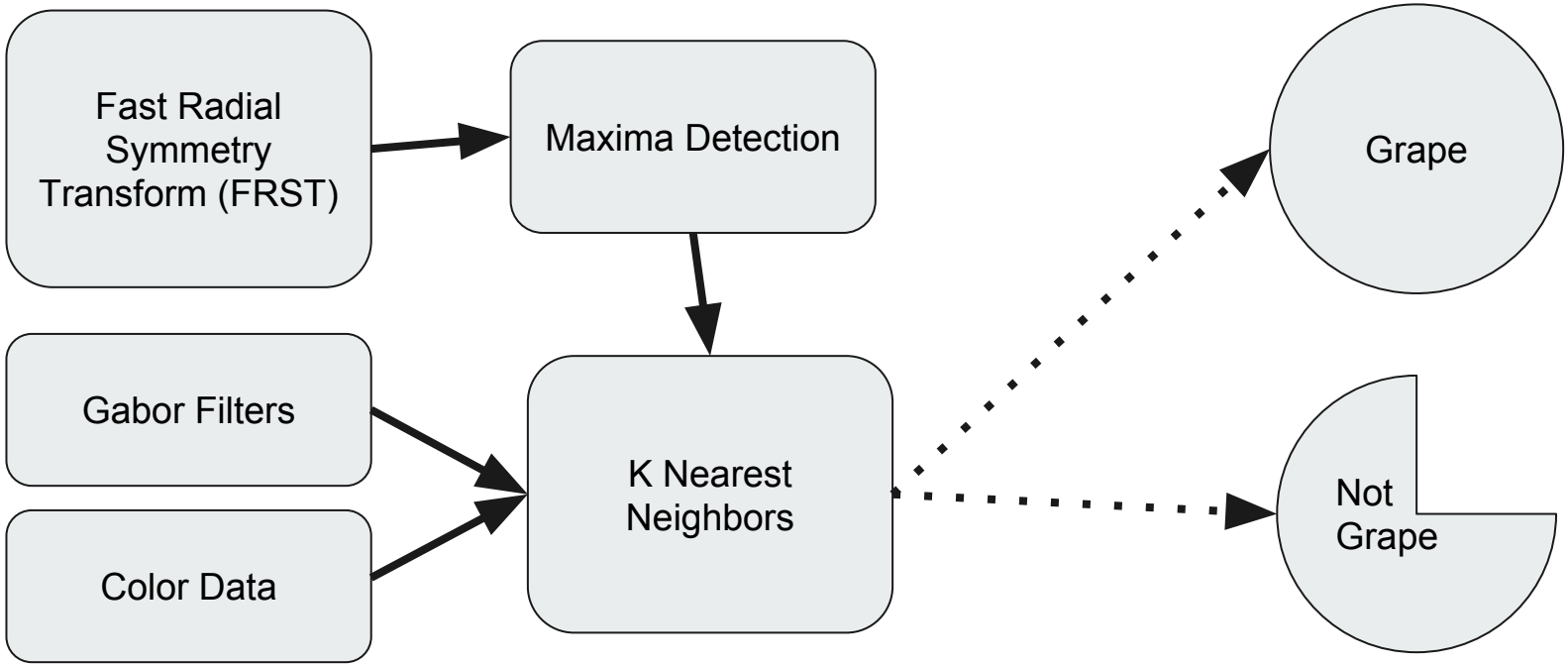
Computer Vision for Grape Counting

Prior Work

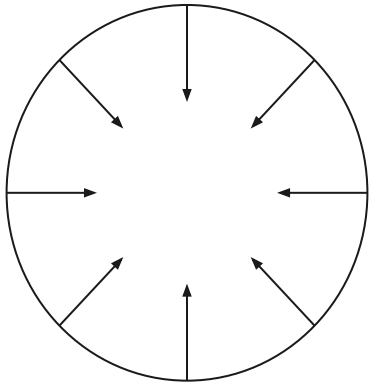
- *Nuske et al.: Yield Estimation in Vineyards by Visual Grape Detection (2011)*
  - Berry count using CV → Yield Predictions
  - 60/**30**/10 rule
    - Validity?
  - Later Nuske studies refine yield estimation model
  - Claim 10% error on yield estimates *(done by retrofitting dataset)*

