gesture 1 Train sequence lengths: [61 62 69 54 55 63 61 78 73 61 62 56 60 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 36 55 57 57 50 42 41]

80%-20% Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 48 50 45 64 59 45 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 45 47 54 63 56 43]

80%-20% Gesture 5 Train sequence lengths: [47 52 55 52 51 53 63 61 63 63 59 57 58]

80%-20% Gesture 6 Train sequence lengths: [42 43 46 44 43 47 42 44 52 46 61 56 64 51 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 50 47 45 42 59 55 44 41 52 51 52 51 55 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 45 46 47 45 44 48 45 44 46 46 45 44 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.006

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 0.963, Run time = 0.008

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 7 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 7, Accuracy = 0.963, Run time = 0.011

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 7 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.013

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 1.000, Run time = 0.015

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 13, Accuracy = 1.000, Run time = 0.018

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 15, Accuracy = 1.000, Run time = 0.022

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

HMM state = 17, Accuracy = 0.852, Run time = 0.025

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 7 7 7 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 1]

HMM state = 19, Accuracy = 0.852, Run time = 0.028

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 7 7 7 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 1]

HMM state = 21, Accuracy = 0.852, Run time = 0.032

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 3 1 7 4 6 4 5 5 5 5 5 6 6 7 7 7 8 8 1]

HMM state = 23, Accuracy = 0.852, Run time = 0.036

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 7 1 1 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 1]

HMM state = 25, Accuracy = 0.778, Run time = 0.039

Label: [1 1 1 1 2 2 2 2 3 3 3 4 4 4 5 5 5 5 5 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 2 2 2 7 1 1 4 6 4 5 5 5 5 5 6 6 7 7 7 3 8 6]

End of epoch 4 Best accuracy = 1.000, HMM state of best accuracy = [ 1 3 9 11 13 15]

Start of epoch 5

80%-20% Train dataset's recording number 116

80%-20% Test dataset's recording number 28

80%-20% Test label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

80%-20% Gesture 1 Train data shape: (736, 21)

80%-20% Gesture 2 Train data shape: (755, 21)

80%-20% Gesture 3 Train data shape: (582, 21)

80%-20% Gesture 4 Train data shape: (787, 21)

80%-20% Gesture 5 Train data shape: (659, 21)

80%-20% Gesture 6 Train data shape: (817, 21)

80%-20% Gesture 7 Train data shape: (681, 21)

80%-20% Gesture 8 Train data shape: (727, 21)

80%-20% Gesture 1 Train sequence lengths: [62 49 54 63 62 61 72 78 61 62 56 56]

80%-20% Gesture 2 Train sequence lengths: [63 49 68 36 36 38 37 36 48 55 57 57 50 42 42 41]

80%-20% Gesture 3 Train sequence lengths: [61 60 38 39 36 50 45 64 55 45 41 48]

80%-20% Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 39 45 40 47 54 61 63 56 43 44]

80%-20% Gesture 5 Train sequence lengths: [47 50 54 52 55 52 51 53 60 59 63 63]

80%-20% Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 47 42 44 52 46 61 56 64 51 48]

80%-20% Gesture 7 Train sequence lengths: [47 48 47 45 42 60 55 44 41 43 51 52 51 55]

80%-20% Gesture 8 Train sequence lengths: [45 45 46 47 47 45 44 48 47 45 44 46 46 45 44 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

HMM state = 3, Accuracy = 0.893, Run time = 0.006

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 6 6 6 6 7 7 7 7 8 8]

HMM state = 5, Accuracy = 0.893, Run time = 0.008

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 6 6 6 6 7 7 7 7 8 8]

HMM state = 7, Accuracy = 0.893, Run time = 0.010

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 6 6 6 6 7 7 7 7 8 8]

HMM state = 9, Accuracy = 0.893, Run time = 0.013

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 6 6 6 6 7 7 7 7 8 8]

HMM state = 11, Accuracy = 0.893, Run time = 0.015

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 6 6 6 6 7 7 7 7 8 8]

HMM state = 13, Accuracy = 0.857, Run time = 0.019

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 6 3 3 3 3 4 5 5 5 6 6 6 6 7 7 7 7 8 8]

HMM state = 15, Accuracy = 0.929, Run time = 0.022

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 7 6 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

