CLASSIFICATION OF YOUNG STELLAR OBJECTS AMONG GAIA ALERT CANDIDATES

József Varga
Konkoly Observatory, Budapest

P. Ábrahám, R. Beck + Konkoly Gaia Group

8th OPTICON
Gaia Science Alerts Workshop,
7 Dec 2017, Warsaw

CSFK

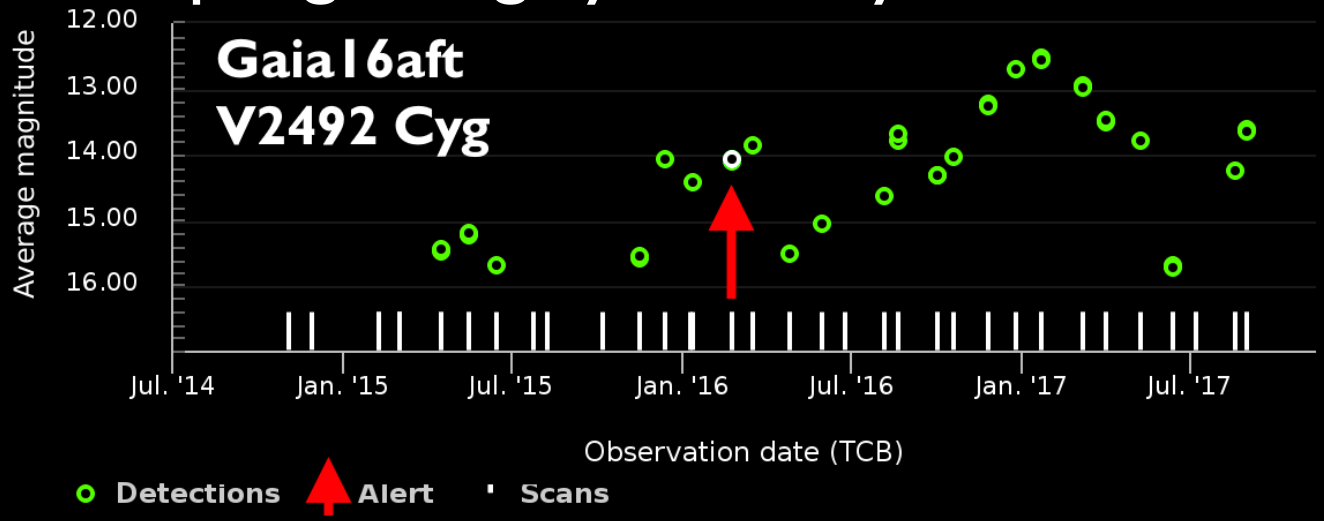
KONKOLY

Motivation

– Many Gaia alerts are unclassified (Class = unknown)
  - possibly many young stellar objects (YSOs)

– Can we identify YSOs from GAIA light-curves alone?
  - and also determine subclass (e.g., EXor, UXor)
  - need automatic classification

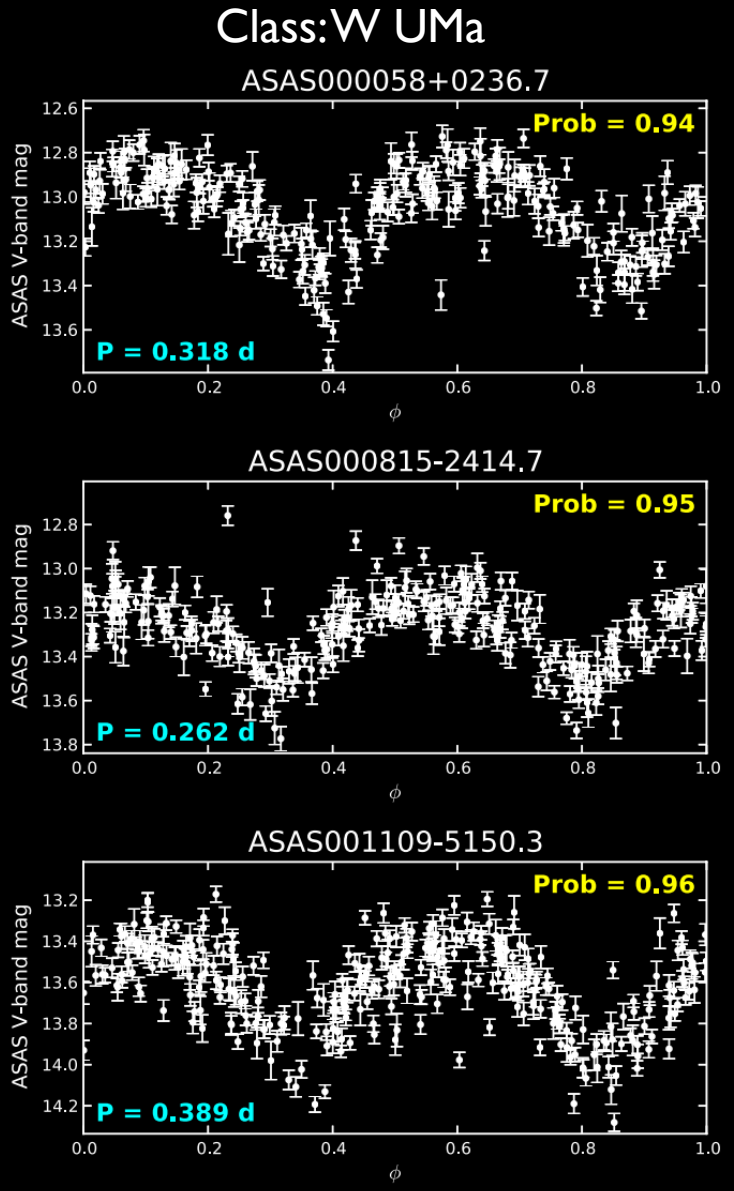
– GAIA sampling: roughly monthly cadence