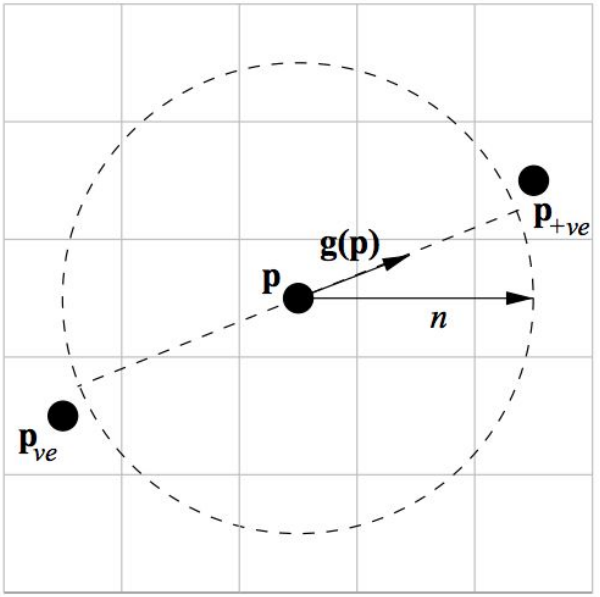
Grape Detection Method



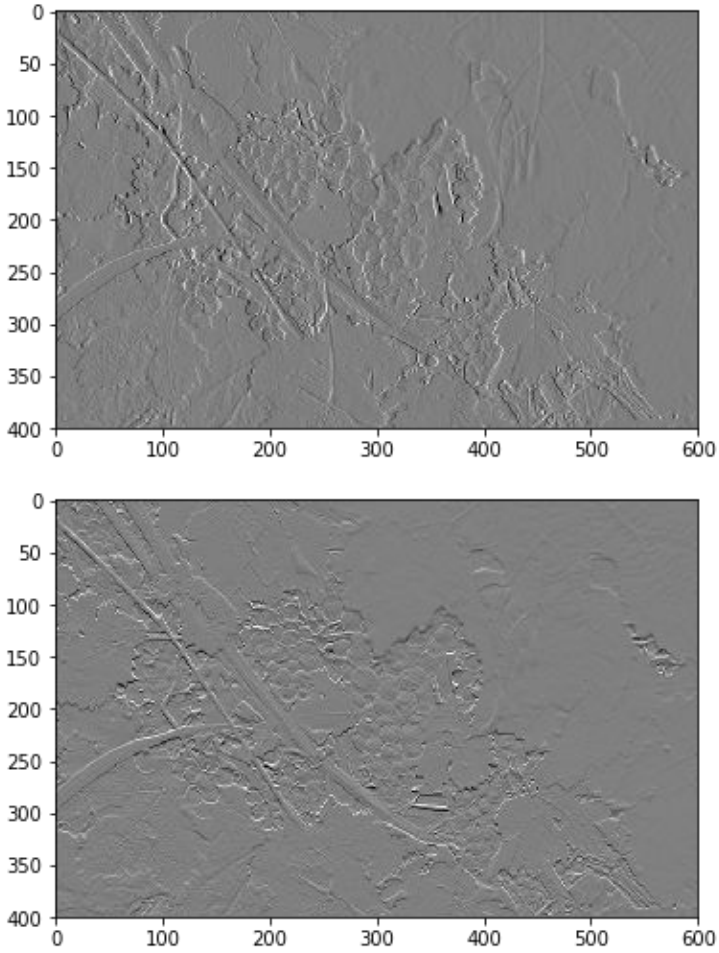
Radial Symmetry Transform

- *Loy & Zelinsky (2003)*
  - Find direction/magnitude of gradient vector from each point
  - Determine locations of radial symmetry
  - ‘Voting’ process
- Python implementation