HMM state = 17, Accuracy = 0.929, Run time = 0.025

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 5 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 6 5 6 7 7 7 7 8 8]

HMM state = 19, Accuracy = 0.929, Run time = 0.029

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 6 3 3 3 3 4 5 5 5 5 6 5 6 7 7 7 7 8 8]

HMM state = 21, Accuracy = 0.929, Run time = 0.033

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 1 1 1 1 2 2 3 6 3 3 3 3 4 5 5 5 5 5 5 6 6 7 7 7 8 8]

HMM state = 23, Accuracy = 0.893, Run time = 0.037

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 5 1 1 1 2 2 3 6 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 6]

HMM state = 25, Accuracy = 0.857, Run time = 0.041

Label: [1 1 1 1 1 1 2 2 3 3 3 3 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 8]

Prediction: [1 1 5 1 1 1 2 2 3 3 7 7 3 3 4 5 5 5 5 5 5 6 7 7 7 7 8 6]

End of epoch 5 Best accuracy = 1.000, HMM state of best accuracy = [1]

------------------------------- End HMM Training and Testing of  **8020 validation, full covariance** -------------------------------

HMM states = [ **1** 3 5 7 9 11 13 15 17 19 21 23 25]

Mean accuracy = [**0.98124406** 0.96362434 0.95785341 0.92486603 0.9497948 0.93721171

0.92713675 0.93621964 0.863721 0.83850054 0.80702415 0.78373185

0.78126781]

------------------------------- Start HMM Training and Testing of jackknife validation, diag covariance -------------------------------

Start of epoch 0

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (923, 21)

Jack-Knife Gesture 2 Train data shape: (672, 21)

Jack-Knife Gesture 3 Train data shape: (680, 21)

Jack-Knife Gesture 4 Train data shape: (696, 21)

Jack-Knife Gesture 5 Train data shape: (860, 21)

Jack-Knife Gesture 6 Train data shape: (740, 21)

Jack-Knife Gesture 7 Train data shape: (752, 21)

Jack-Knife Gesture 8 Train data shape: (682, 21)

Jack-Knife Gesture 1 Train sequence lengths: [49 54 55 63 62 61 72 78 73 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [36 36 38 38 37 36 48 55 57 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [38 38 39 35 36 39 48 50 45 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [43 39 40 40 42 39 45 40 47 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [54 52 55 52 51 53 60 63 61 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [45 46 44 43 47 42 44 52 46 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 45 42 59 60 55 44 41 43 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [46 47 47 45 44 48 47 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.917, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 7 3 4 4 4 5 5 5 7 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 0.958, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 5 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 0.792, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 6 6 6 6 7 7 7 5 5 5]

HMM state = 7, Accuracy = 0.917, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 0.792, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 6 6 6 6 7 7 7 7 7 7]

HMM state = 13, Accuracy = 0.833, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 5 6 6 6 7 7 7 7 7 7]

HMM state = 15, Accuracy = 0.833, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 5 6 6 6 7 7 7 7 7 7]

HMM state = 17, Accuracy = 0.875, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 7 7 7]

HMM state = 19, Accuracy = 0.833, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 5 6 6 6 7 7 7 7 7 7]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.875, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 7 7 7]

HMM state = 23, Accuracy = 0.875, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 7 7 7]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.875, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 7 7 7]

End of epoch 0 Best accuracy = 1.000, HMM state of best accuracy = [9]

Start of epoch 1

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (957, 21)

Jack-Knife Gesture 2 Train data shape: (742, 21)

Jack-Knife Gesture 3 Train data shape: (749, 21)

Jack-Knife Gesture 4 Train data shape: (707, 21)

Jack-Knife Gesture 5 Train data shape: (848, 21)

Jack-Knife Gesture 6 Train data shape: (733, 21)

Jack-Knife Gesture 7 Train data shape: (763, 21)

Jack-Knife Gesture 8 Train data shape: (677, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 63 62 61 72 78 73 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 38 37 36 48 55 57 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 35 36 39 48 50 45 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 40 42 39 45 40 47 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 52 51 53 60 63 61 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 43 47 42 44 52 46 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 59 60 55 44 41 43 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 45 44 48 47 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.833, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 6 6 6 4 5 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 0.792, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 6 6 6 5 5 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 0.875, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 6 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 7, Accuracy = 0.875, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 6 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 0.750, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 6 6 6 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 0.708, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 6 6 4 6 6 6 6 6 6 7 7 7 6 8 8]

