

Universität Stuttgart
Institut für Signalverarbeitung und Systemtheorie
Prof. Dr.-Ing. B. Yang

Project II

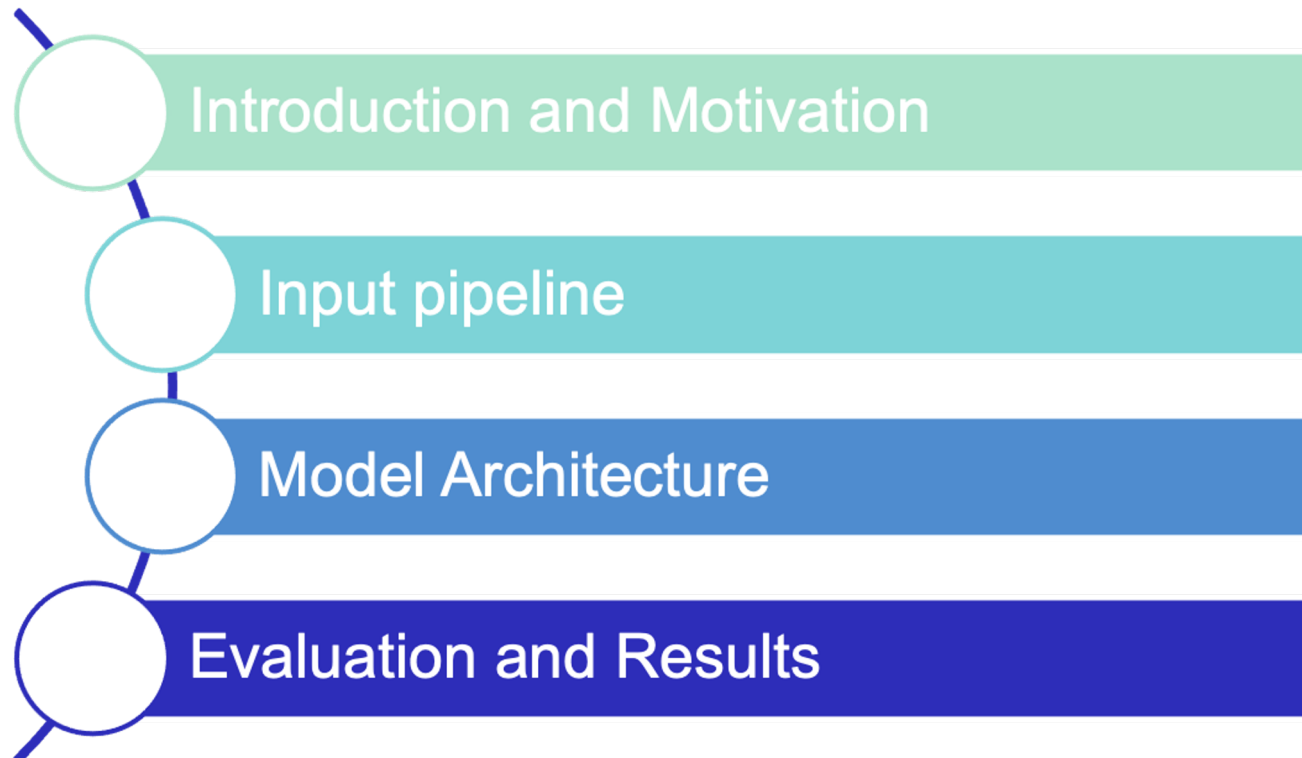
Human Activity Recognition

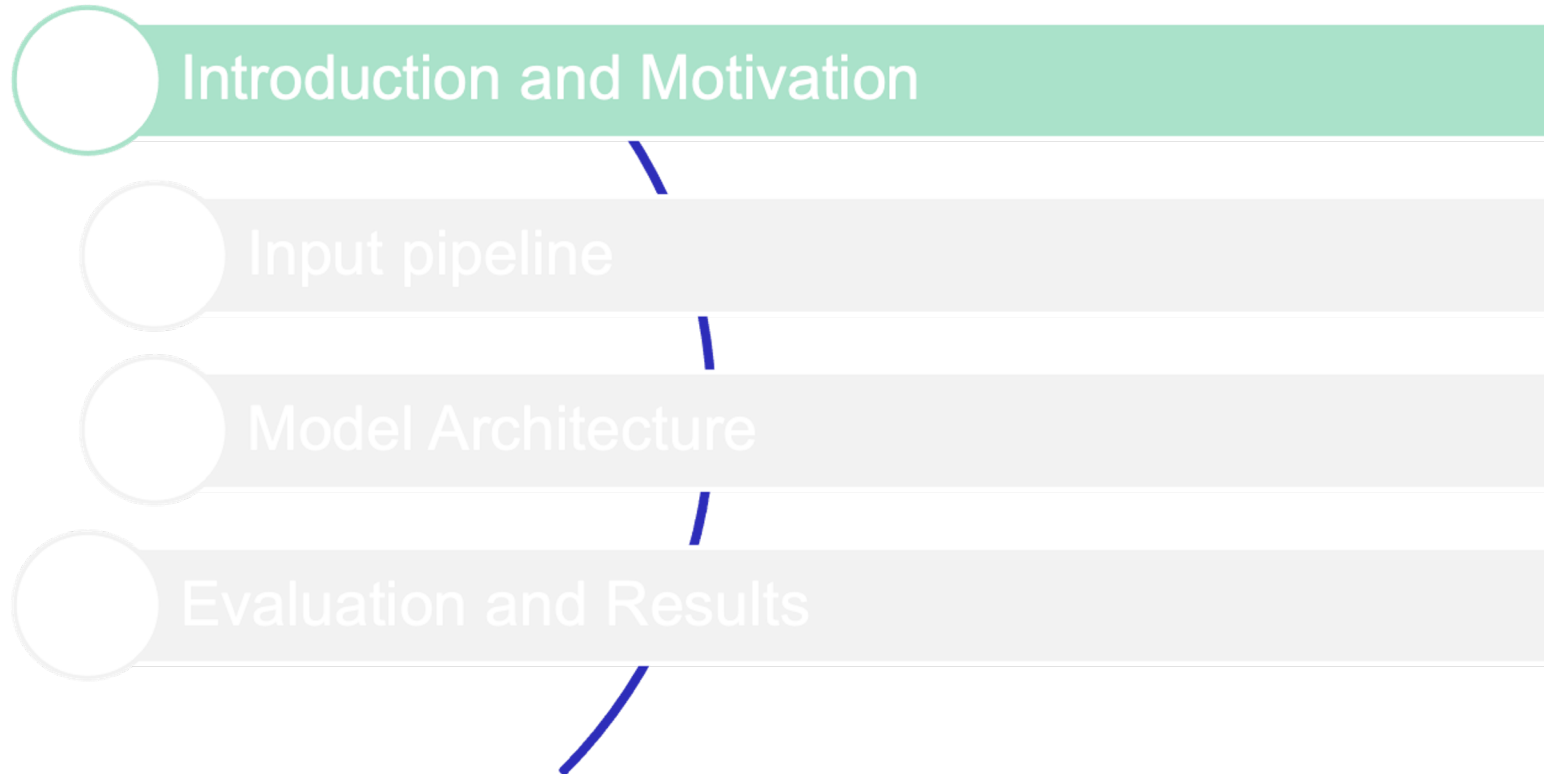
Deep Learning Lab
Winter Semester 2021/2022

TEAM-09

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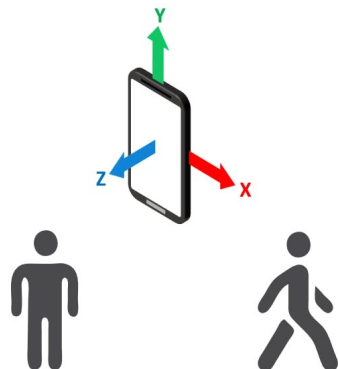




What is Human Activity Recognition?

