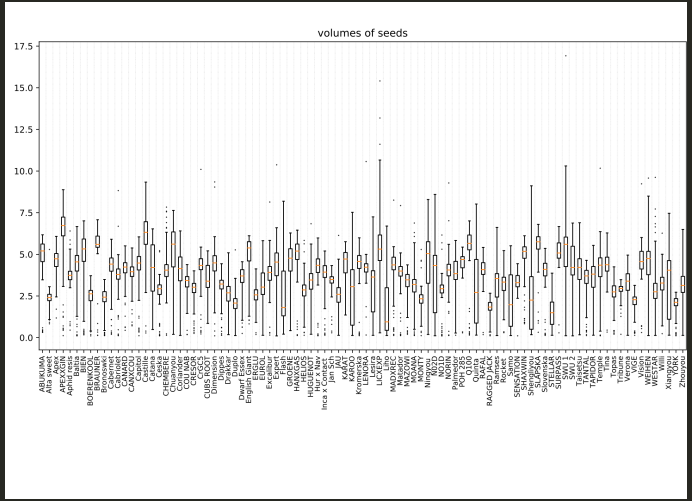
# Looking at microCT data of Brassica pods

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

# Pod Width

# Sphericity

# Volume


volumes of seeds
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
ABJURUMA
Alta sweet
Alex
APEXIDIN
Aphid resis
Baltia
BEN
BOERENVOL
BRAUNER
Brunswick
Cabernet
Cabrelet
CANARD
CANVOU
Capitol
Castile
Catalina
Cesia
CHEMBERE
Chianyou
Cinnamon
COLNAB
CRESOR
CUBS ROOT
Dimension
Dippes
Drakkar
Duplo
Dwarf Essex
English Giant
EUROL
Excalibur
Expert
Fiesta
GRIEBE
HAMGAS
HELIOS
HUGUENOT
Hur x Nav
Inca x Contact
Jan Sch
JAU
KAKAT
KARIOO
Kronenbrink
LENORA
Lestra
LICKEP
Lino
MADIRIEC
Mandor
MAZOWI
MOAMA
MONTY
Ninoyou
NIDO
NOAD
NORIN
Pandemar
POH 205
OLIO
Quinta
RAFAL
RAGGED JACK
Ramses
Rocket
Sarno
SENSATION
SHAKWIN
Shengjiaqiu
SLAPSKA
Sinnemaka
STELLAR
SUBPASS
SWU 1
SWU 2
Tajeskou
TANTAL
TAPIDOR
Temple
Tina
Topas
Triaure
Verona
VIGE
Vision
WEIHEN
WEIPAR
Willi
Xiangyou
YORK
Zhouyou

# Surface Area

# Correlations

# 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

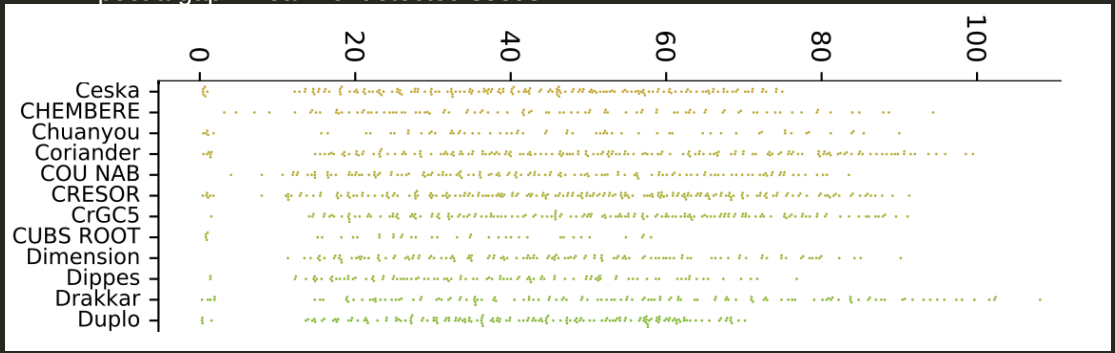
# Distinguishing between beak tip and Real Seeds™

## Failed approaches:

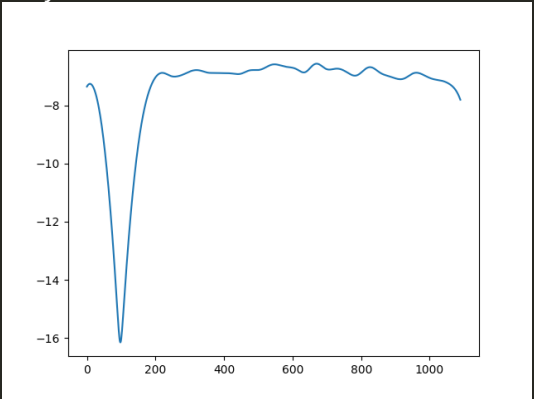
1. Assert that seeds must not be implausible - Removed insufficiently many seeds
    - Too close to the ends of the pod
    - Too large given pod dimensions
2. Real z position of seeds of a pod is a sample from some probability distribution, fit and paramterize the distribution to classify seeds.
    - 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