HMM state = 13, Accuracy = 0.750, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 6 6 4 6 6 6 6 6 6 7 7 7 6 8 8]

HMM state = 15, Accuracy = 0.708, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 6 6 4 6 6 6 6 6 6 7 7 7 6 8 8]

HMM state = 17, Accuracy = 0.708, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 6 6 4 6 6 6 6 6 6 7 7 7 6 8 8]

HMM state = 19, Accuracy = 0.833, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 6 6 6 6 6 6 7 7 7 6 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.708, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 4 4 6 6 6 6 6 6 7 7 7 6 6 6]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.667, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 6 6 4 6 6 6 6 6 6 7 7 7 6 6 6]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.750, Run time = 0.009

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 6 6 6 6 6 6 7 7 7 6 6 2]

End of epoch 1 Best accuracy = 0.875, HMM state of best accuracy = [5 7]

Start of epoch 2

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (929, 21)

Jack-Knife Gesture 2 Train data shape: (741, 21)

Jack-Knife Gesture 3 Train data shape: (754, 21)

Jack-Knife Gesture 4 Train data shape: (708, 21)

Jack-Knife Gesture 5 Train data shape: (853, 21)

Jack-Knife Gesture 6 Train data shape: (736, 21)

Jack-Knife Gesture 7 Train data shape: (723, 21)

Jack-Knife Gesture 8 Train data shape: (680, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 72 78 73 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 48 55 57 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 48 50 45 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 45 40 47 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 60 63 61 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 44 52 46 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 44 41 43 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 47 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.875, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 4 5 5 6 6 6 3 7 3 8 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 0.958, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 13, Accuracy = 1.000, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 15, Accuracy = 0.875, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 5 5 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 17, Accuracy = 0.875, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 5 5 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 19, Accuracy = 0.875, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 5 5 5]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.750, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 1 5 5 5 6 6 6 7 7 7 5 5 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.750, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 1 5 5 5 6 6 6 7 7 7 5 5 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.833, Run time = 0.009

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 4 4 4 5 5 5 6 6 6 7 7 7 8 8 2]

End of epoch 2 Best accuracy = 1.000, HMM state of best accuracy = [ 3 5 7 9 13]

Start of epoch 3

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (892, 21)

Jack-Knife Gesture 2 Train data shape: (692, 21)

Jack-Knife Gesture 3 Train data shape: (721, 21)

Jack-Knife Gesture 4 Train data shape: (697, 21)

Jack-Knife Gesture 5 Train data shape: (825, 21)

Jack-Knife Gesture 6 Train data shape: (726, 21)

Jack-Knife Gesture 7 Train data shape: (769, 21)

Jack-Knife Gesture 8 Train data shape: (681, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 63 62 61 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 51 53 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 47 42 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 59 60 55 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 46 46 45 44 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 0.917, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 1 7 8]

HMM state = 13, Accuracy = 0.917, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 5 6 6 6 7 7 7 1 8 8]

HMM state = 15, Accuracy = 0.875, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 17, Accuracy = 0.875, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 19, Accuracy = 0.875, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 21, Accuracy = 0.917, Run time = 0.009

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 1 8 1]

HMM state = 23, Accuracy = 0.875, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 25, Accuracy = 0.875, Run time = 0.011

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 5 7 5]

End of epoch 3 Best accuracy = 1.000, HMM state of best accuracy = [1 3 5 7 9]

Start of epoch 4

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (931, 21)

Jack-Knife Gesture 2 Train data shape: (686, 21)

Jack-Knife Gesture 3 Train data shape: (686, 21)

Jack-Knife Gesture 4 Train data shape: (651, 21)

Jack-Knife Gesture 5 Train data shape: (824, 21)

Jack-Knife Gesture 6 Train data shape: (687, 21)

Jack-Knife Gesture 7 Train data shape: (742, 21)