Motivation

– Richards et al. (2012)
  - classification of variable stars
    – 28 classes
    – probabilistic
    – machine learning
  - application to the All-Sky Automated Survey (ASAS)
    – < 20% error

– our experiment: apply a similar approach
  - to GAIA light-curves



Richards et al. (2012)

Data

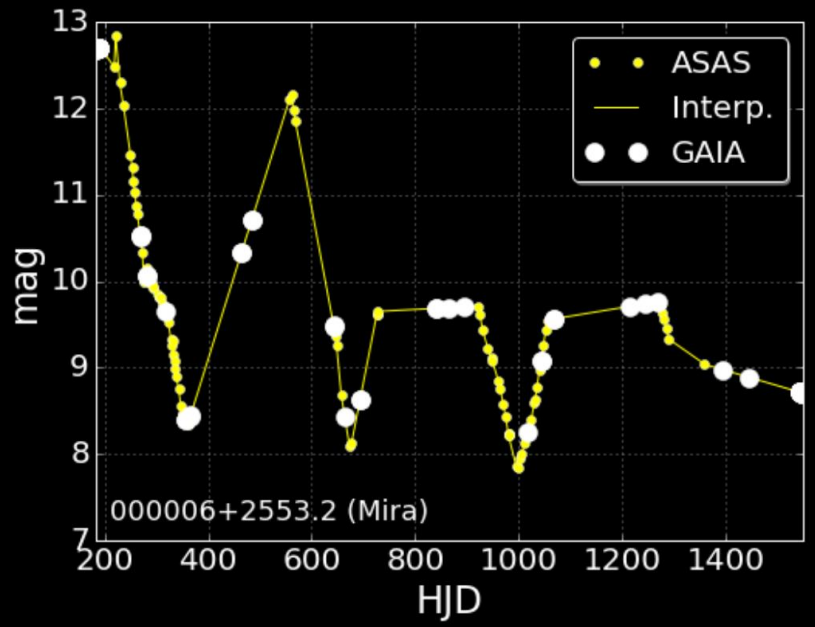
– use sources classified by ASAS as a training set

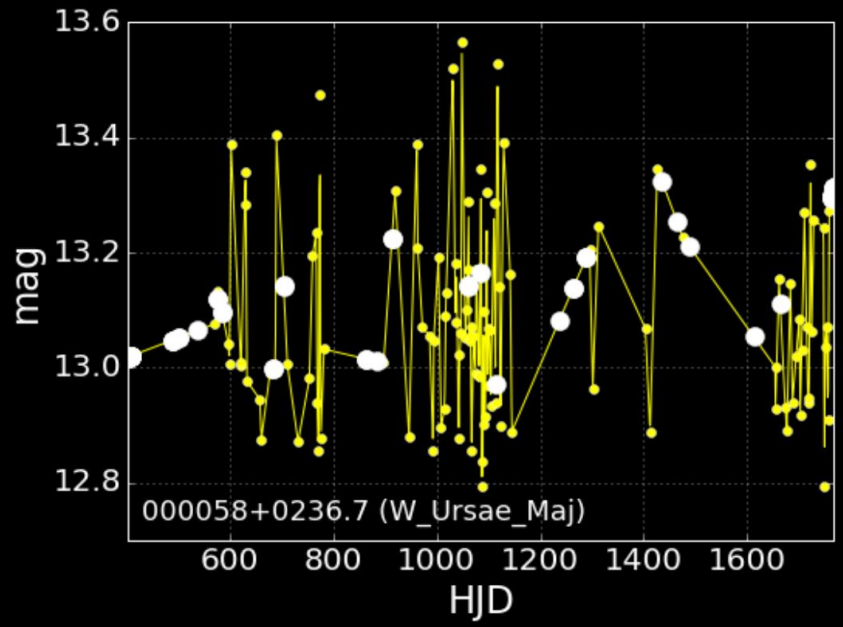
– plan:

- use real GAIA light-curves for YSOs in ASAS catalog

– as a first step:

- resample ASAS data to GAIA epochs
  - simulated GAIA light-curves





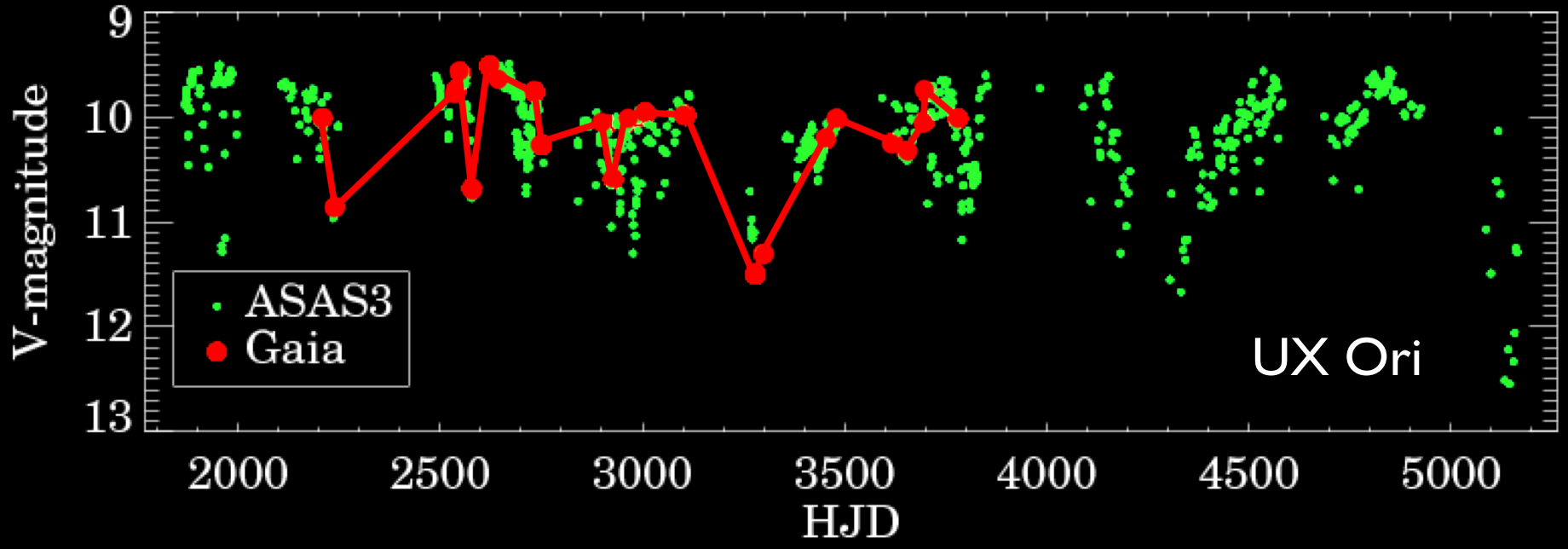
YSO light-curve sampling

– aperiodic variations are common

– what fraction of the variability can be detected by the GAIA sampling?