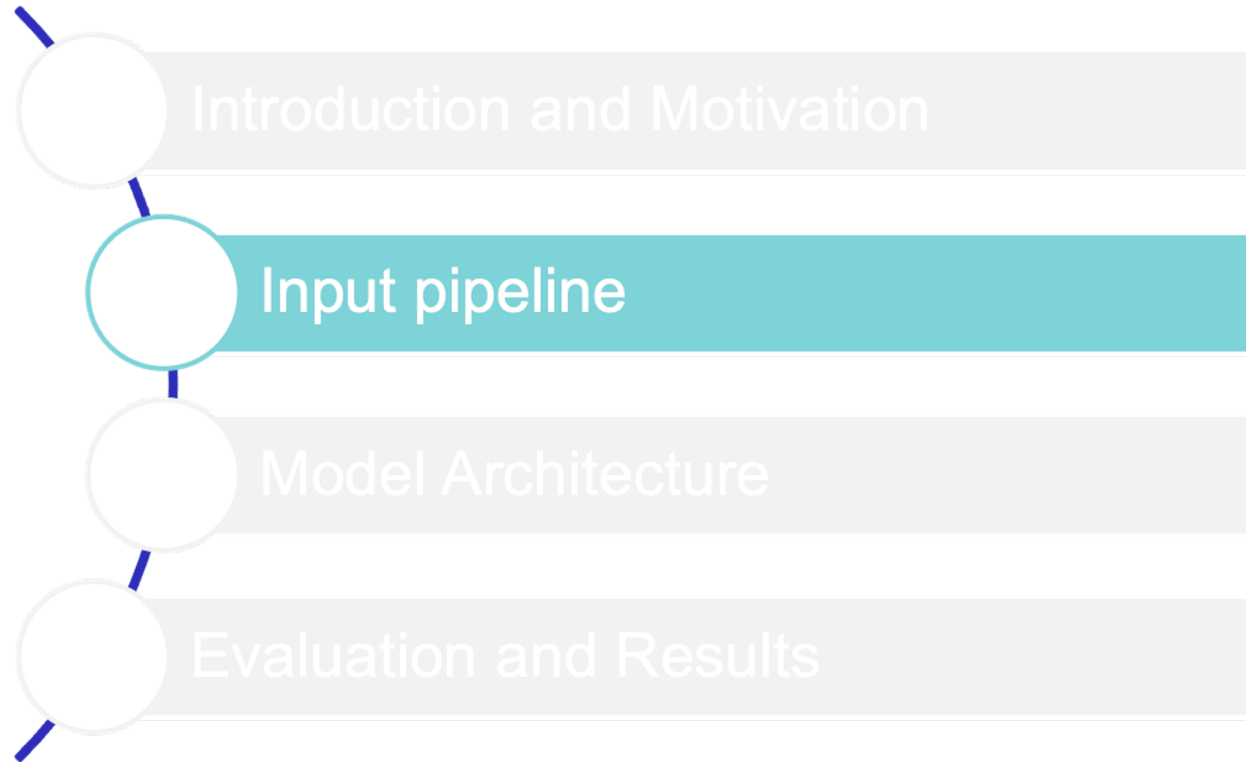


Why Human Activity Recognition?



- Classifying known well-defined movements based on sensor data collected by external sensors and body-worn sensors
- HAPT dataset: data recorded with the smartphone, contains tri-axial accelerometer and gyroscope data
- Surveillance systems
- Rehabilitation procedures
- Monitoring elderly people

https://hackster.imgix.net/uploads/attachments/1125620/_uxwo2F3FMI.blob?auto=compress%2Cformat&w=900&h=675&fit=min



Dataset

- Human Activity Recognition(HAPT) dataset
- Data Cleansing → sort out the unlabelled data
- Split dataset

