Paris-Saclay Center for Data Science

LSST Large Synoptic Survey Telescope

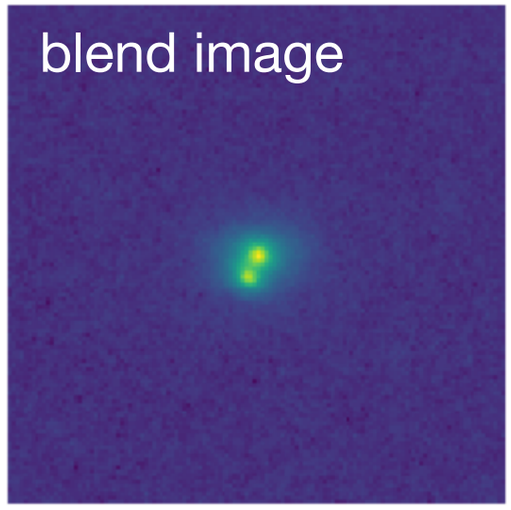
Photometry of blended galaxies with deep learning

Alexandre Boucaud
aboucaud@lal.in2p3.fr

Photometry on blended regions

- **two-object** blends 75% of the time (Dawson et al. 2016)
- aperture photometry unstable => **model fitting** photometry
- need a good model for the sources
  - use multi-band information => see Robert's talk
  - find good priors => segmentation, flux ratio (this talk)
  - …
- complementarity of space vs. ground => see Cyrille's talk

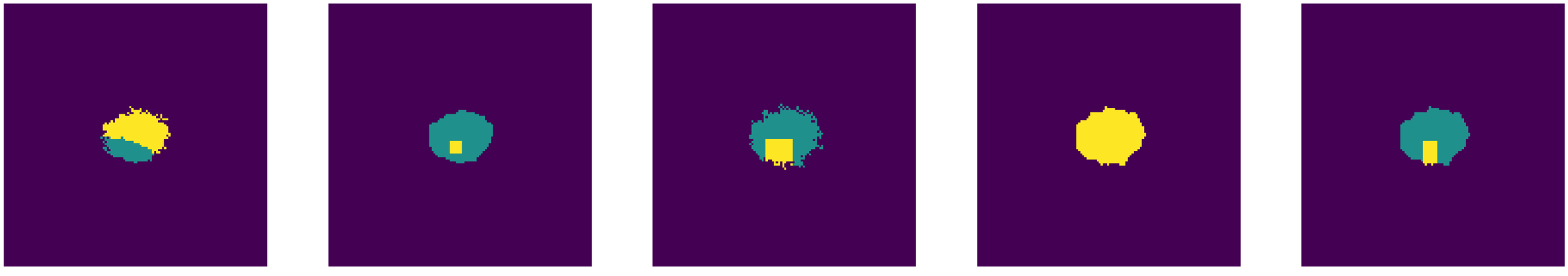
Classic segmentation approach: SExtractor



SExtractor computes a “frontier” to separate blended objects

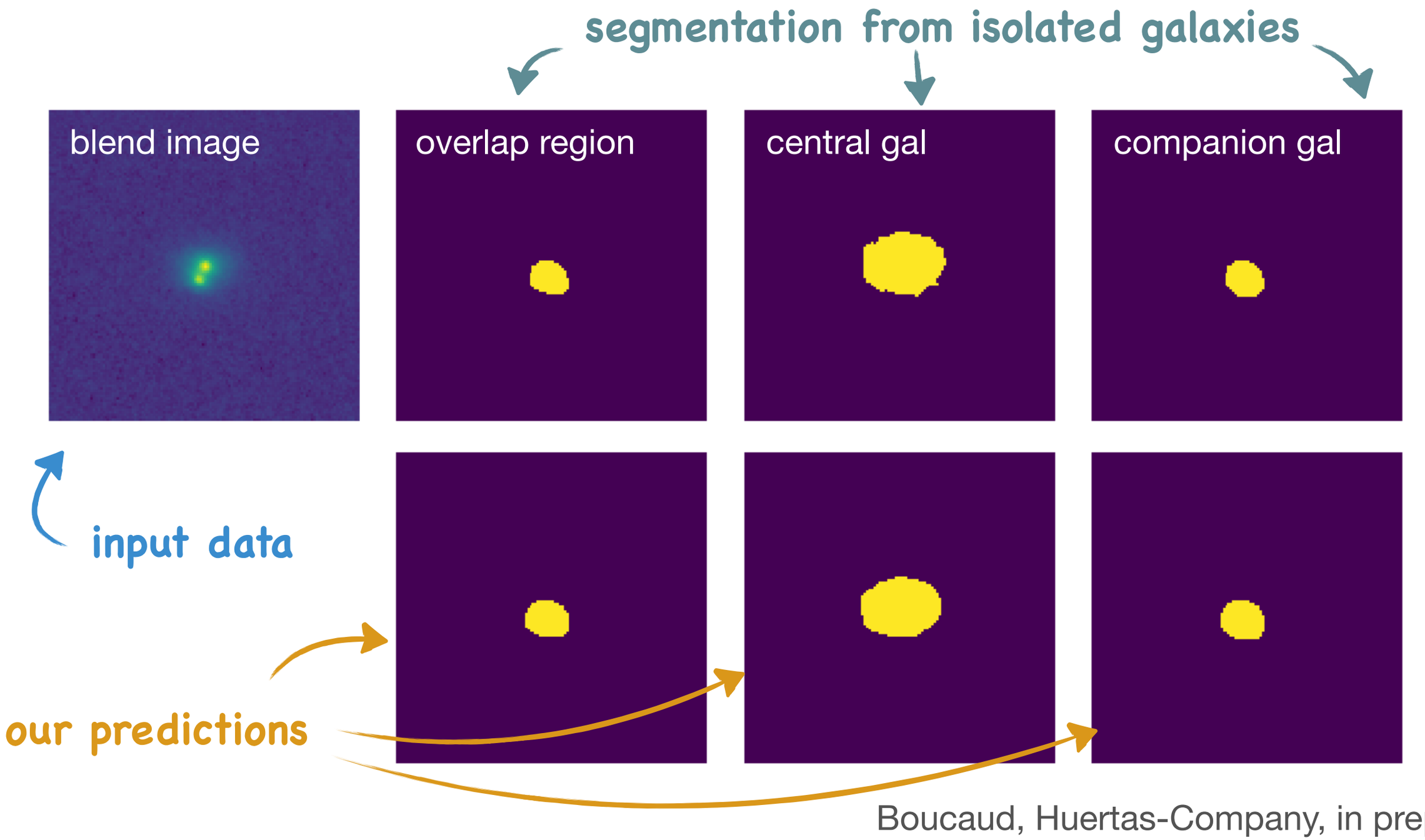
Highly **dependent on** software **settings** and cannot render the shape of both object **simultaneously**.

