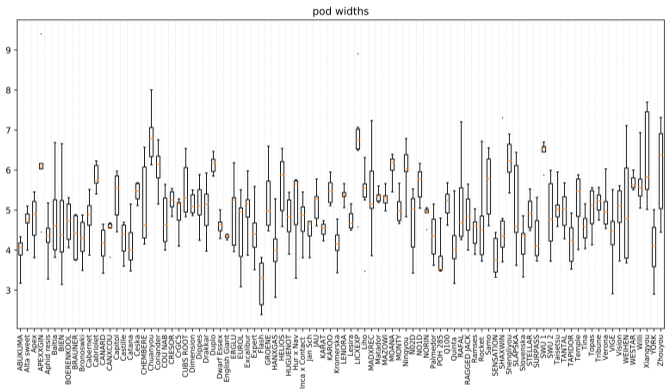


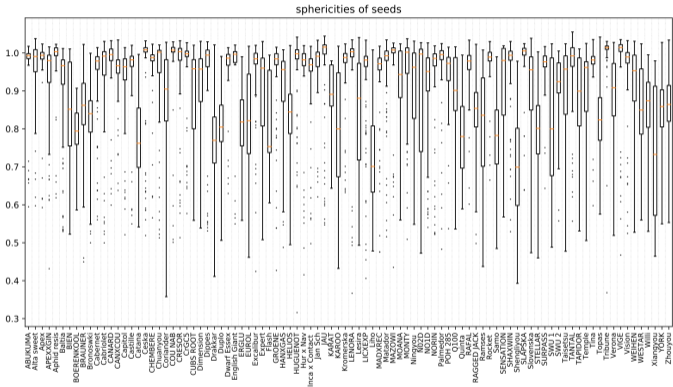
Looking at microCT data of Brassica pods

I am not a biologist, please stop me and correct me if I say silly things.