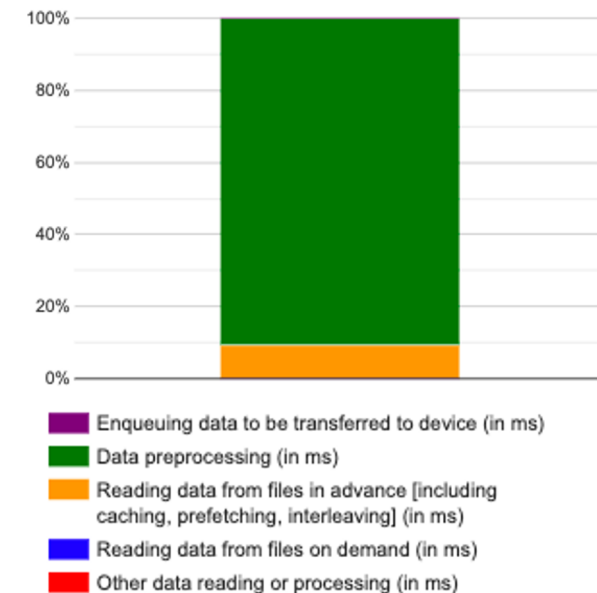
Data Preprocessing

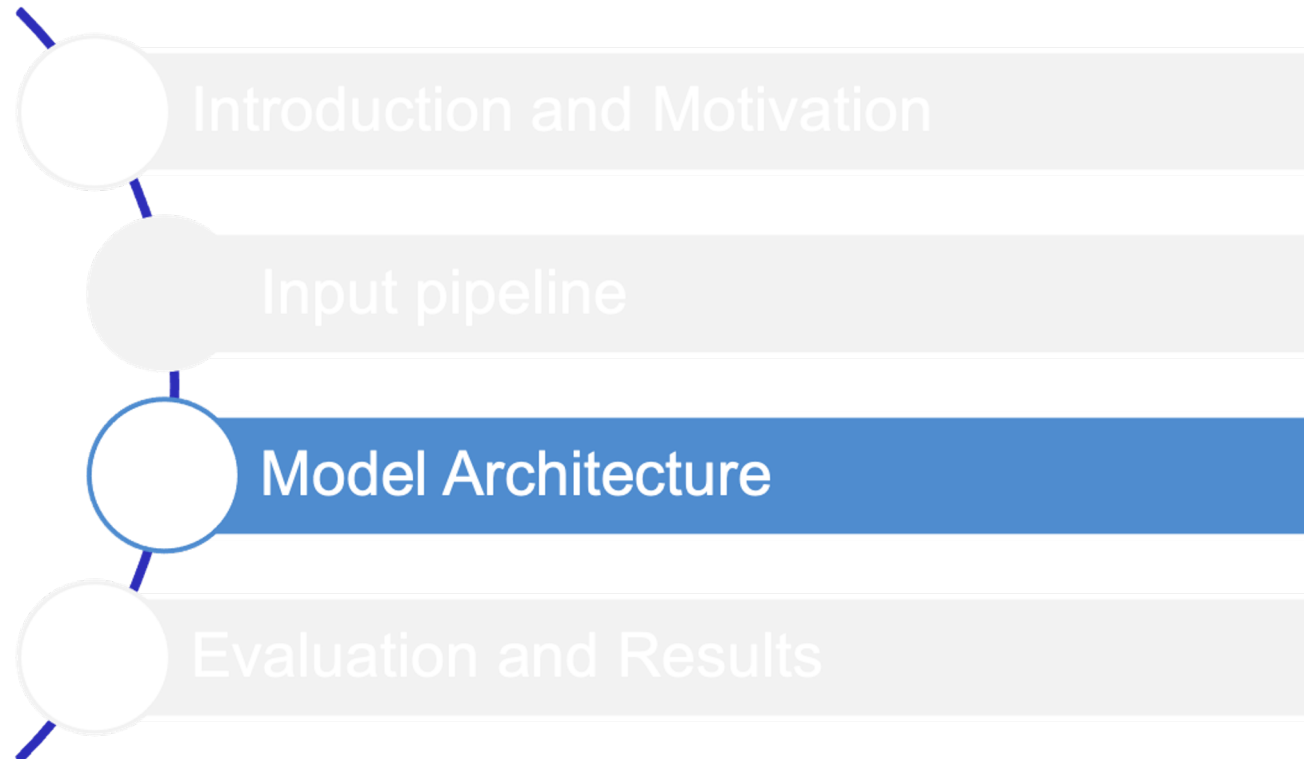
- Z-normalization
- Sliding window technique
 - train dataset w/ 50% overlap
 - test and validation w/o overlap