Jack-Knife Gesture 8 Train data shape: (680, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 63 62 61 72 78 73 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 48 55 57 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 48 50 45 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 45 40 47 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 51 53 60 63 61 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 47 42 44 52 46 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 59 60 55 44 41 43 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 47 45 44 44 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 0.958, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 6 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 0.917, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 6 4 6 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 7, Accuracy = 0.833, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 6 6 6 6 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 0.917, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 6 4 6 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 0.833, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 6 6 6 6 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 13, Accuracy = 0.917, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 7 3 4 4 4 6 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 15, Accuracy = 0.792, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 7 3 6 6 6 6 5 5 6 6 6 7 7 7 8 8 8]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 17, Accuracy = 0.792, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 6 4 6 5 5 6 6 6 7 7 7 4 4 4]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 19, Accuracy = 0.833, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 6 5 5 6 6 6 7 7 7 4 4 4]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 21, Accuracy = 0.833, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 6 5 5 6 6 6 7 7 7 4 4 4]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 23, Accuracy = 0.708, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 7 7 7 3 3 3 4 4 4 6 5 5 6 6 6 7 7 7 7 7 7]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.792, Run time = 0.011

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 6 4 6 5 5 6 6 6 7 7 7 3 3 3]

End of epoch 4 Best accuracy = 1.000, HMM state of best accuracy = [1]

Start of epoch 5

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (943, 21)

Jack-Knife Gesture 2 Train data shape: (727, 21)

Jack-Knife Gesture 3 Train data shape: (730, 21)

Jack-Knife Gesture 4 Train data shape: (686, 21)

Jack-Knife Gesture 5 Train data shape: (835, 21)

Jack-Knife Gesture 6 Train data shape: (718, 21)

Jack-Knife Gesture 7 Train data shape: (736, 21)

Jack-Knife Gesture 8 Train data shape: (685, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 63 62 61 72 78 73 61 61 62]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 48 55 57 57 59 50]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 48 50 45 64 55 59]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 45 40 47 54 61 63]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 51 53 60 63 61 59 63 63]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 47 42 44 52 46 61 56 64]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 59 60 55 44 41 43 52 51 52]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 47 45 44 46 46 45]

HMM state = 1, Accuracy = 0.875, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 5 4 5 5 5 6 6 6 3 3 7 8 8 8]

HMM state = 3, Accuracy = 0.667, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 1 1 1 1 6 6 6 7 7 7 8 3 3]

HMM state = 5, Accuracy = 0.792, Run time = 0.003

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 3 1 3 5 5 5 6 6 6 7 7 7 8 3 7]

HMM state = 7, Accuracy = 0.667, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 7 1 1 5 6 6 6 7 7 7 2 2 2]

HMM state = 9, Accuracy = 0.750, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 7 1 5 5 5 6 6 6 7 7 7 2 2 2]

HMM state = 11, Accuracy = 0.750, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 1 5 5 5 6 6 6 7 7 7 2 2 2]

HMM state = 13, Accuracy = 0.792, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 7 7 4 5 5 5 6 6 6 7 7 7 2 2 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 15, Accuracy = 0.750, Run time = 0.005

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 3 3 7 7 4 5 5 5 6 6 6 7 7 7 2 2 2]

HMM state = 17, Accuracy = 0.750, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 3 3 7 7 4 5 5 5 6 6 6 7 7 7 2 2 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 19, Accuracy = 0.792, Run time = 0.007

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 4 5 5 5 6 6 6 7 7 7 2 2 2]

HMM state = 21, Accuracy = 0.792, Run time = 0.009

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 4 5 5 5 6 6 6 7 7 7 2 2 2]

HMM state = 23, Accuracy = 0.750, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 3 3 1 1 4 5 5 5 6 6 6 7 7 7 2 2 2]

Some rows of transmat\_ have zero sum because no transition from the state was ever observed.