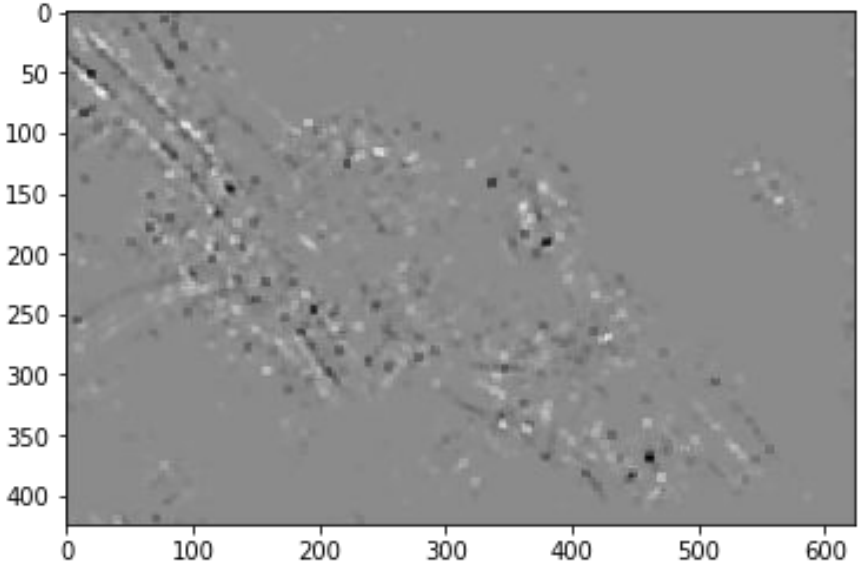


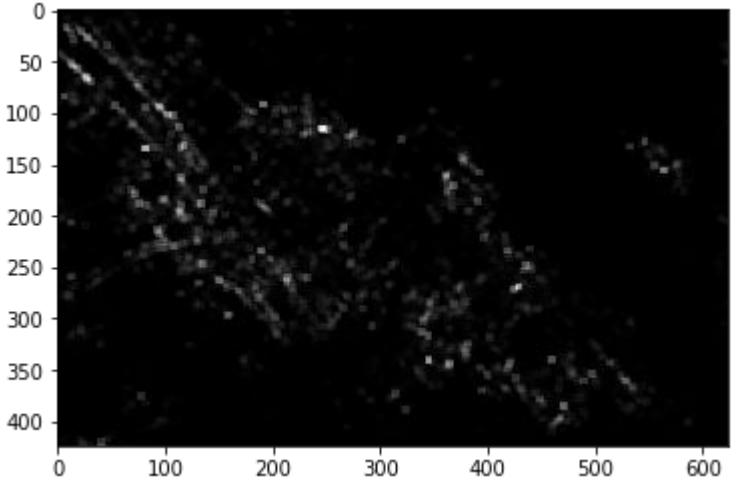


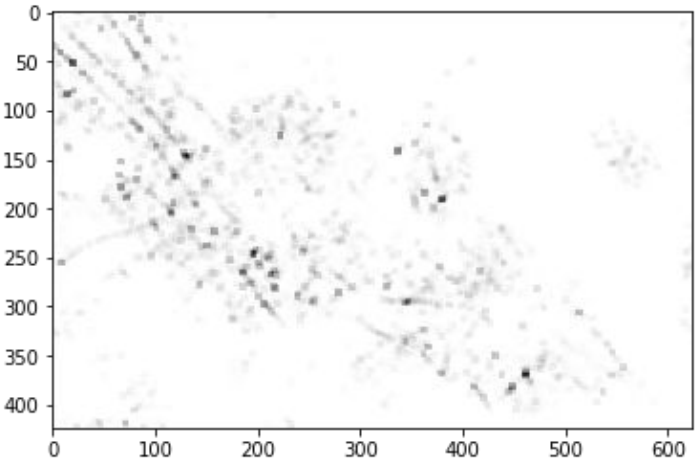
Radial Symmetry Transform



Radial Symmetry Transform

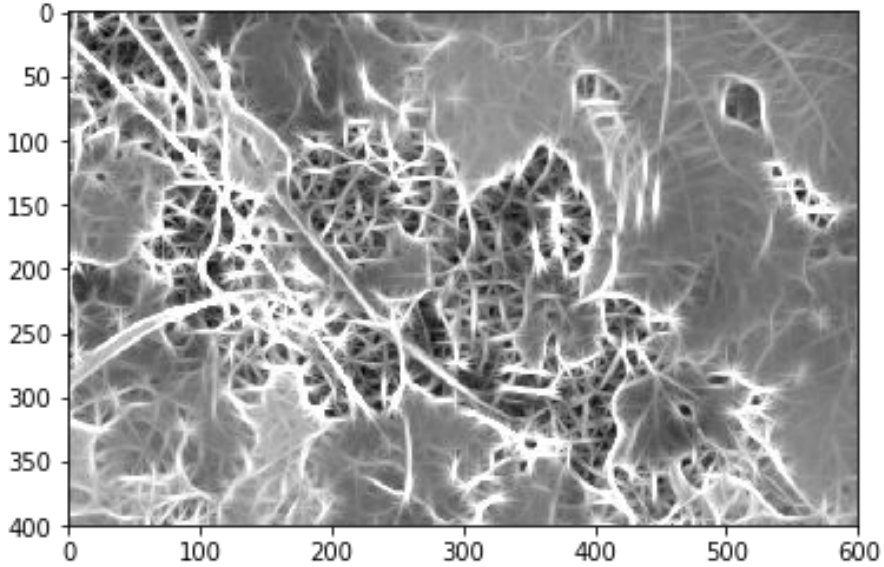


