Chemical mapping of the stellar halo of the Milky Way

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Introduction

- **Gaia parallaxes too imprecise** to measure distance beyond a few kpc → Use **photometric distances**

- **Problem :** need to **discriminate** the dwarfs and the giants → **Data-driven Machine Learning based algorithm**

Discrimination Dwarfs/Giants, distance and metallicity from multi wavelength photometry

- **From the CFIS-PS1-Gaia photometry :**

  * **Step 1:** dwarf/giant classification

  * **Step 2:** estimate the metallicity →

  * **Step 3:** get the absolute magnitude

- **Recover 70% of the giants with [Fe/H]<-1.0**

- ~ **30% of contamination**

- $\sigma_{[Fe/H]} < 0.2$ **dex**
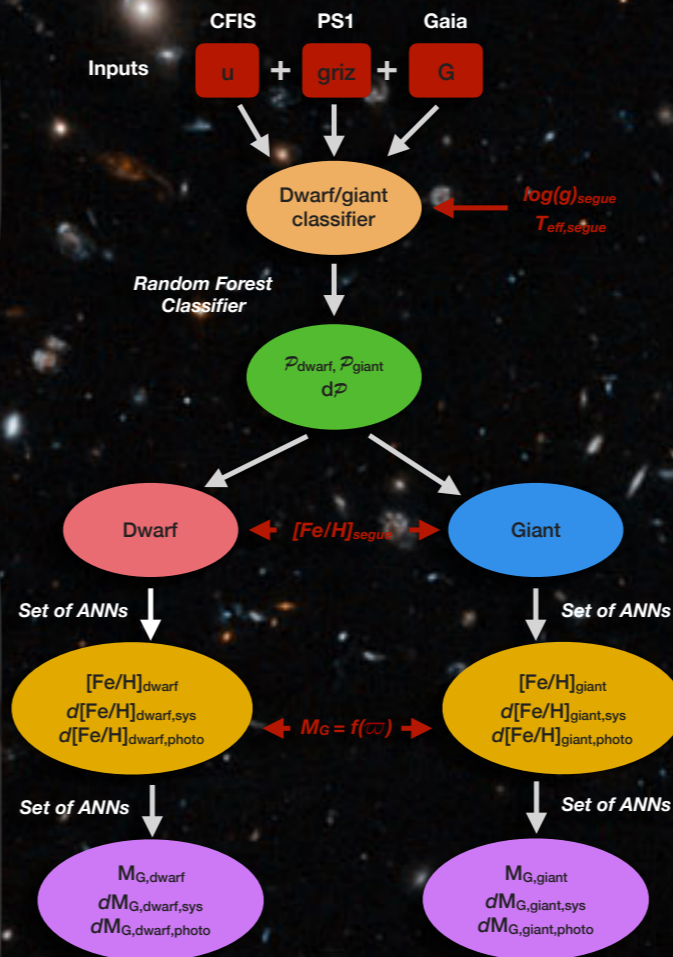
- Trained on SDSS/Segue, verified with Lamost and GCs/dSph

Fig 1. Illustration of the algorithm

Inputs — CFIS: u + PS1: griz + Gaia: G

Dwarf/giant classifier ← $log(g)_{segue}$, $T_{eff,segue}$

Random Forest Classifier

$\mathcal{P}_{dwarf}$, $\mathcal{P}_{giant}$, d$\mathcal{P}$

Dwarf ← [Fe/H]$_{segue}$ → Giant

Set of ANNs

[Fe/H]$_{dwarf}$, d[Fe/H]$_{dwarf,sys}$, d[Fe/H]$_{dwarf,photo}$ — $M_G = f(\varpi)$ — [Fe/H]$_{giant}$, d[Fe/H]$_{giant,sys}$, d[Fe/H]$_{giant,photo}$

Set of ANNs

$M_{G,dwarf}$, $dM_{G,dwarf,sys}$, $dM_{G,dwarf,photo}$ — $M_{G,giant}$, $dM_{G,giant,sys}$, $dM_{G,giant,photo}$

Verification with Globular clusters

Fig 2. CMDs of 3 globular clusters calculated from:

* the absolute magnitude predicted by the **algorithm (right)**

* the **Gaia parallaxes (middle)**

* the distance of the **literature (left)**
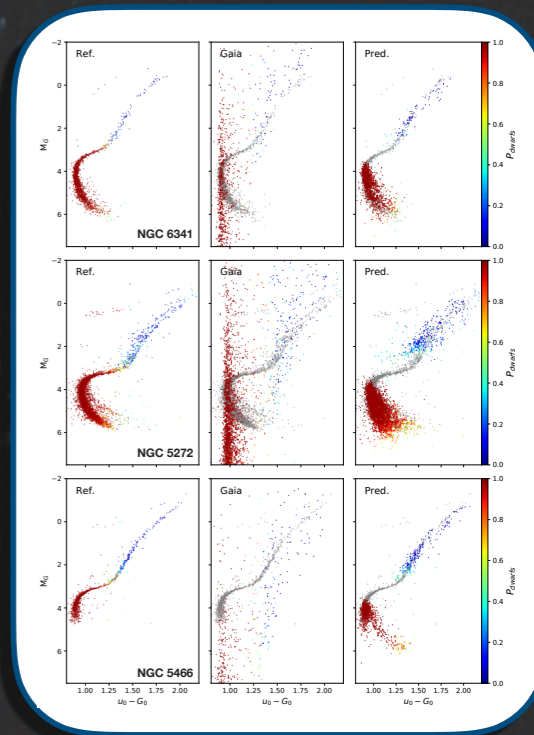
Precision of the distance :

* **17 % for the dwarfs**

* **26 % for the giants**

For more details please come and chat to me !