HMM state = 25, Accuracy = 0.750, Run time = 0.009

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 3 3 1 1 4 5 5 5 6 6 6 7 7 7 2 2 2]

End of epoch 5 Best accuracy = 0.875, HMM state of best accuracy = [1]

------------------------------- End HMM Training and Testing of  **jackknife validation, diag covariance** -------------------------------

HMM states = [ **1** 3 5 7 9 11 13 15 17 19 21 23 25]

Mean accuracy = [**0.91666667** 0.89583333 0.89583333 0.88194444 0.90277778 0.82638889

0.86805556 0.80555556 0.8125 0.84027778 0.8125 0.77083333

0.8125 ]

------------------------------- Start HMM Training and Testing of jackknife validation, full covariance -------------------------------

Start of epoch 0

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (923, 21)

Jack-Knife Gesture 2 Train data shape: (672, 21)

Jack-Knife Gesture 3 Train data shape: (680, 21)

Jack-Knife Gesture 4 Train data shape: (696, 21)

Jack-Knife Gesture 5 Train data shape: (860, 21)

Jack-Knife Gesture 6 Train data shape: (740, 21)

Jack-Knife Gesture 7 Train data shape: (752, 21)

Jack-Knife Gesture 8 Train data shape: (682, 21)

Jack-Knife Gesture 1 Train sequence lengths: [49 54 55 63 62 61 72 78 73 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [36 36 38 38 37 36 48 55 57 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [38 38 39 35 36 39 48 50 45 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [43 39 40 40 42 39 45 40 47 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [54 52 55 52 51 53 60 63 61 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [45 46 44 43 47 42 44 52 46 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 45 42 59 60 55 44 41 43 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [46 47 47 45 44 48 47 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.958, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 0.792, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 6 6 6 6 7 7 7 2 7 2]

HMM state = 5, Accuracy = 0.875, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 4 4 5 6 5 6 6 6 7 7 7 6 8 8]

HMM state = 7, Accuracy = 0.750, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 4 4 6 6 6 6 6 6 7 7 7 7 8 7]

HMM state = 9, Accuracy = 0.875, Run time = 0.013

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 4 4 5 6 5 6 6 6 7 7 7 7 8 8]

HMM state = 11, Accuracy = 0.958, Run time = 0.015

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 7 8 8]

HMM state = 13, Accuracy = 0.917, Run time = 0.018

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 7 8 7]

HMM state = 15, Accuracy = 0.875, Run time = 0.021

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 7 7 6]

HMM state = 17, Accuracy = 0.792, Run time = 0.024

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 6 6 6 6 7 7 7 7 7 6]

HMM state = 19, Accuracy = 0.833, Run time = 0.028

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 6 5 6 6 6 7 7 7 7 7 7]

HMM state = 21, Accuracy = 0.750, Run time = 0.032

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 5 5 5 5 5 5 6 6 6 7 7 7 7 7 7]

HMM state = 23, Accuracy = 0.833, Run time = 0.035

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 5 4 4 5 5 5 6 6 6 7 7 7 7 7 7]

HMM state = 25, Accuracy = 0.667, Run time = 0.038

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 5 2 3 3 3 4 5 4 5 5 5 6 6 6 6 6 6 7 7 7]

End of epoch 0 Best accuracy = 0.958, HMM state of best accuracy = [ 1 11]

Start of epoch 1

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (957, 21)

Jack-Knife Gesture 2 Train data shape: (742, 21)

Jack-Knife Gesture 3 Train data shape: (749, 21)

Jack-Knife Gesture 4 Train data shape: (707, 21)

Jack-Knife Gesture 5 Train data shape: (848, 21)

Jack-Knife Gesture 6 Train data shape: (733, 21)

Jack-Knife Gesture 7 Train data shape: (763, 21)

Jack-Knife Gesture 8 Train data shape: (677, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 63 62 61 72 78 73 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 38 37 36 48 55 57 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 35 36 39 48 50 45 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 40 42 39 45 40 47 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 52 51 53 60 63 61 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 43 47 42 44 52 46 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 59 60 55 44 41 43 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 45 44 48 47 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.917, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 5 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 0.625, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 7 4 6 6 6 6 6 6 6 6 7 7 7 2 2 1]

HMM state = 5, Accuracy = 0.500, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 6 6 6 6 6 6 6 6 6 7 7 7 2 2 2]

HMM state = 7, Accuracy = 0.500, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 6 6 6 6 6 6 6 6 6 7 7 7 7 6 7]

HMM state = 9, Accuracy = 0.625, Run time = 0.011

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 6 6 6 6 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 11, Accuracy = 0.500, Run time = 0.013

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 1 1 6 6 6 6 6 6 6 6 7 7 7 1 1 1]

HMM state = 13, Accuracy = 0.667, Run time = 0.015

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 4 6 6 6 6 6 6 6 6 7 7 7 8 8 8]