Efficient data loading

- Storing data in the TFRecord format
- Reading TFRecords for loading the data into the model

Breakdown of input processing time on the host



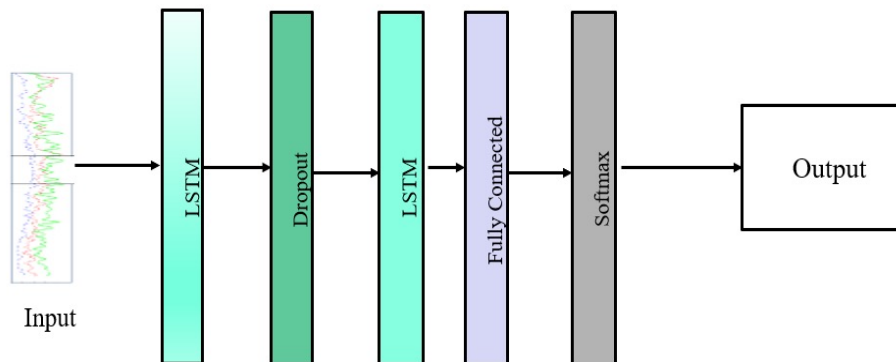


Model Architecture



Model 1 : Pure LSTM

- 2 LSTM layers with dropout layer
- Fit for time-series classification
- Less accuracy on prediction of transition activities

