Human Activity Recognition using Deep Learning

D. Browne and S. D. Prestwich
{david.browne,steven.prestwich}@insight-centre.org

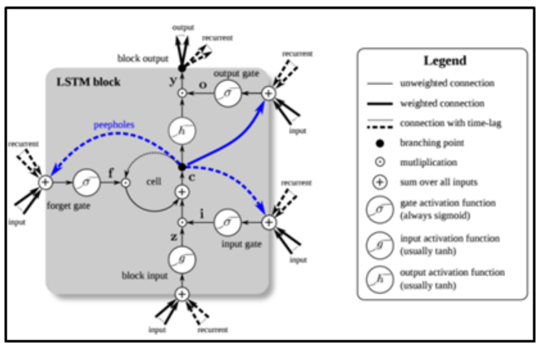
Insight Centre for Data Analytics

Objective

To introduce a novel technique that uses an auto-encoder to remove noise and find a minimum latent space to encode a time window of data. These stacked encodings are then feed into a sequential DL model to train and carry out inference.

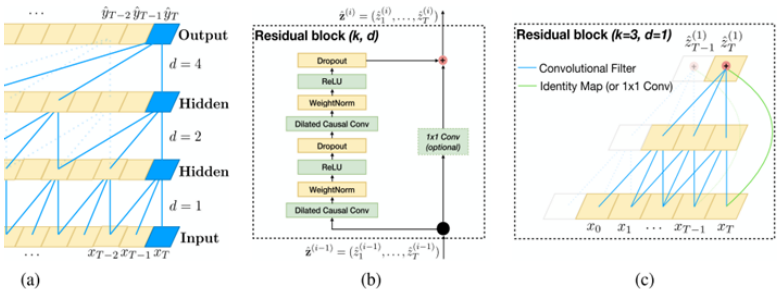
Model Comparison

LSTM



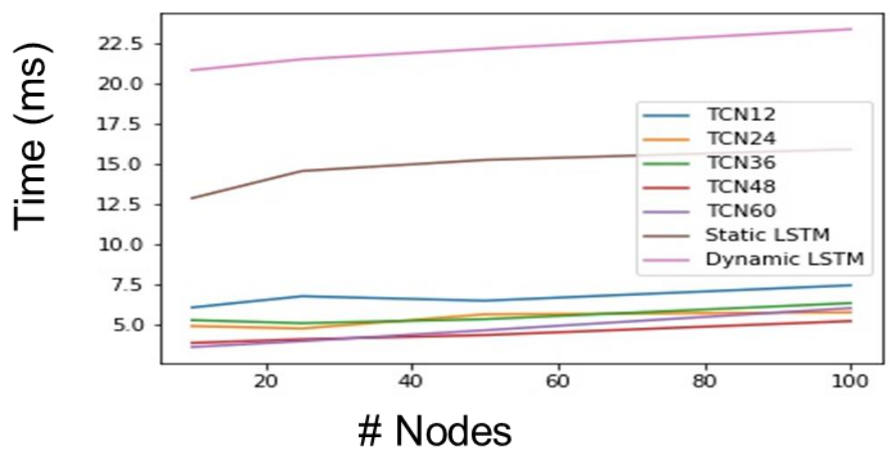
A long short term deep learning model has been the choice Model for sequential data for many years. It is very flexible, being able to vary the number of inputs and outputs. It can also take advantage of attention modules. Two of the main disadvantages of it are; its data hungry and is a sequential bottleneck

TCN



Temporal Convolutional networks are a relatively new network for sequential data, but boosts many advantages. They have an increased memory depth and also have the ability to be parallelized. This, along with a non-sequential flow, enables a TCN to be 1-2 orders of magnitude faster.