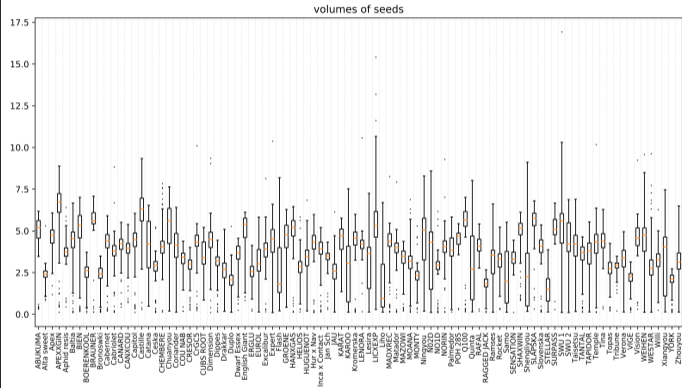
Pod Width



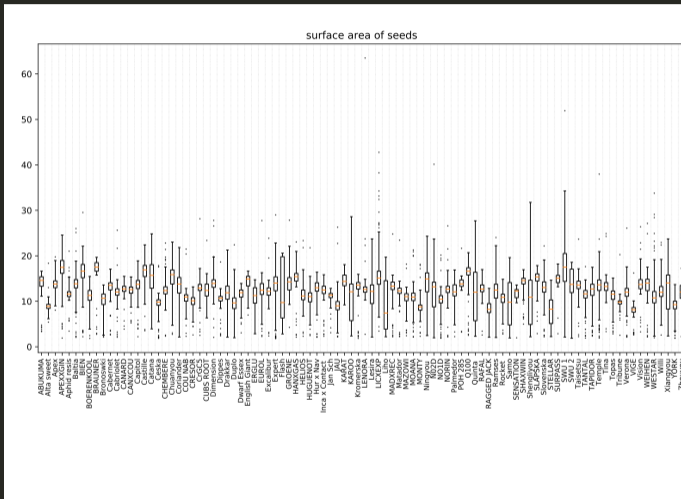
Sphericity



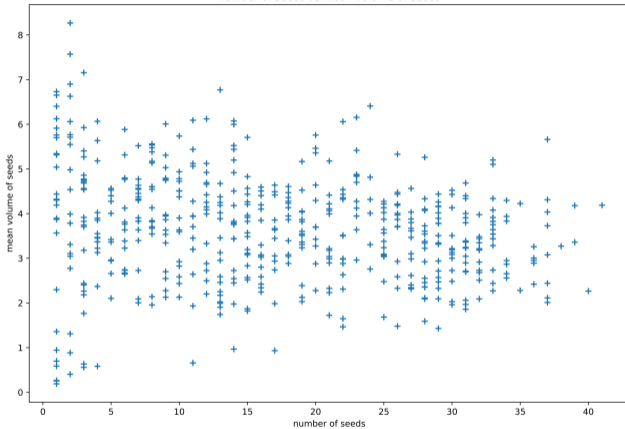
Volume



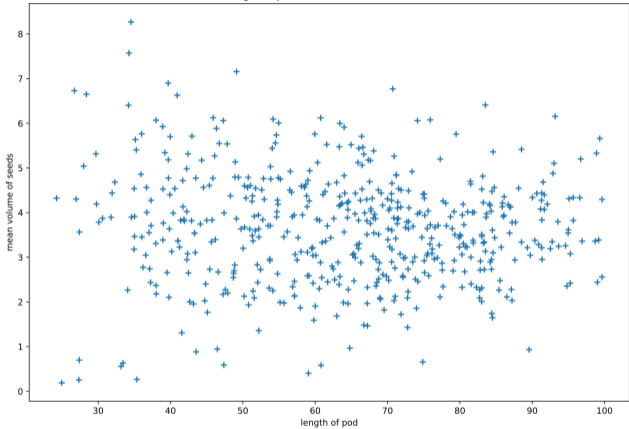
Surface Area



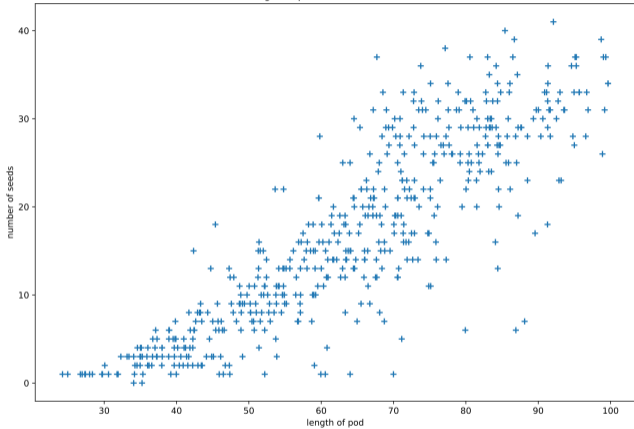
number of seeds vs mean volume of seeds



length of pod vs mean volume of seeds



length of pod vs number of seeds



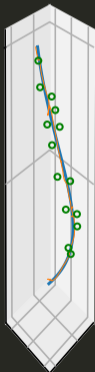
Filtering false seeds



- Image analysis produces many false seeds at the beak tip
- Density and size is comparable to seed
- Hard to recognise by graphical methods alone
- Recognise them by mathematical means instead

Spine fitting

- For every CT slice we have the centroid of the object
- Fit X and Y position as cubic functions of z
- Define 'real z' as the distance measured along the fitted curve from the beak to the z coordinate of the point



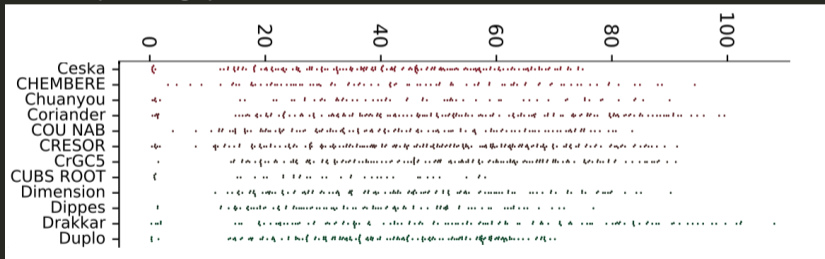
Classify beak tip and Real Seeds™

Failed approaches:

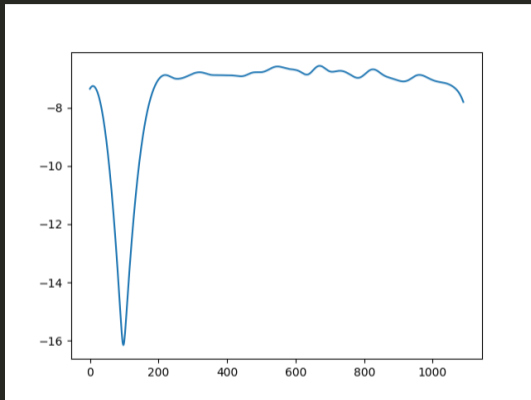
1. Assert that seeds must not be implausible - Removed insufficiently many seeds
 - Too close to the ends of the pod
 - Too large given pod dimensions
2. Real z position of seeds of a pod is a sample from some probability distribution, fit and parameterize the distribution to classify seeds.
 - Sum of two normal(-ish) distributions - noise at beak might be normal, everything else definitely is not
 - More complicated distribution - too complicated
3. K-Means clustering - Silly for 1 dimensional data
4. Jenks Natural Breaks Optimisation - Should work in theory, did not work well in practice

Break at Minimum Kernel Density Estimation (KDE)

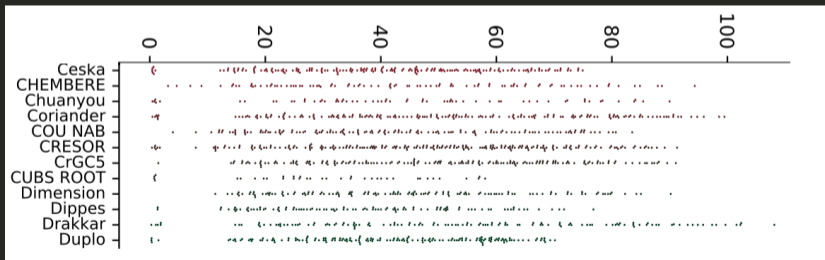
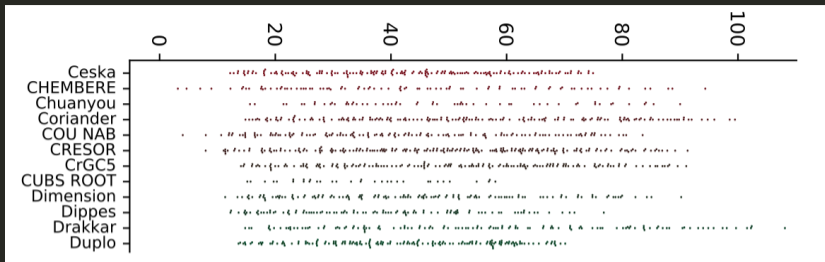
- Beak has no Real Seeds™ and low density
- Expect a gap in real z of detected seeds



- Use KDE to find density of seeds as function of real z



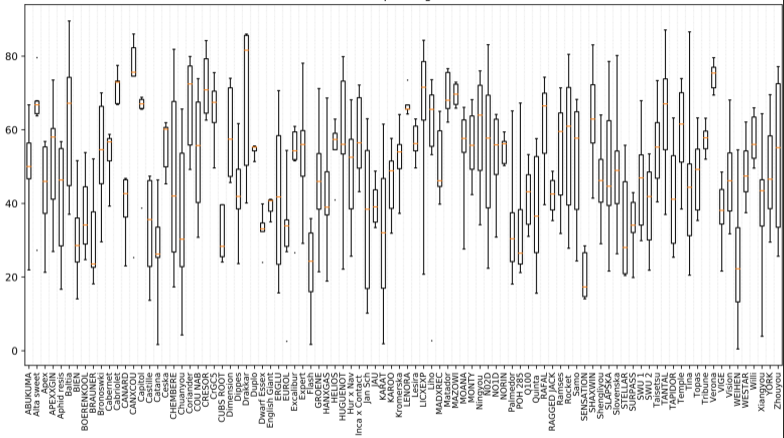
- First seed has real z less than 100?
- Find the local minimum at lowest real z where $\log(\text{KDE}) < -10$
- Keep seeds with greater real z
- Profit



Beak and Silique length

Use the seed with lowest real z to mark the boundary of beak and silique:

silique length



beak length

