

Plant Phenotyping by Feature Extraction

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Figure 1: Is this an environmental influence on food production?¹

¹G. Lean. *There's a food crisis coming. Are we ready?* The Telegraph UK, 2015.

Phenotype

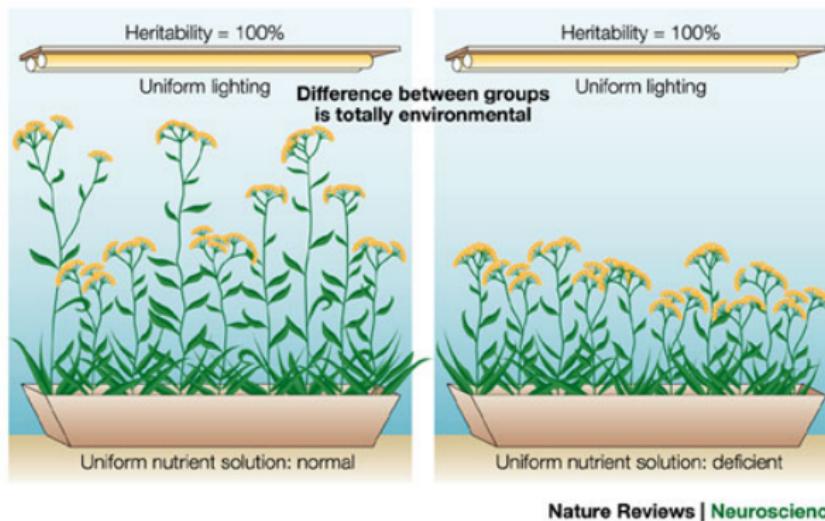


Figure 2: Phenotype of a crop is determined by both the Genotype and its Environment.²

² J.R. Gray and P.M. Thompson. "Neurobiology of intelligence: science and ethics - Box 2: Gene-environment interactions". In: *Nature Reviews Neuroscience* 5 (2004)

Research Question

What features are required for a plant representation which is breed, scale, rotation and growth rate invariant?

Plantlet based Phenotyping



Figure 3: Arabidopsis Thalia Tray RGB image on the left, Nicotiana Tabacum single plant RGB image on the right. Both images are taken from the plant-phenotype.org database.³

³ Massimo Minervini et al. "Finely-grained annotated datasets for image-based plant phenotyping". In: *Pattern Recognition Letters* (2015), pp. 1–10

Method: Salient points & Histogram of Oriented Gradients

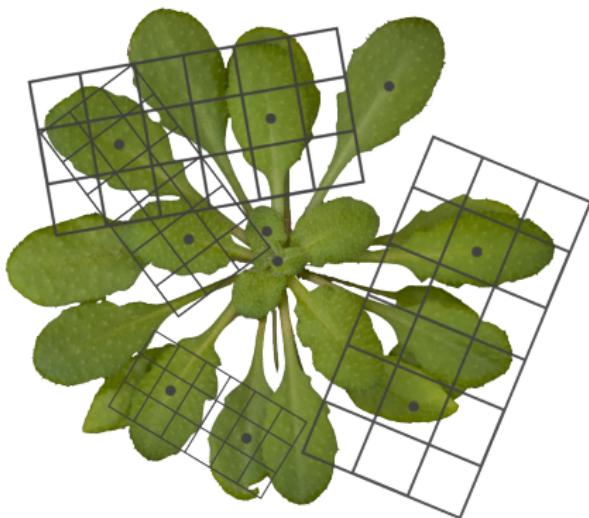


Figure 4: Locate salient points and make pairs to extract parameters.