Timing Results



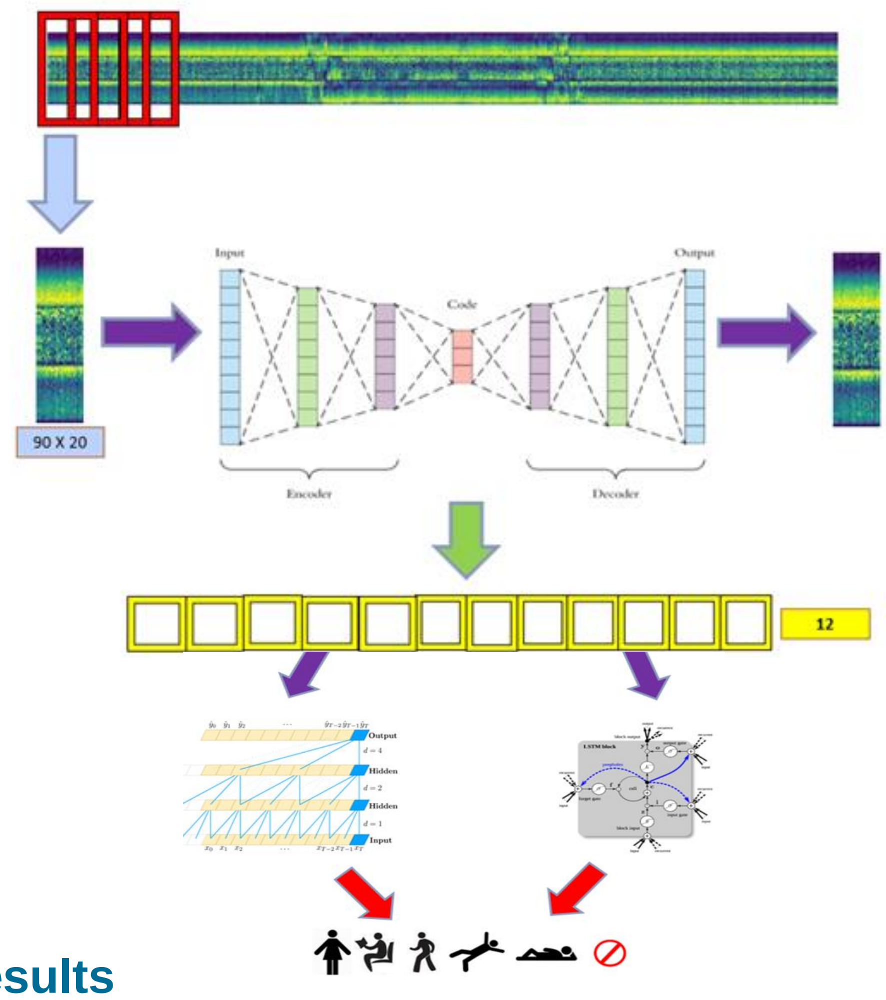
References

[1] S. Yousef et al. A Survey on Behavior Recognition Using WiFi Channel State Information. IEEE Commun Mag, Vol 55, no 10, (2017), pp. 98–104.

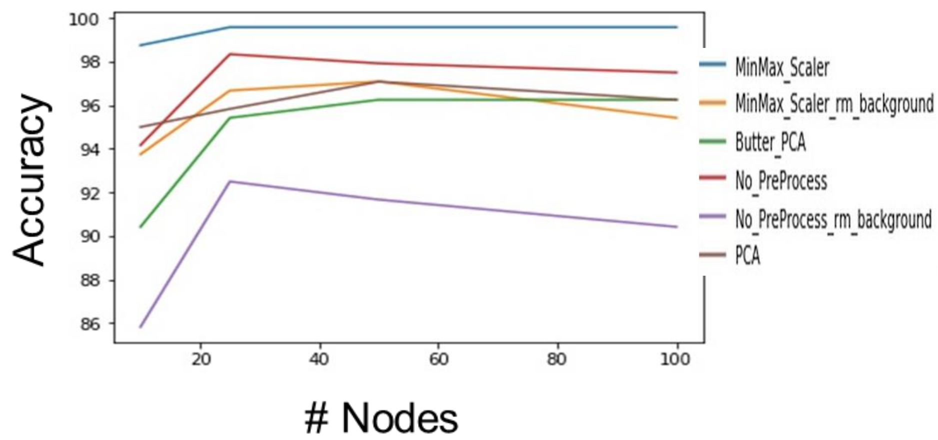
[2] Wang, Fangxin, et al. Channel Selective Activity Recognition with WiFi: A Deep Learning Approach Exploring Wideband Information.. IEEE Transactions on Network Science and Engineering, (2018).

Analytics Flow

Pre-process: Dim reduction



Results



Conclusions and Future Work

We introduced a DL process to accurately predict human activity to state-of-the-art results. Our method is non-intrusive as it requires no attached sensors like the majority of similar publications. Instead it uses the disturbance in WiFi signals to generate a spectrograph of the environment, which is then used as inputs to the DL model.

A temporal convolutional network is chosen as the sequential model, which we believe is the first time in this area it is used, due to its computational efficiency performance over a LSTM.

For future work, we hope to overcome problems with spatial and temporal generalization.

A World Leading SFI Research Centre

This project has been funded by Science Foundation Ireland grant SFI/12/RC/2289

EUROPEAN UNION
European Regional Development Fund