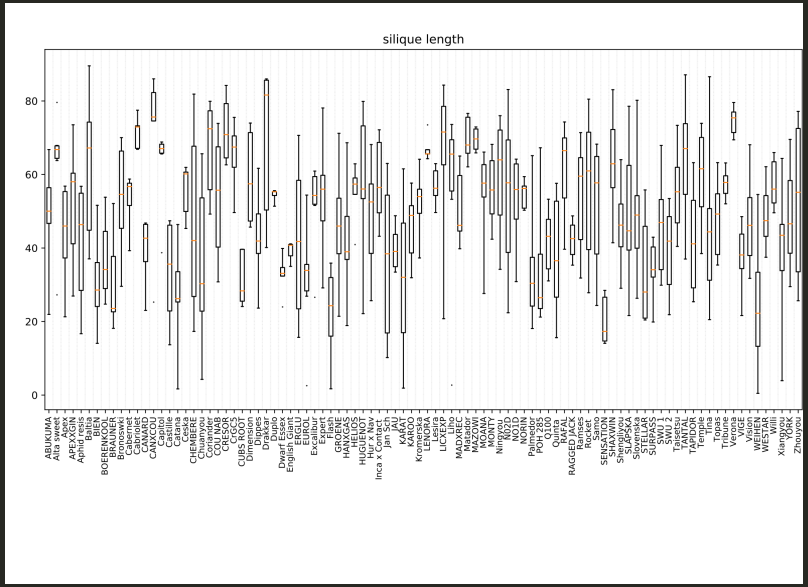

- First seed has real z less than 100?
- Find the local minimum at lowest real z where log(KDE)<-10
- Keep seeds with greater real z
- Profit

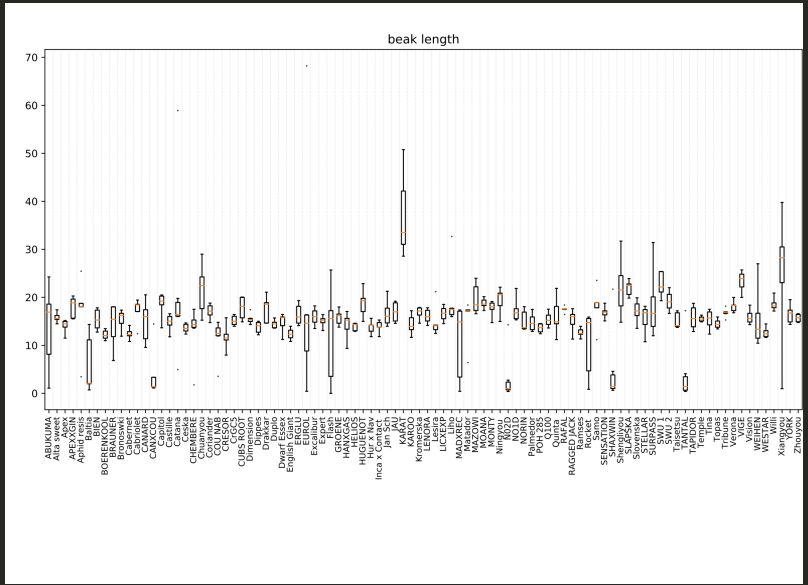
0
20
40
60
80
100
Ceska
CHEMBERE
Chuanyou
Coriander
COU NAB
CRESOR
CrGC5
CUBS ROOT
Dimension
Dippes
Drakkar
Duplo


0
20
40
60
80
100
Ceska
CHEMBERE
Chuanyou
Coriander
COU NAB
CRESOR
CrGC5
CUBS ROOT
Dimension
Dippes
Drakkar
Duplo

# Beak and Silique length

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


silique length
0
20
40
60
80
ABUKUMA
Alta sweet
Apex
APEXXGIN
Aphid resis
Balta
BIEN
BOERENKOOL
BRAUNER
Brunoswiel
Cabernet
Cabriolet
CANARD
CANXCOU
Capitol
Castille
Catana
Ceska
CHEMBERE
Chuanyou
Coriander
COUNAB
CRESOR
CrGCS
CUBS ROOT
Dimension
Dippes
Drakkar
Duplo
Dwarf Essex
English Giant
ERGLU
EUROL
Excalibur
Expert
Fish
GRONE
HANGAS
HELIOS
HUGUENOT
Hurx Nav
Inca x Contact
Jan Sch
JAU
KARAT
KAROO
Kromerska
LENORA
Lesira
LICKEXP
Lino
MADUREC
Matador
MAZOWI
MOANA
MONTY
Nimrod
NO2D
NO3D
NORIN
Palmedor
POH 285
Q100
Quinta
RAFAL
RAGGED JACK
Ramses
Rocket
Sarno
SENSATION
SHAKWIN
Shengliyou
SLAPSKA
Slovenska
STELLAR
SURASS
SWU 1
SWU 2
Taisetsu
TANTAL
TAPIDOR
Temple
Tina
Topas
Tribune
Verona
VIGE
Vision
WEIHEN
WESTAR
Willi
Xiangyou
YORK
Zhouyou


beak length
70
60
50
40
30
20
10
0
ABUKUMA
Alta Sweet
Apex
APEXGIN
Aphid Tesis
Balta
BIEN
BOERENKOOL
BRAUNER
Brunoswiki
Cabernet
Cabriolet
CANARD
CANXCOU
Capitol
Castille
Catana
Ceska
CHEMBERE
Chaumont
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