– test with UX Orionis type stars

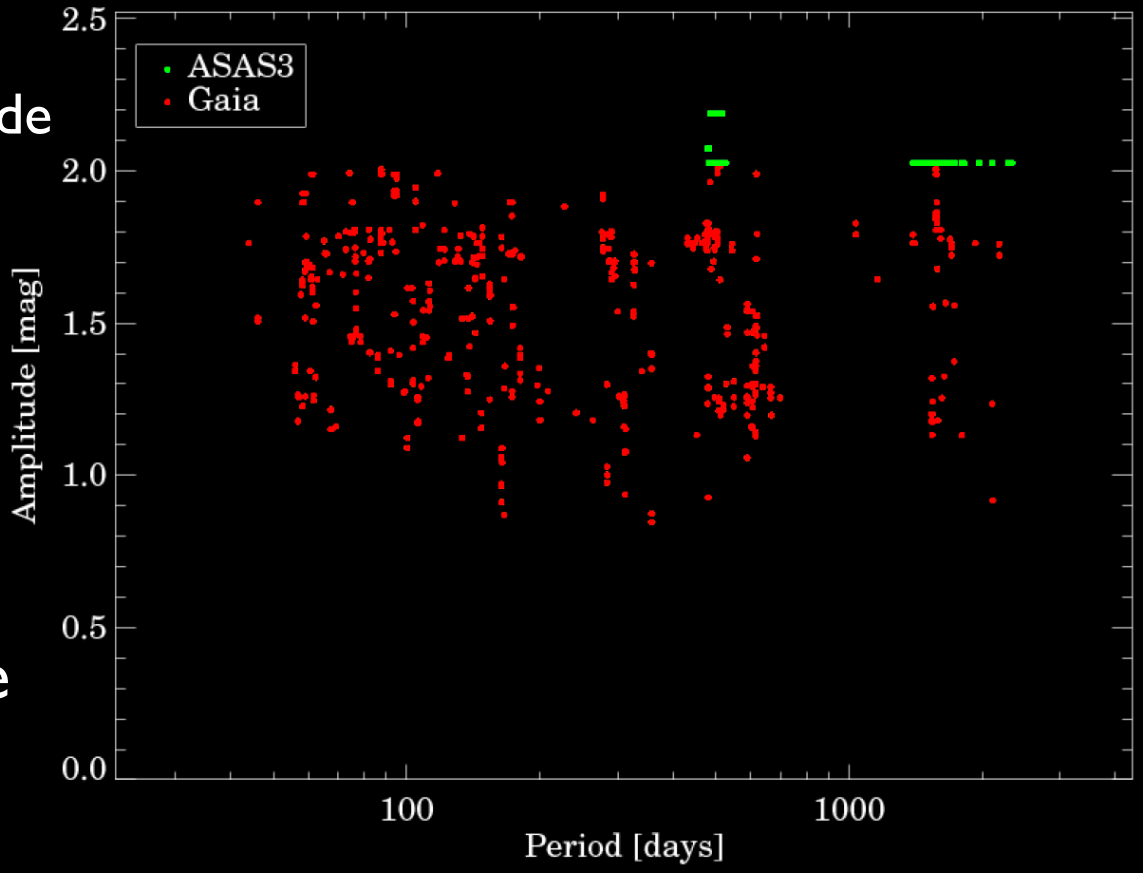
- periodic fadings (few weeks)



YSO light-curve sampling

– synthetic light-curves sampled at GAIA epochs
  - randomly shift the starting epoch
  - repeat sampling many times
  - measure
    – variability amplitude
    – period

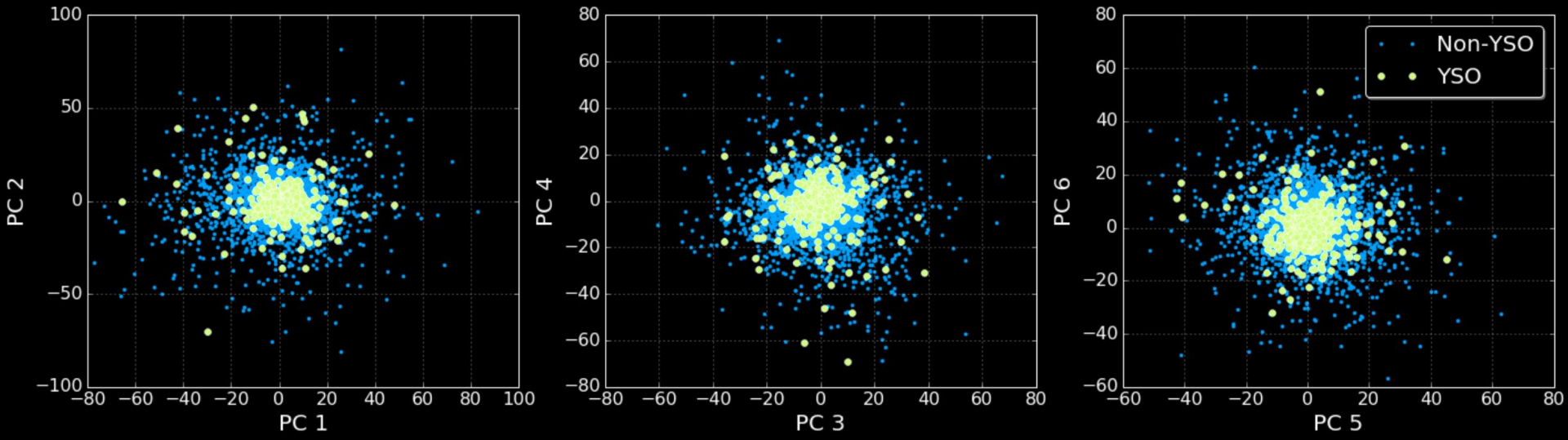
– results
  - variability can be recovered
    >1 mag amplitude
  - large scatter in the period