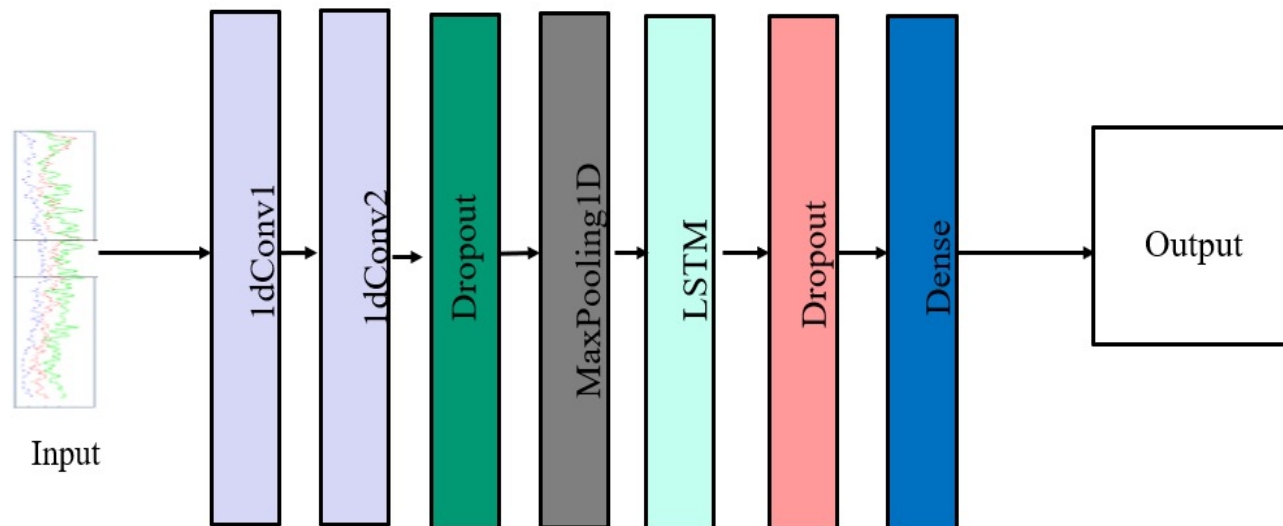


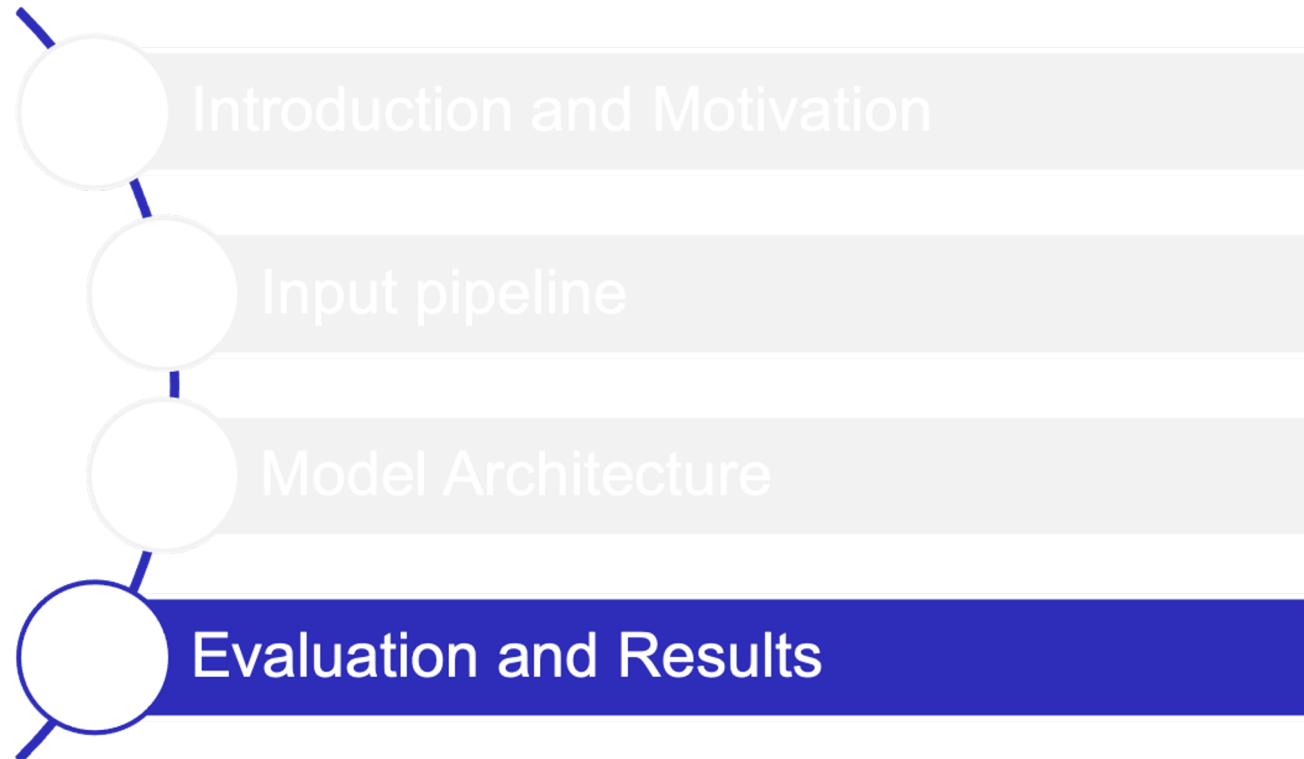
Confusion Matrix

	1	2	3	4	5	6	7	8	9	10	11	12
1	23880	263	245	77	163	0	38	26	0	58	28	27
2	140	22023	306	2	41	0	19	0	0	0	0	0
3	582	572	21554	1	13	0	0	0	0	0	0	0
4	23	0	0	26830	1622	175	187	57	20	91	27	0
5	118	16	28	33	30174	0	63	14	0	0	59	0
6	0	0	0	0	0	29615	0	0	52	377	282	351
7	52	103	22	209	439	1	936	0	0	47	240	0
8	46	106	10	88	167	0	0	1141	0	56	0	0
9	1	2	4	54	21	14	13	135	1399	7	620	0
10	39	4	0	90	1	18	21	0	0	1966	23	47
11	33	46	7	16	178	14	0	0	251	61	1980	6
12	13	82	120	11	41	14	36	74	0	1462	29	317
Predictions	1	2	3	4	5	6	7	8	9	10	11	12

Model 2 : 1D CNN+ LSTM

- CNN: extract features
- LSTM: classification based on time-series data
- Better performance on prediction of transition activities