HMM state = 15, Accuracy = 0.875, Run time = 0.018

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 6 1 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 17, Accuracy = 0.917, Run time = 0.021

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 6 7 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 19, Accuracy = 0.667, Run time = 0.023

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 4 4 4 5 5 5 6 6 6 6 6 6 8 7 7]

HMM state = 21, Accuracy = 0.625, Run time = 0.027

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 6 6 6 5 5 5 5 5 5 6 6 6 7 6 6 8 8 7]

HMM state = 23, Accuracy = 0.708, Run time = 0.029

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 3 1 5 5 5 5 5 5 6 6 6 7 7 7 8 7 7]

HMM state = 25, Accuracy = 0.750, Run time = 0.033

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 1 5 5 5 5 5 5 6 6 6 7 7 7 8 7 7]

End of epoch 1 Best accuracy = 0.917, HMM state of best accuracy = [ 1 17]

Start of epoch 2

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (929, 21)

Jack-Knife Gesture 2 Train data shape: (741, 21)

Jack-Knife Gesture 3 Train data shape: (754, 21)

Jack-Knife Gesture 4 Train data shape: (708, 21)

Jack-Knife Gesture 5 Train data shape: (853, 21)

Jack-Knife Gesture 6 Train data shape: (736, 21)

Jack-Knife Gesture 7 Train data shape: (723, 21)

Jack-Knife Gesture 8 Train data shape: (680, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 72 78 73 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 48 55 57 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 48 50 45 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 45 40 47 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 60 63 61 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 44 52 46 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 44 41 43 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 47 45 44 46 46 45 44 45 43]

HMM state = 1, Accuracy = 0.875, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 0.792, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 4 4 4 5 5 5 6 6 6 7 7 7 4 8 4]

HMM state = 5, Accuracy = 0.625, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 6 6 6 5 5 5 6 6 6 7 7 7 5 4 4]

HMM state = 7, Accuracy = 0.708, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 5 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 9, Accuracy = 0.750, Run time = 0.012

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 11, Accuracy = 0.750, Run time = 0.014

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 13, Accuracy = 0.667, Run time = 0.017

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 1 2 1 7 7 7 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 15, Accuracy = 0.708, Run time = 0.019

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 1 5 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 17, Accuracy = 0.708, Run time = 0.022

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 1 1 1 1 4 4 4 5 5 5 6 6 6 7 7 7 1 1 1]

HMM state = 19, Accuracy = 0.792, Run time = 0.026

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 1 3 4 4 4 5 5 5 6 6 6 7 3 7 7 1 1]

HMM state = 21, Accuracy = 0.708, Run time = 0.029

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 5 5 5 5 5 5 5 6 6 7 7 7 5 1 1]

HMM state = 23, Accuracy = 0.625, Run time = 0.031

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 3 1 4 4 1 5 5 5 6 6 6 1 1 1 1 1 1]

HMM state = 25, Accuracy = 0.625, Run time = 0.035

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 4 4 4 5 5 5 6 6 6 1 1 3 1 1 1]

End of epoch 2 Best accuracy = 0.875, HMM state of best accuracy = [1]

Start of epoch 3

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (892, 21)

Jack-Knife Gesture 2 Train data shape: (692, 21)

Jack-Knife Gesture 3 Train data shape: (721, 21)

Jack-Knife Gesture 4 Train data shape: (697, 21)

Jack-Knife Gesture 5 Train data shape: (825, 21)

Jack-Knife Gesture 6 Train data shape: (726, 21)

Jack-Knife Gesture 7 Train data shape: (769, 21)

Jack-Knife Gesture 8 Train data shape: (681, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 63 62 61 61 61 62 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 57 59 50 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 64 55 59 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 54 61 63 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 51 53 59 63 63 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 47 42 61 56 64 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 59 60 55 52 51 52 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 46 46 45 44 45 43]

HMM state = 1, Accuracy = 1.000, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 3, Accuracy = 1.000, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 0.917, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 7, Accuracy = 1.000, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 9, Accuracy = 0.958, Run time = 0.012

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 1]

HMM state = 11, Accuracy = 1.000, Run time = 0.015

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 13, Accuracy = 0.792, Run time = 0.017

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 6 7 6 1 1 5]