Automatic classification I

– Principal component analysis (PCA)

- no separation between classes
- no success



Automatic classification 2

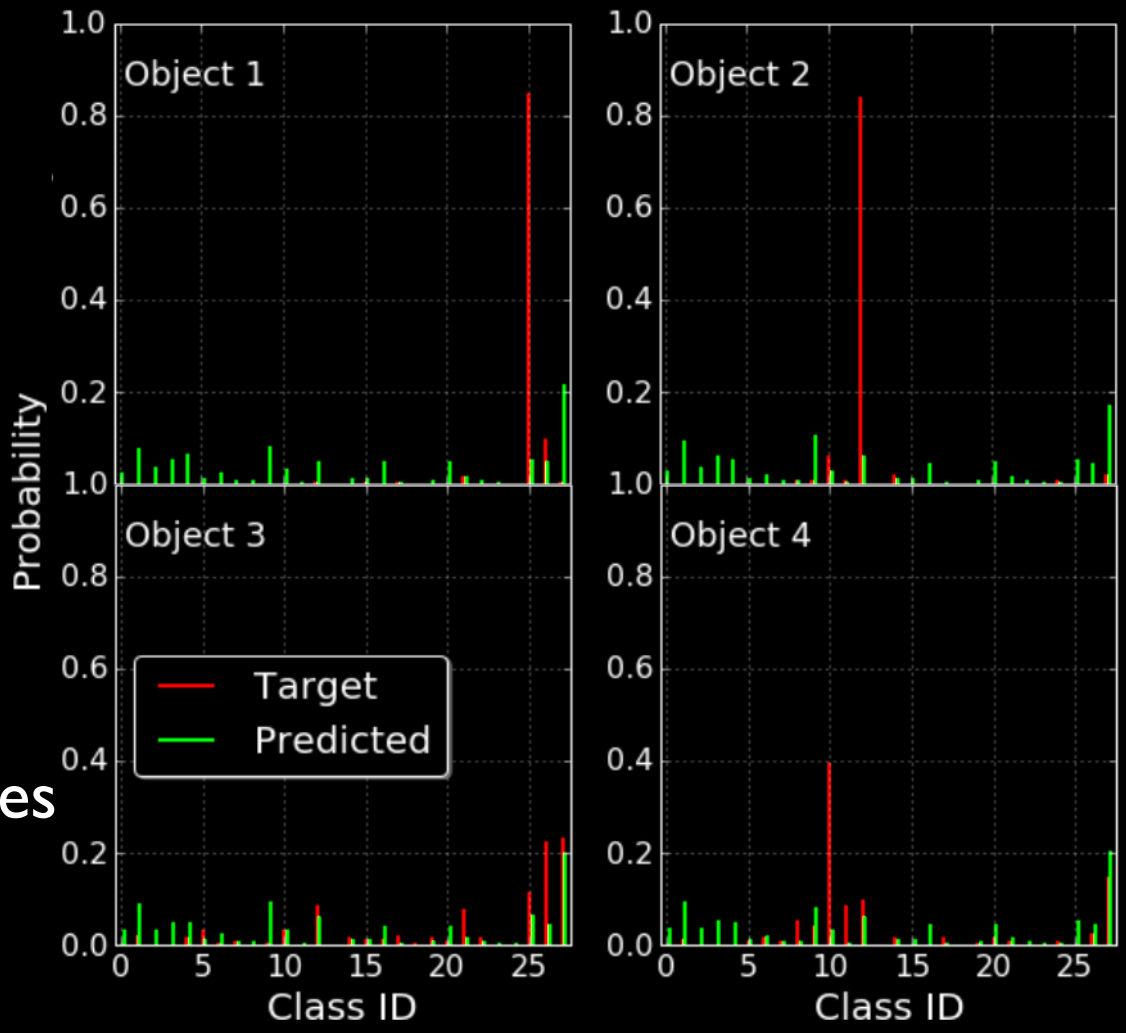
– Deep learning algorithm

- neural network
- apply directly to the light-curves

– Result: no success

– Main difficulty:

finding a suitable, homogeneous representation for the GAIA light-curves



Future plans

- use real GAIA light-curves
  - find a suitable representation
  - might not work
- or try an analytic representation
  - like in Richards et al. (2012)
- further possibility:
  - use GAIA spectra
    - promising possibility

Thank you for your attention