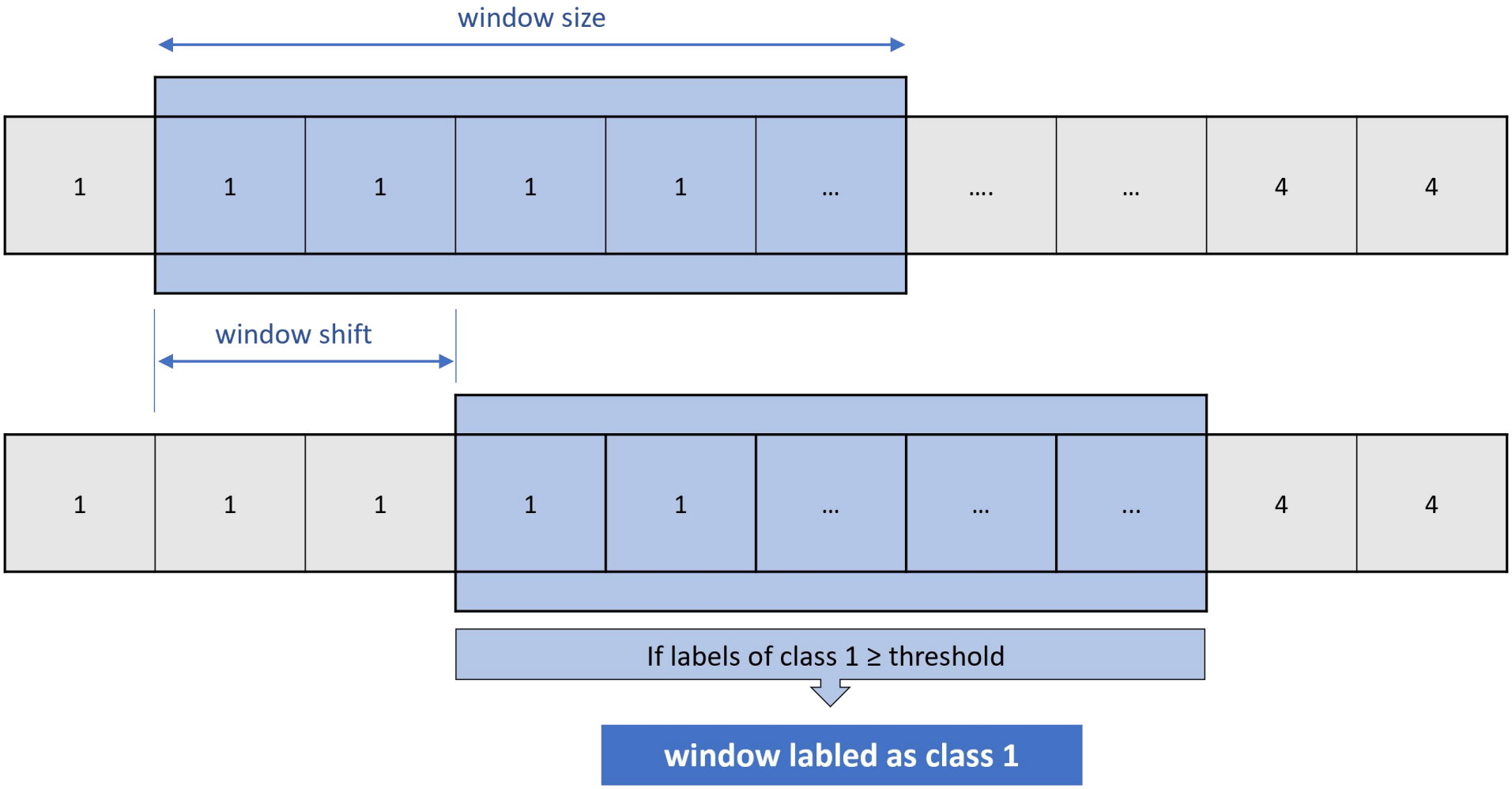
Human Activity Recognition
HAPT & HAR

Team 18

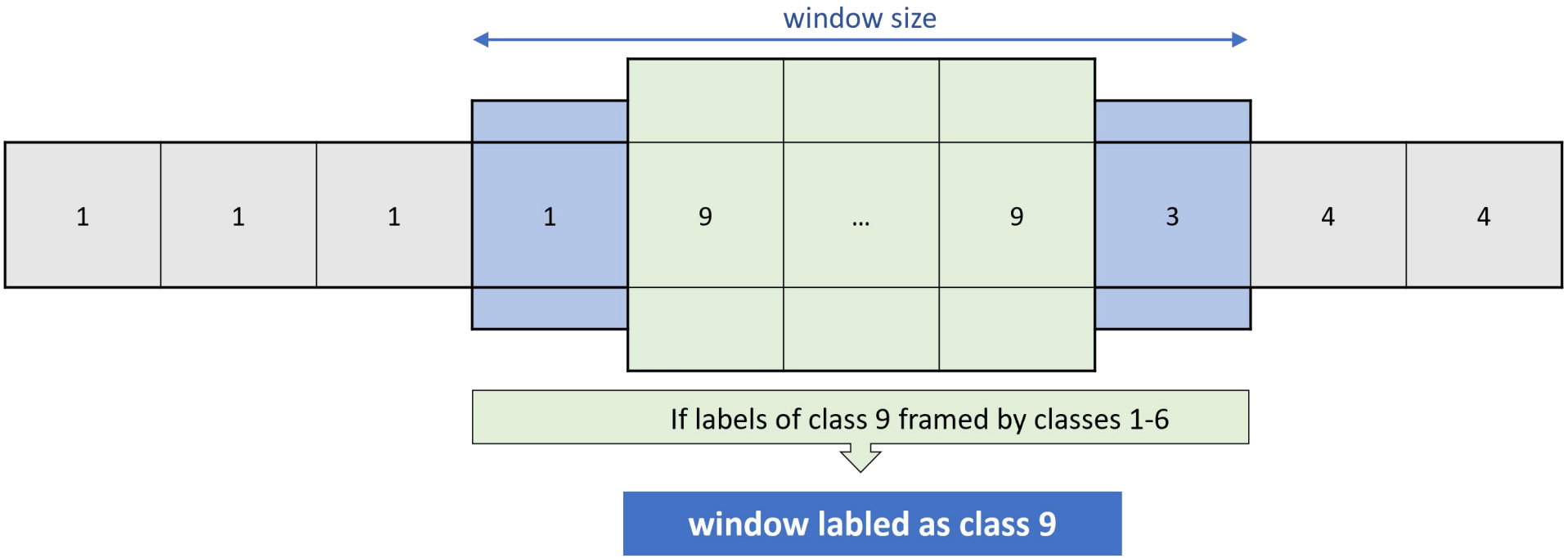
Presented by: Yitian Shi