HMM state = 15, Accuracy = 0.792, Run time = 0.020

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 6 6 6 8 1 5]

HMM state = 17, Accuracy = 0.833, Run time = 0.024

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 3 3 4 4 4 5 5 5 6 6 6 7 7 7 5 5 5]

HMM state = 19, Accuracy = 0.875, Run time = 0.028

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 5 4 5 5 5 6 6 6 7 7 7 8 5 5]

HMM state = 21, Accuracy = 0.667, Run time = 0.031

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 5 5 5 5 5 5 6 6 6 6 6 6 8 1 1]

HMM state = 23, Accuracy = 0.875, Run time = 0.034

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 5 4 5 5 5 6 6 6 7 7 7 8 1 1]

HMM state = 25, Accuracy = 0.625, Run time = 0.037

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 5 5 5 5 5 5 6 6 6 3 3 3 1 1 1]

End of epoch 3 Best accuracy = 1.000, HMM state of best accuracy = [ 1 3 7 11]

Start of epoch 4

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (931, 21)

Jack-Knife Gesture 2 Train data shape: (686, 21)

Jack-Knife Gesture 3 Train data shape: (686, 21)

Jack-Knife Gesture 4 Train data shape: (651, 21)

Jack-Knife Gesture 5 Train data shape: (824, 21)

Jack-Knife Gesture 6 Train data shape: (687, 21)

Jack-Knife Gesture 7 Train data shape: (742, 21)

Jack-Knife Gesture 8 Train data shape: (680, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 63 62 61 72 78 73 56 60 56]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 48 55 57 42 42 41]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 48 50 45 45 41 48]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 45 40 47 56 43 44]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 51 53 60 63 61 59 57 58]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 47 42 44 52 46 51 51 48]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 59 60 55 44 41 43 51 55 55]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 47 45 44 44 45 43]

HMM state = 1, Accuracy = 0.667, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 6 6 3 4 5 4 5 5 5 6 6 6 7 6 6 5 5 5]

HMM state = 3, Accuracy = 0.833, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 4 6 4 5 5 5 6 6 6 7 7 7 8 8 8]

HMM state = 5, Accuracy = 0.667, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 3 3 6 6 6 6 5 5 6 6 6 7 7 7 4 6 3]

HMM state = 7, Accuracy = 0.833, Run time = 0.011

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 6 4 5 5 5 6 6 6 7 7 7 5 5 5]

HMM state = 9, Accuracy = 0.667, Run time = 0.013

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 6 6 4 5 5 5 6 6 6 7 7 7 5 5 5]

HMM state = 11, Accuracy = 0.750, Run time = 0.016

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 7 4 4 4 5 5 5 6 6 6 7 7 7 2 2 2]

HMM state = 13, Accuracy = 0.792, Run time = 0.019

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 3 4 4 4 5 5 5 6 6 6 7 7 7 3 3 3]

HMM state = 15, Accuracy = 0.792, Run time = 0.023

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 4 4 4 5 5 5 6 6 6 7 7 7 8 6 2]

HMM state = 17, Accuracy = 0.750, Run time = 0.027

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 4 4 6 5 5 5 6 6 6 7 1 7 8 6 8]

HMM state = 19, Accuracy = 0.708, Run time = 0.030

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 4 6 4 5 5 5 6 6 6 7 7 7 6 3 6]

HMM state = 21, Accuracy = 0.625, Run time = 0.035

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 1 5 5 5 5 5 6 5 6 7 1 1 8 8 8]

HMM state = 23, Accuracy = 0.542, Run time = 0.039

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 4 5 6 5 5 5 6 6 6 1 1 1 2 5 2]

HMM state = 25, Accuracy = 0.292, Run time = 0.042

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [5 5 5 2 2 2 1 1 5 6 5 6 5 5 5 5 5 6 5 5 5 1 1 1]

End of epoch 4 Best accuracy = 0.833, HMM state of best accuracy = [3 7]

Start of epoch 5

Jack-Knife Train dataset's recording number 120

Jack-Knife Test dataset's recording number 24

Jack-Knife Test label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Jack-Knife Gesture 1 Train data shape: (943, 21)

Jack-Knife Gesture 2 Train data shape: (727, 21)

