Abstract

Introduction

What is open clusters, why they are important, what are the available data

What is stellar evolution, why is it important, astroseismology (do we have to include these)

Hendriks & Aerts 2018

Method

What is machine learning, what is neural networks, what is tensorflow/keras

hierarchical Bayesian modelling of stellar ages in an open cluster

HMC, NUTS

to get the ages to feed into NUTS, need astroseismic data, neural net

Results?

D. Stello et. al 2016 gave masses for 33 red giants in M67

Found mu and sigma for M67 based on D. Stello

Implication

Good stuff about approximating stellar models/grids with neural net: much much faster, possibly cant account for loss function

Good stuff for getting age and spread of cluster’s star age:

Work flow

Week 1-4 background research and proposal

Week 5-7 HMC and NUTS on M67

Week 8-11 research for grid/stellar models for neural net

Term break building neural net

Week 1-5 building and testing neural net with validating program

Week 6-8 extra stuff

Week 9-11 write up

References

European CoRoT

(Auvergne et al. 2009) and the NASA Kepler (Koch et al.

2010) space telescopes

A prominent application of machine learning (ML) to lowmass star asteroseismology based on damped pressure modes was developed by Bellinger et al. (2016).

Why does non-linearity has to be added to neural network

Overfitting -> penalty term for high weights regularization (Ng 2004)

The input data for the neural network are 8D: the six stellar parameters (M, X, Z, Xc, fov, and Dmix) and two integer mode quantum numbers connected with the frequency of the zonal mode: l and npg. The output of the network is the mode frequency f i th for all modes i with degree 0, 1, or 2 and for all radial orders npg Î- + [ 50, 5] (see Figure 1).

After trained model from grids, now with a trained neural network, to go backwards and find the corresponding stellar parameters with a given set of mode freq, used a cost function under a particle finder (PF). PF looks for the local region in the 6D input space and finds the values that gives the least error compared to the mode freqs, under some layered loops of constraining functions.

Forward modelling in astroseismology = making a model that gives observables (del nu, nu max, individual mode freq) from stellar parameters (mass, radius, age)

Kendall & Gal (2017): procedures to turning a deep neural network into a Bayesian deep neural network that also gives uncertainties

To site tensorflow: <https://www.tensorflow.org/about/bib>