Jonas Vogt

HAPT – Data Handling

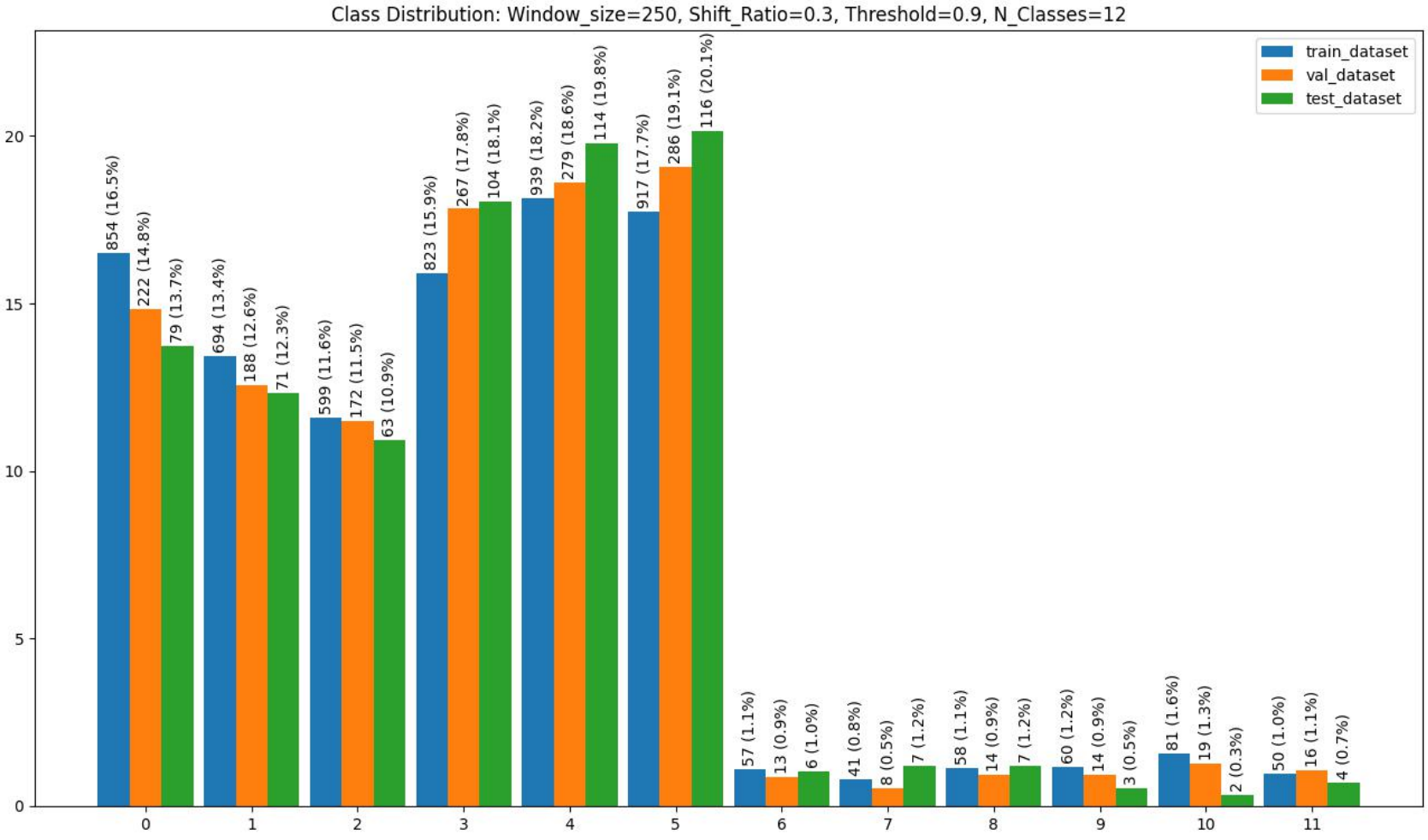


HAPT – Data Handling

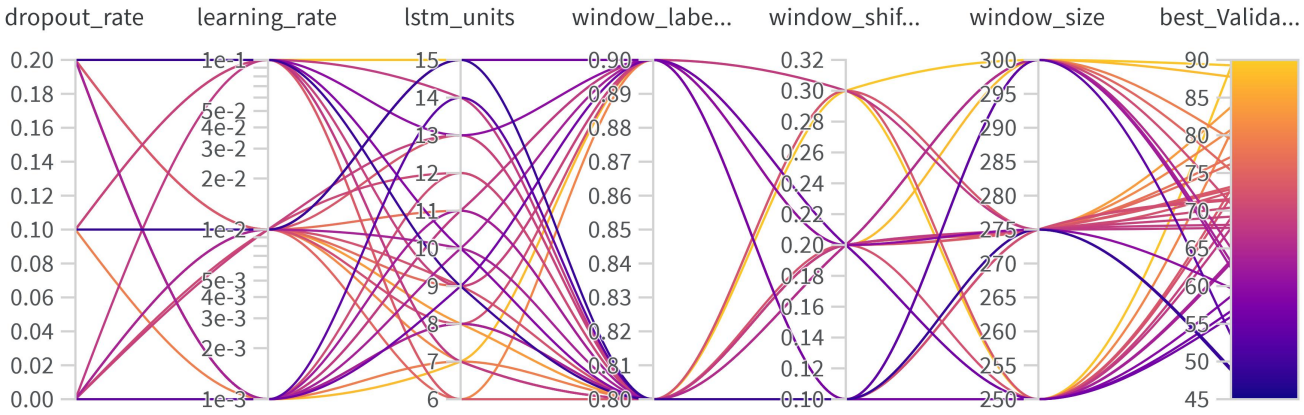
Prioritization of transitional Classes



HAPT – Class Distribution



HAPT – Results

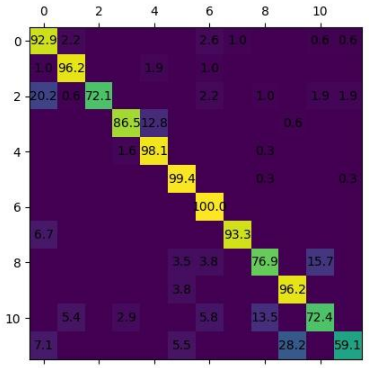


wandb results:

- window-size: 300
- threshold: 0.9
- shift-ratio: 0.4

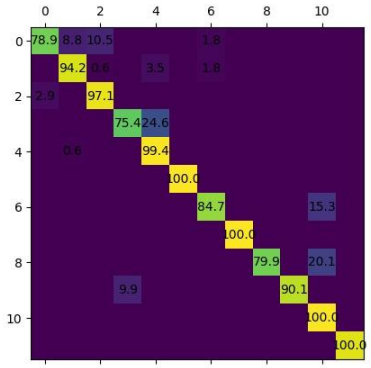
Best RNN

- 13 LSTM units
- 40% dropout rate



Best Stacked RNN

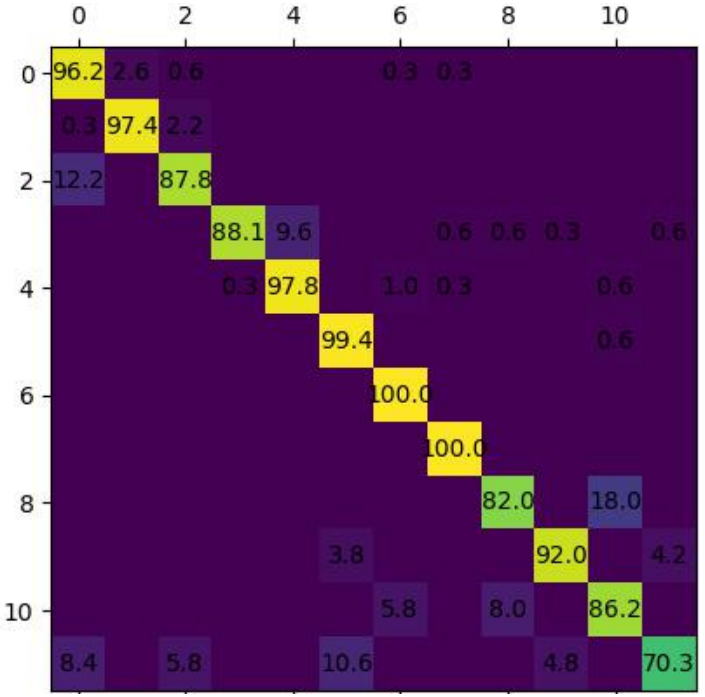
- Two Layers of 11 units each
- 10 % dropout rate



HAPT – Results

The best results we've achieved are as follows:

Architecture	Window size	Dropout rate	Balanced test accuracy
LSTM 13	250	0.4	86.92%
LSTM 10	300	0.2	88.90%
GRU 10	300	0.2	84.44%
Stacked LSTM (11,11)	250	0.1	91.40%
Stacked GRU (11,11)	300	0.1	77.91%
Stacked LSTM (15,12)	250	0.3	88.50%
Stacked LSTM (8,11)	250	0.5	84.50%
Transformer encoder	300		82.28%
Soft-Voting	250		**91.64%**



HAPT – Transformer encoder

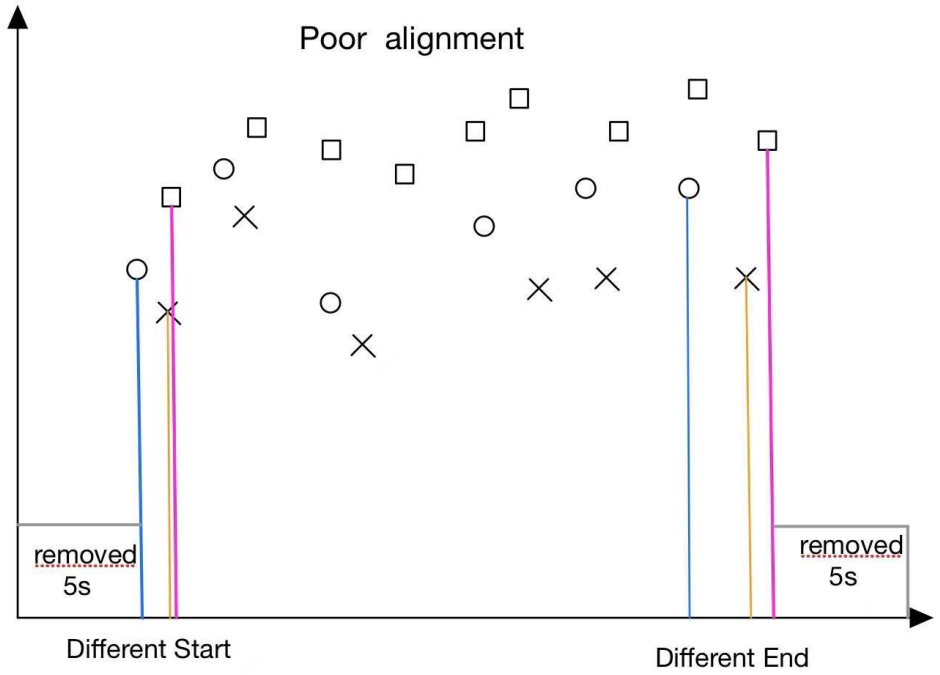
Besides traditional RNN and LSTM architectures, we've also applied the Transformer encoder structure as the backbone with a normal classification head. We have the following configurations compared to the model structure from the encoder part of the base Transformer model proposed by Vaswani et al.[1]:

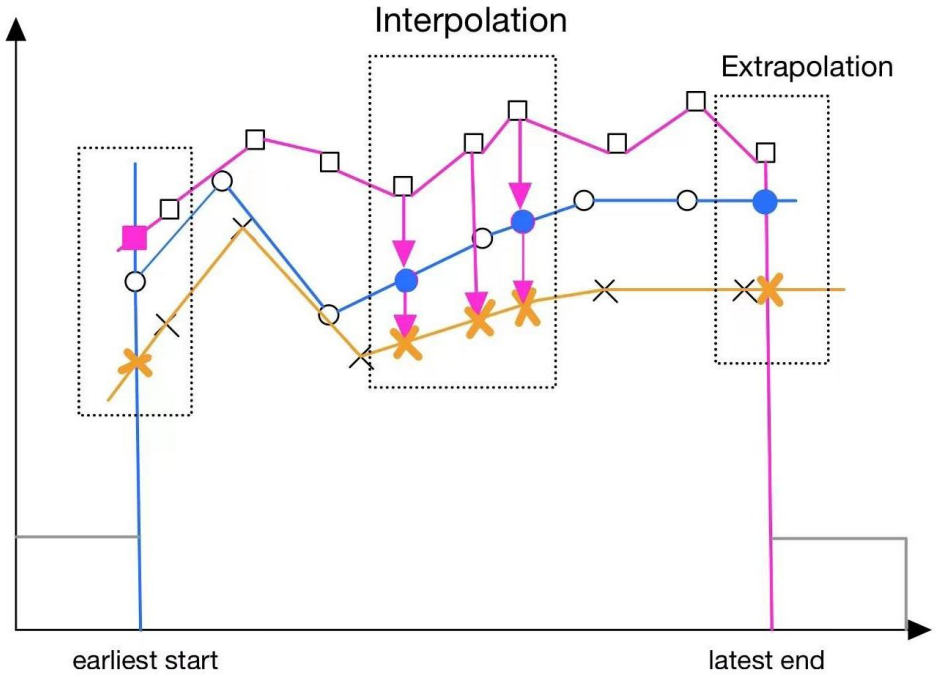
Model	layers	d_model	d_feed_forward	num_head	d_key/value
Base model	6	512	2048	8	64
Our model	1	32	128	4	8

[1] Ashish Vaswani, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N Gomez, Łukasz Kaiser, and Illia Polosukhin. Attention is all you need. In NIPS, 2017.

