Detection with a more realistic pipeline
Short Recap

- The SNR to Distance plot of last week is based on white Gaussian background which is not realistic and the amplitude is a bad reference for real background.

- We found that the model will overtrain at SNR=15.

- This week we will be aiming to inject CCSN into a more realistic background and find out the solutions for overfitting at SNR = 15.
Apply Filter to Strain

- Highpass: 30Hz
- Lowpass: 1000Hz
- The plot of LIGO Noise does not include injections
SNR Test

The detectable distance is much larger compared from last week.
L2 Regularization

- \( \hat{y} = \text{function(strain)}, \text{target} = y \)
- \( \text{loss} = y \log(\hat{y}) + (1 - y) \log(1 - \hat{y}) \)
- Adding regularization term to loss function may help us avoid overfitting
- \( \text{new_loss} = y \log(\hat{y}) + (1 - y) \log(1 - \hat{y}) + \sum_{i=1}^{k} \lambda w_i^2 \)
Performance at SNR = 8

- 60K Training data
- 50 Epochs
- Applied Dropout
- Applied L2 Regularization
Performance at SNR = 15

- 12K Training data
- 50 Epochs
- Applied Dropout
- Applied L2 Regularization
Performance at SNR = 30

- 12K Training data
- 50 Epochs
- Applied Dropout
- Applied L2 Regularization
Summary

A. Done:
   a. Realistic Background
   b. Band pass
   c. After applying dropout and regularization the performance has an obvious improvement

B. To Do:
   a. Whitening
   b. Search for other detection or classification model
   c. Study how do other people do transient signals classification

https://indico.cern.ch/event/793125/contributions/3490030/attachments/1882096/3101419/1stRTAworkshopEC.pdf