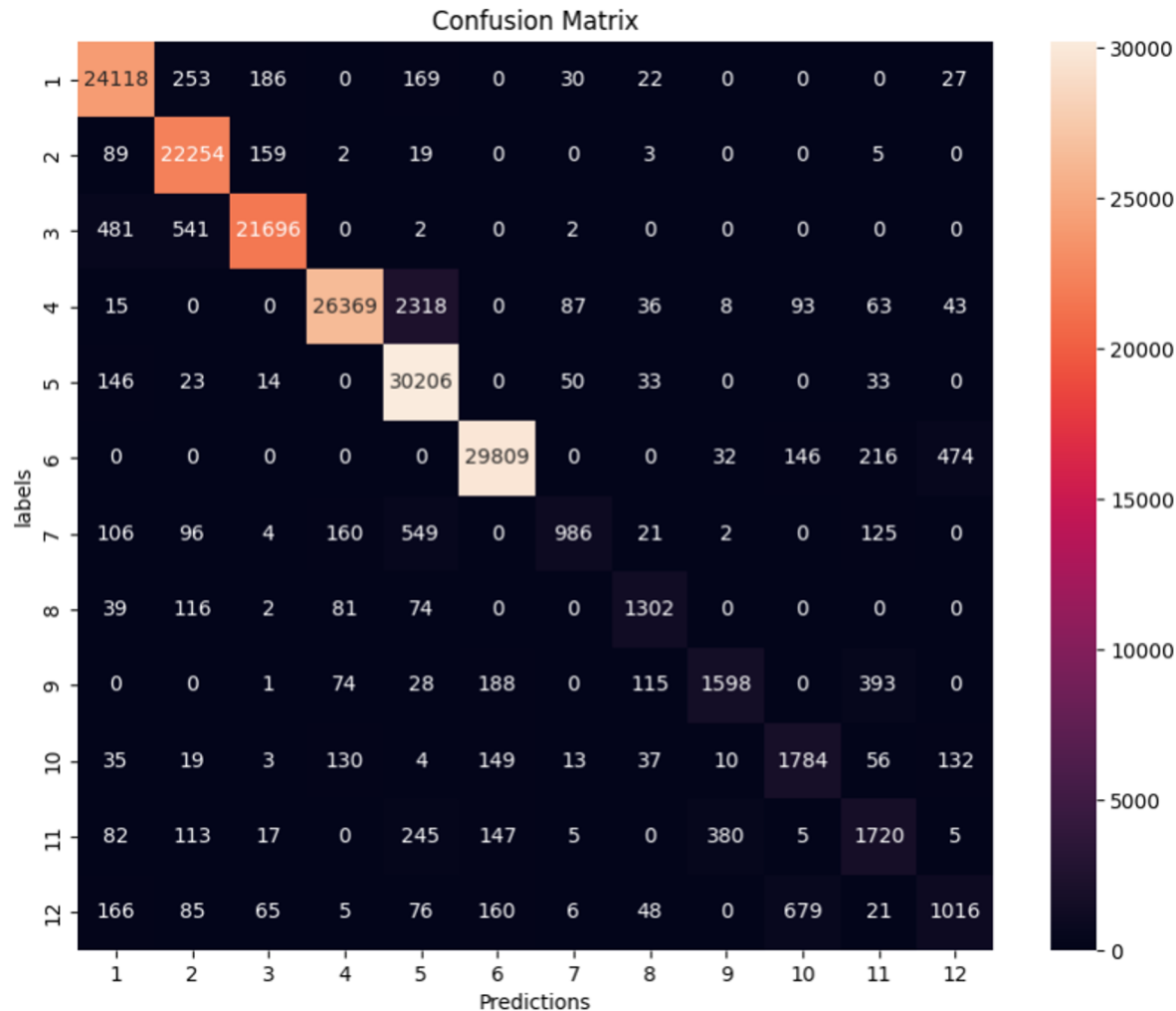




Evaluation and Results



Metrics – Confusion Matrix



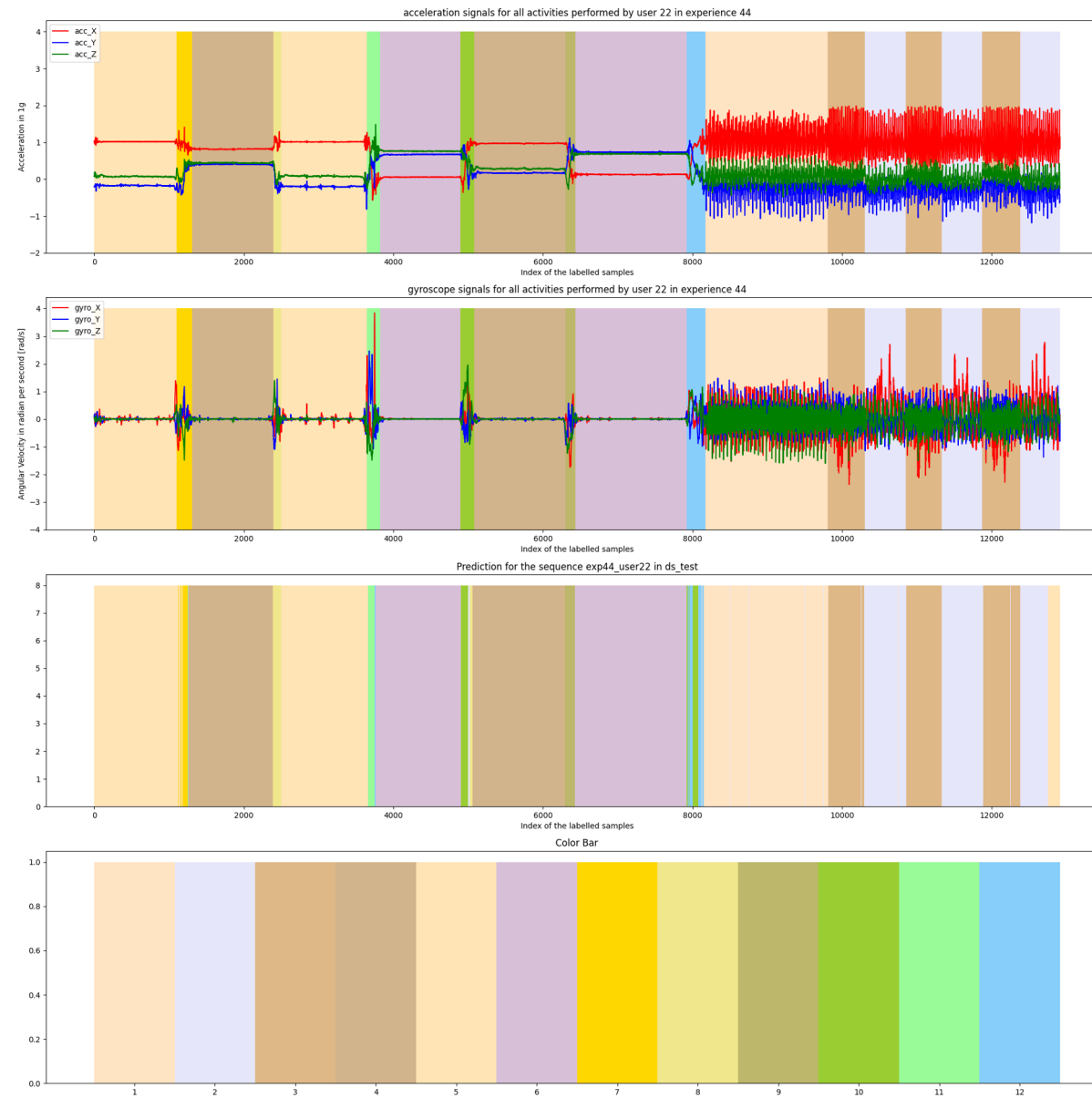
The achieved test accuracy is

- with CNN-LSTM model : **94.2%**.
- with LSTM model is **91.2%**.

Evaluation and Results



Visualisation of a sequence (exp44_user22) from test dataset



Thank you