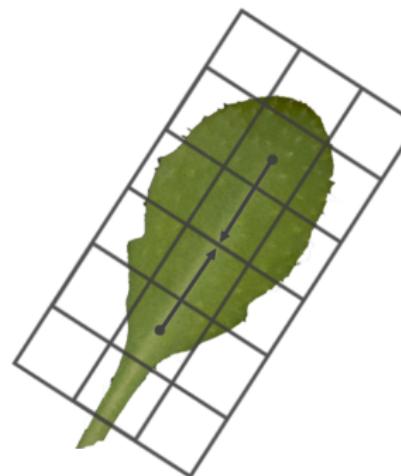


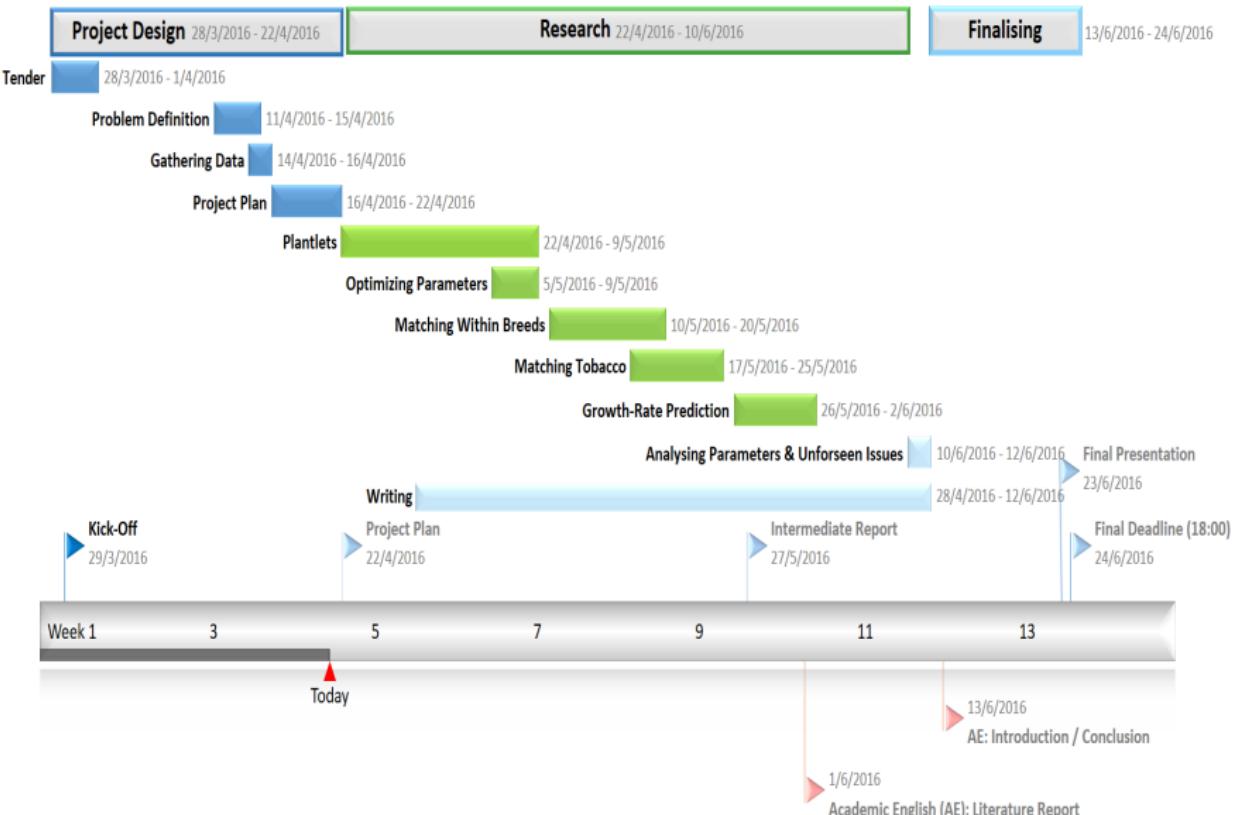
Figure 5: Use HoG to find 18 parameters. All pair features make up the representation of a plant: 'Plantlet'.

Evaluation of Results

... Invariant?

- **Breed:** Classification rates Arabidopsis mutants & Tobacco
- **Scale:** Salient points are collected with an Gaussian blur
- **Rotation:** Similarity between Plantlets or rotated images & classification rate with rotated image
- **Time:** Mean prediction error

Plan & Schedule



Questions?