Jack-Knife Gesture 3 Train data shape: (730, 21)

Jack-Knife Gesture 4 Train data shape: (686, 21)

Jack-Knife Gesture 5 Train data shape: (835, 21)

Jack-Knife Gesture 6 Train data shape: (718, 21)

Jack-Knife Gesture 7 Train data shape: (736, 21)

Jack-Knife Gesture 8 Train data shape: (685, 21)

Jack-Knife Gesture 1 Train sequence lengths: [61 62 69 49 54 55 63 62 61 72 78 73 61 61 62]

Jack-Knife Gesture 2 Train sequence lengths: [63 49 68 36 36 38 38 37 36 48 55 57 57 59 50]

Jack-Knife Gesture 3 Train sequence lengths: [61 60 63 38 38 39 35 36 39 48 50 45 64 55 59]

Jack-Knife Gesture 4 Train sequence lengths: [46 39 48 43 39 40 40 42 39 45 40 47 54 61 63]

Jack-Knife Gesture 5 Train sequence lengths: [47 52 50 54 52 55 52 51 53 60 63 61 59 63 63]

Jack-Knife Gesture 6 Train sequence lengths: [42 43 43 45 46 44 43 47 42 44 52 46 61 56 64]

Jack-Knife Gesture 7 Train sequence lengths: [47 48 50 47 45 42 59 60 55 44 41 43 52 51 52]

Jack-Knife Gesture 8 Train sequence lengths: [45 45 45 46 47 47 45 44 48 47 45 44 46 46 45]

HMM state = 1, Accuracy = 0.833, Run time = 0.004

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 4 7 4 5 5 5 6 6 6 7 7 7 3 2 3]

HMM state = 3, Accuracy = 0.708, Run time = 0.006

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 1 7 5 1 5 6 6 6 7 7 7 2 2 2]

HMM state = 5, Accuracy = 0.667, Run time = 0.008

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 7 7 1 1 1 5 5 5 6 6 6 7 7 7 7 7 7]

HMM state = 7, Accuracy = 0.667, Run time = 0.010

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 7 7 1 7 7 5 5 5 6 6 6 7 7 7 3 7 7]

HMM state = 9, Accuracy = 0.625, Run time = 0.012

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 1 7 1 7 7 5 1 5 6 6 6 7 7 7 3 7 7]

HMM state = 11, Accuracy = 0.583, Run time = 0.015

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 1 1 1 5 6 5 6 6 6 7 7 7 3 3 3]

HMM state = 13, Accuracy = 0.625, Run time = 0.017

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 1 1 1 5 5 5 6 6 6 7 7 7 3 2 2]

HMM state = 15, Accuracy = 0.708, Run time = 0.020

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 7 3 1 1 1 5 5 5 6 6 6 7 7 7 3 2 2]

HMM state = 17, Accuracy = 0.625, Run time = 0.024

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 7 7 7 1 1 1 5 5 5 6 6 6 7 7 7 7 2 2]

HMM state = 19, Accuracy = 0.708, Run time = 0.027

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 1 5 5 5 5 5 6 5 6 7 7 7 2 2 2]

HMM state = 21, Accuracy = 0.750, Run time = 0.031

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 5 5 5 5 5 5 6 6 6 7 7 7 3 2 2]

HMM state = 23, Accuracy = 0.625, Run time = 0.035

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 3 3 3 5 5 5 5 5 5 5 5 5 7 7 7 6 5 5]

HMM state = 25, Accuracy = 0.417, Run time = 0.038

Label: [1 1 1 2 2 2 3 3 3 4 4 4 5 5 5 6 6 6 7 7 7 8 8 8]

Prediction: [1 1 1 2 2 2 1 1 1 5 5 5 5 5 5 5 5 5 1 1 7 3 3 3]

End of epoch 5 Best accuracy = 0.833, HMM state of best accuracy = [1]

------------------------------- End HMM Training and Testing of  **jackknife validation, full covariance** -------------------------------

HMM states = [ **1** 3 5 7 9 11 13 15 17 19 21 23 25]

Mean accuracy = [**0.875** 0.79166667 0.70833333 0.74305556 0.75 0.75694444

0.74305556 0.79166667 0.77083333 0.76388889 0.6875 0.70138889

0.5625 ]

Process finished with exit code 0