

## Assignment#1

Answer:

1. The challenge of the electroencephalogram-based brain-computer interface (BCI) is that the signal is in non-stationary form, and the dataset number is relatively small. Furthermore, several studies explain that the complex deep learning model does not always successfully generalize the dataset and typically has low evaluation matrices. Thus, it needs an advanced deep learning framework in developing the model architecture.
2. We adopted a residual dense network (RDN) to address the challenges. The model consists of residual connection from input identity mapping  $x$  to the output  $\mathcal{H}(x)$  to estimate the error value  $\mathcal{F}(x)$ , or:

$$\mathcal{H}(x) := \mathcal{F}(x) + x$$

Intuitively, if an identity mapping  $x$  is optimal, it would be easier to push the residual  $\mathcal{F}(x)$  to zero, by a stack of DenseNet. Therefore, we are able to develop a deep network without severe vanishing gradients.