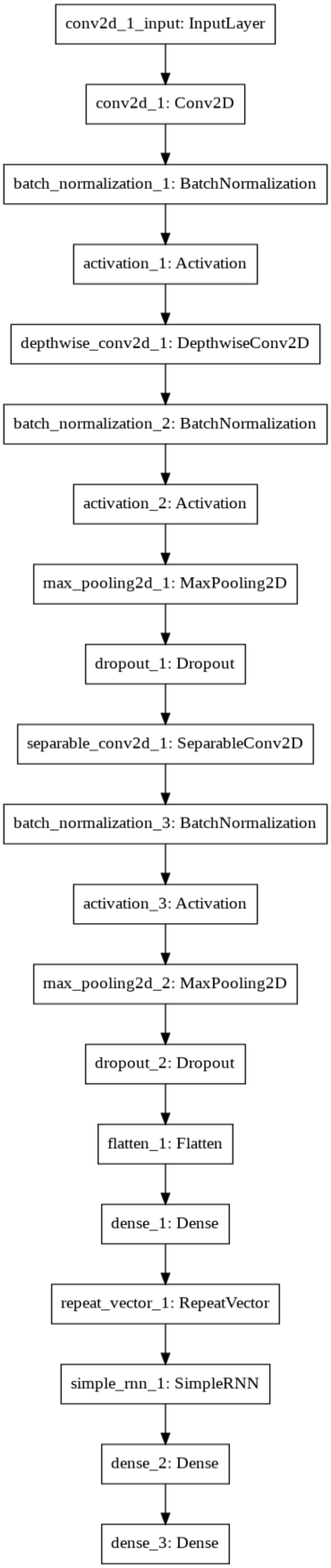

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Literature Review and Architecture of the model

The model we developed is based on EEGNet as proposed by (Lawhern, 2018). We have expanded on the originally proposed network by the author, primarily in terms of adding more regularization to the model. However, the core idea of using Depthwise and Separable Convolution layers remain the same as (Lawhern, 2018). Alongside you will find a diagrammatic representation of our model.

Hyperparameter tuning and optimization

We have used SVM Smote for random oversampling to balance out the classes. For our dense layers we used the swish activation function (Ramachandran, Zoph, & Le, 2017). L2 regularizer was employed as kernel and bias regularizer in the Conv2D layers. We also used keras callback of early_stopping with a patience of 5 to reduce overfitting of the model.

Results

We also tested various other architectures including a BDLSTM and RNN and all the results are listed below. The model which gave us the highest test accuracy was the EEGNet.

Model	Model Accuracy	Val Accuracy	Codalab Accuracy
CNN	0.73	0.713	0.6208
RNN	0.9125	0.8872	0.6904
BDLSTM	0.895	0.887	0.6841
EEGNet	**0.886**	**0.8772**	**0.7075**

Discussion of Results

The EEGNet used by Lawhern " generalizes across paradigms better than, and achieves comparably high performance to, the reference algorithms when only limited training data is available" (Lawhern, 2018, p. 1). Our model has a lower generalization than the original model proposed, however it had the highest generalization among the models we tested. RNN and BDLSTM had the worst generalization among the models we tested. Hence, we can see our results to be consistent with Lawhern in terms of EEGNet outperforming other models in generalizability of the model to unseen data.

References

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Lawhern, V. J. (2018). EEGNet: a compact convolutional neural network for EEG-based brain–computer interfaces. . *Journal of neural engineering*, 15(5), 056013.

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Appendix

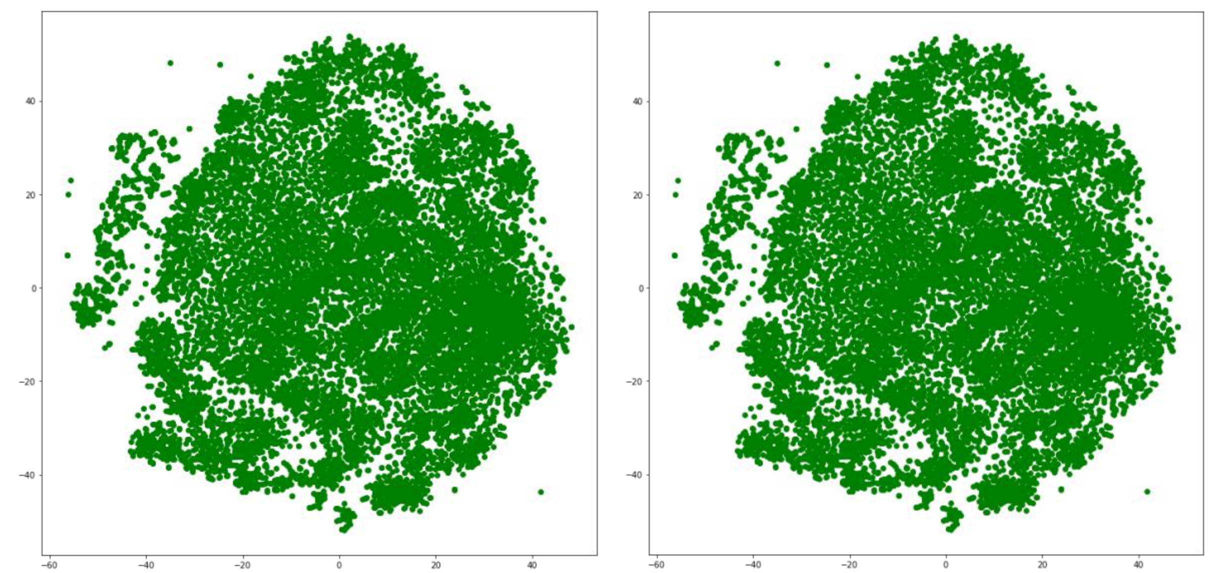

Fig 1. (a) shows the original distribution of the data (b) after random oversampling using SVM SMOTE.