

# Y4 Project meeting 12 record

Date and time: 20/01/2020 14:00

Attended by: Guy, Harry and Hin

Discussed:

1. Complications Harry might have regarding Q&A during seminar
2. Reporting progress and results since last meeting:
  - a. Advancements with HBM: successfully recovered mean and spread age of a NN converted pseudo-cluster ( $N(2.5, 0.5)$  Gyr) within 2 sigmas of estimate, given a hyperprior that is at least 5 sigmas away, NN trained on small grid. It is apparent that HBM has a much better grasp at age estimation for non MS stars as expected.
  - b. Advancements with NN: attempted training on Google Colab on big grid, but have been facing runtime > 12 hours termination problems, Guy suggested to cut down the grid by trimming high and low (with regarding to M67) ages, [Fe/H] and initial Y, and get the number of models down to 1mil from 12mil
3. NN learning problems:
  - a. Optimizer nadam is potentially causing a secondary peak in epoch-loss plot due to momentum problems. This not only hinders training efficiency, but also interferes with early stopping. Currently, Guy said he has been having a lot of problems with getting loss down to  $10^{-4}$ , which is kind of the goal
  - b. The training rate of NN drastically decreases from being optimal once one of the hyperparameters (eg. learning rate, regularization...) is off from ideal. Hence it is usually more time efficient to stop a bad run, figure out the problem, and start over.
  - c. A lot of the optimal hyperparameters, choice of regularizer/dropout, optimizer are unique to each NN problem, and each grid that we are training to, so it can only be obtained from trial and error due by ourselves.
4. Allocations of jobs:
  - a. Hin and Harry: training and optimizing the process of training on big grid to reach desired NN precision
  - b. Harry: investigate the variation of final loss and number of epochs to attain them as a function of NN width and depth
  - c. Hin: fundamentals recovery test with the cluster constructed directly from the grid itself, allowing errors to come from both NN and HBM
5. Guy suggests using G band when calculating luminosity/absolute magnitude rather than Kepler magnitudes. It is also possible in the future to include distance to the star as a conversion in the HBM in the future.
6. About applying framework onto other clusters:
  - a. We are mostly only interested in the clusters that have been well studied
  - b. A list of Kepler and K2 clusters with relatively good data and extent of study is listed in Cody et al. 2018 <https://arxiv.org/pdf/1810.12267.pdf>

- c. If we intend to do cluster-to-cluster HBM analysis, it makes more sense to train one NN on one giant grid that includes the parameter spaces of all clusters we intend to investigate than to train specifically for each and combine them under the HBM.
  - d. However, it is suggested that we only focus on one cluster—M67 for now, and only expand once we obtain good enough results on the groundwork.
- 7. Guy will not be in UK (Sydney) on the weeks 3<sup>rd</sup> and 10<sup>th</sup> Feb, we can arrange for Skype meetings during next meeting for that.

To do:

Students:

- 1. Do the stuff above in point 4
- 2. Find out how to get into blueBEAR
- 3. Read papers

Supervisor:

- 1. Prepare M67-specific grid to be passed next week

Next meeting: 27/01/2020 14:00

Recorded by: Hin