HAR (realworld2016) - Data Preprocessing

Difficulties

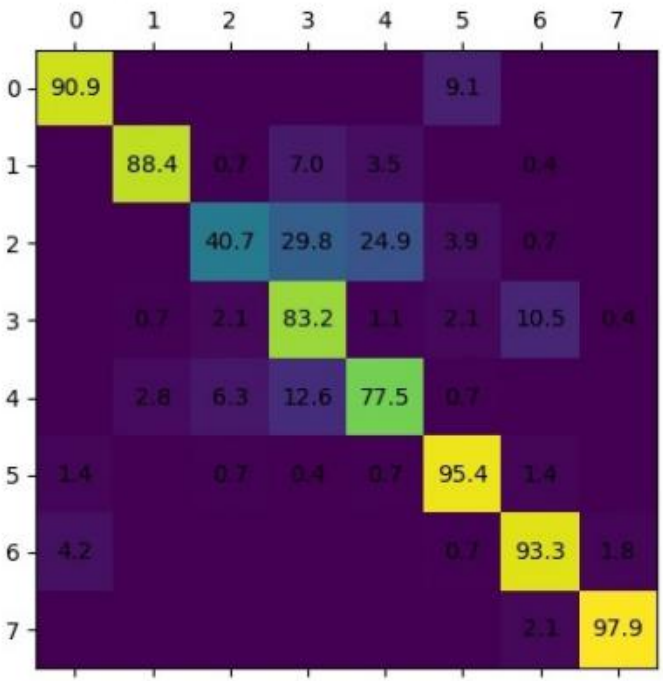




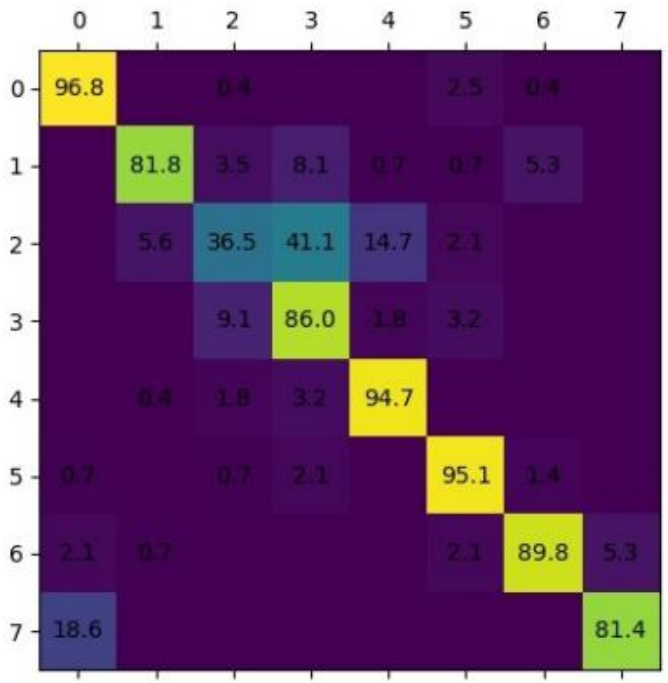
- Wrong alignment
- Different start/end point and data length

HAR (realworld2016) - Results

Sensor position	Architecture	Balanced test accuracy
upperarm	stacked LSTM (10,10)	83.42%
chest	LSTM 10	82.76%
shin	stacked LSTM (10,10)	81.84%
waist	stacked LSTM (10,10)	75.44%
forearm	stacked LSTM (10,10)	73.03%
head	stacked LSTM (10,10)	67.32%

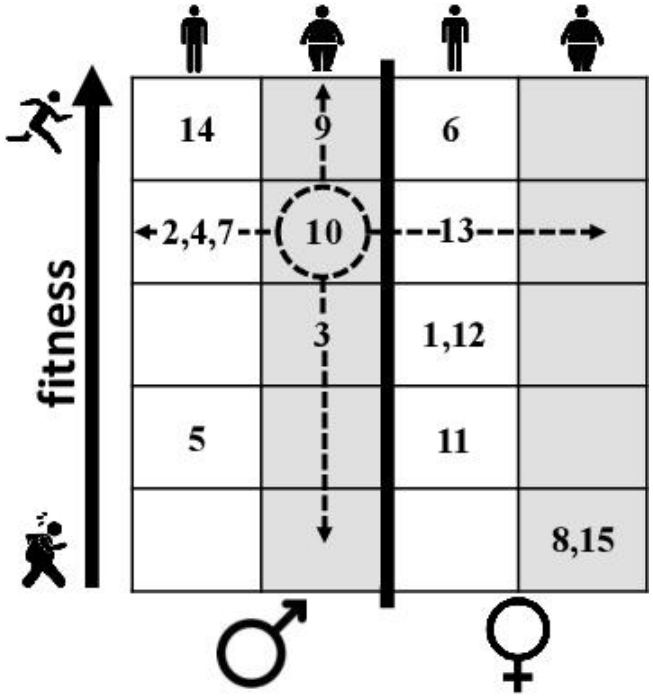


(a) upperarm



(b) chest

HAR (realworld2016) - Results



Position	Architecture	Validation	Test	accuracy difference
upperarm	stacked LSTM (10,10)	49.40%	83.42%	-34.02%
waist	stacked LSTM (10,10)	52.99%	75.44%	-22.45%
thigh	LSTM 11	76.69%	56.32%	20.37%

- Different distribution between validation/test set

HAPT - Android application

Thank you for your attention!

And see you in the poster session