- `DEBLEND_NTHRESH`
- `DEBLEND_MINCONT`
- `FILTER`
- `CLEAN_PARAM`
- `BACK_SIZE`



examples of SExtractor segmaps with various configurations for top-left image

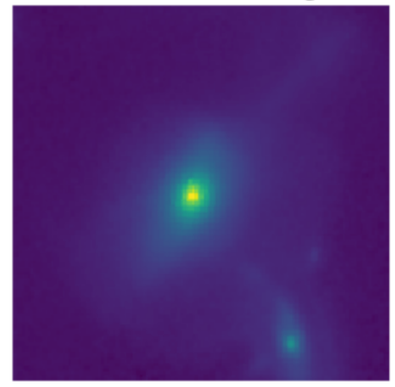
Segmentation of 2-obj blends with deep neural nets



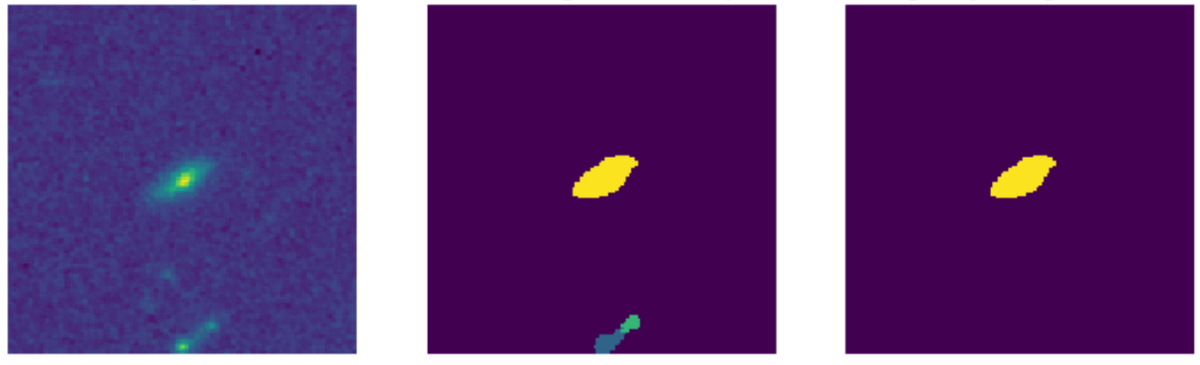
Boucaud, Huertas-Company, in prep

Dataset of blended CANDELS pairs

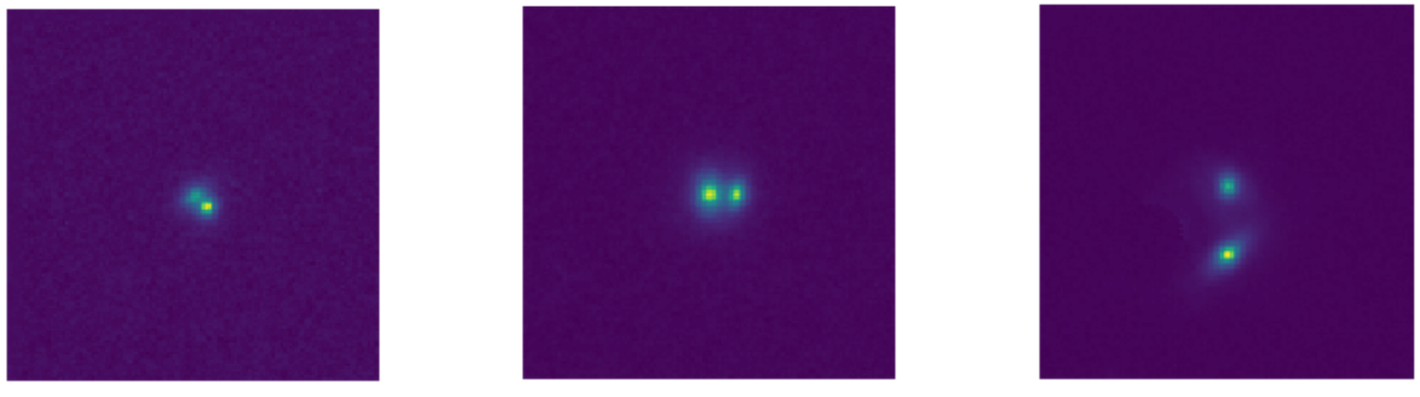
"Gold sample" of isolated galaxies from CANDELS
control of **distance**, **magnitude** and **morphology**



Removal of neighbours
(replaced with noise realisations)

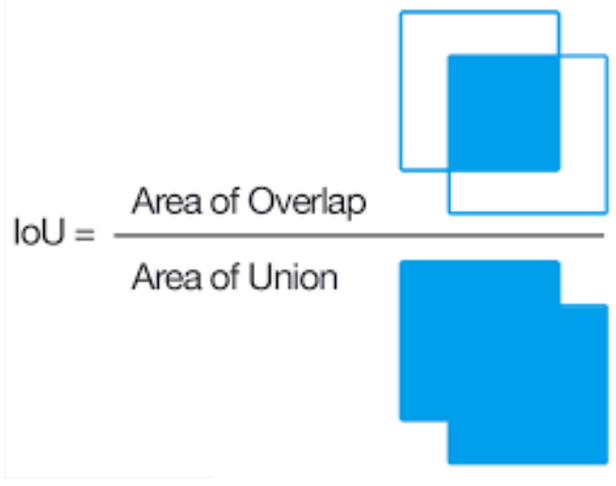


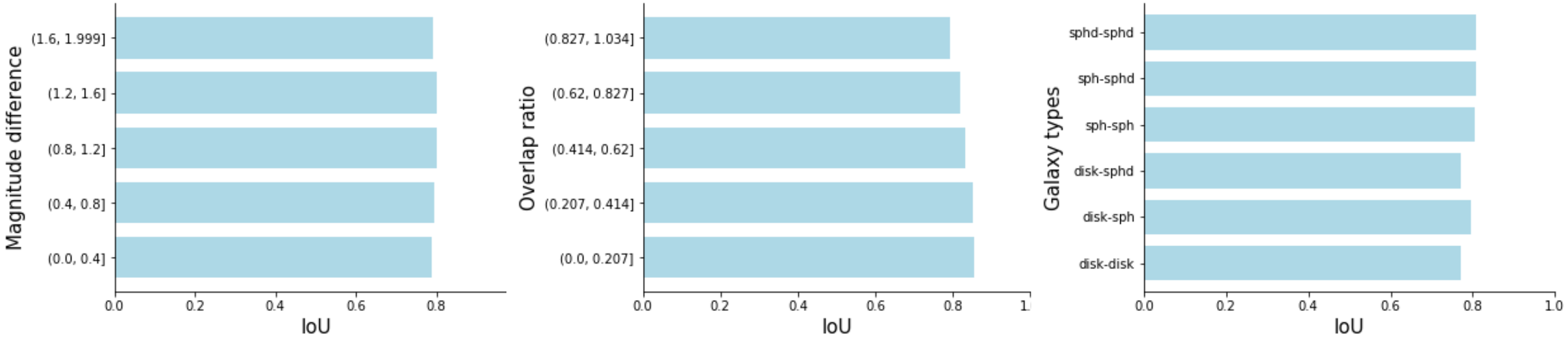
Manual blending



Assessment of segmentation performance

metric : Intersection over Union





segmentation performance is **very good** and **independent** of magnitude difference, blending or galaxy type (not incl. irregular profiles)

Boucaud, Huertas-Company, in prep

Work status

- tuneable **catalog** of blended CANDELS galaxies will be made **available soon**

- deep learning can be interesting to tackle blending issues

- our DNN can recover **individual segmentation** maps and a noisy measurement of the **flux ratio** depending on the overlap

- other alternatives to be implemented in the Euclid pipeline: `ASTErIsM` (Tramacere et al. 2016)

Open questions

- **metrics**
  best way to assess the quality of blended photometry ?
  how do we compare methods ?

- **realistic dataset of blends**
  ground + space ?
  which properties ?
  same region of the sky ? (HST + HSC on COSMOS)

- **challenge**
  is it something worth the effort at this stage ?
  who would be willing to invest some time on it ?