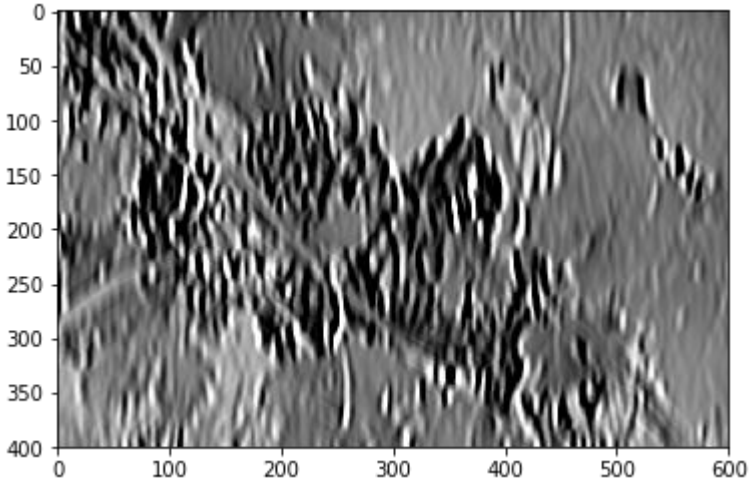




Gabor Filters

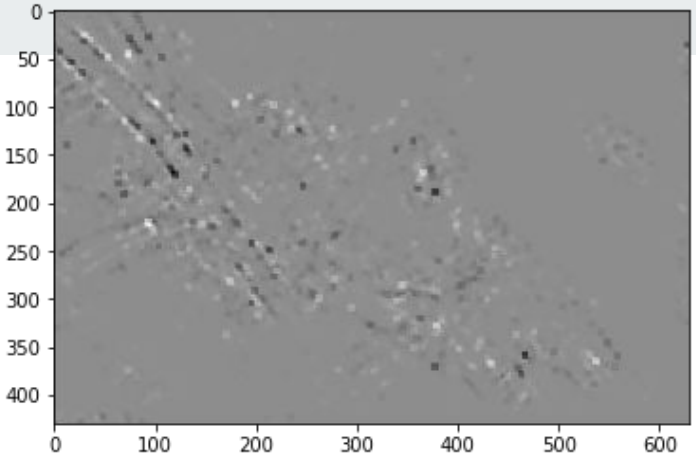
- Edge detection w/ directionality
- Supposedly similar to how brains process images





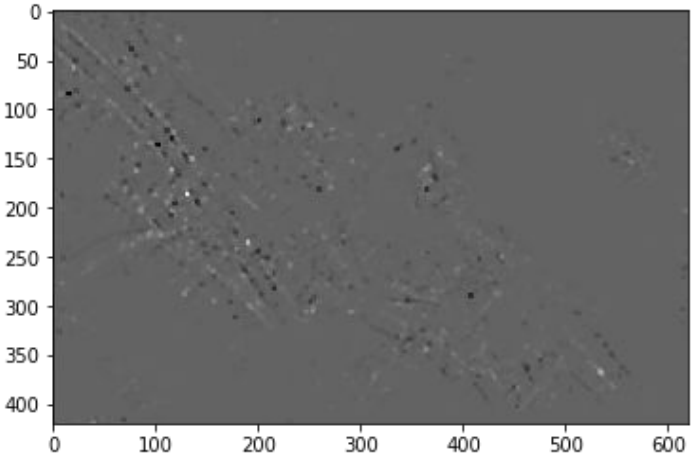
Results

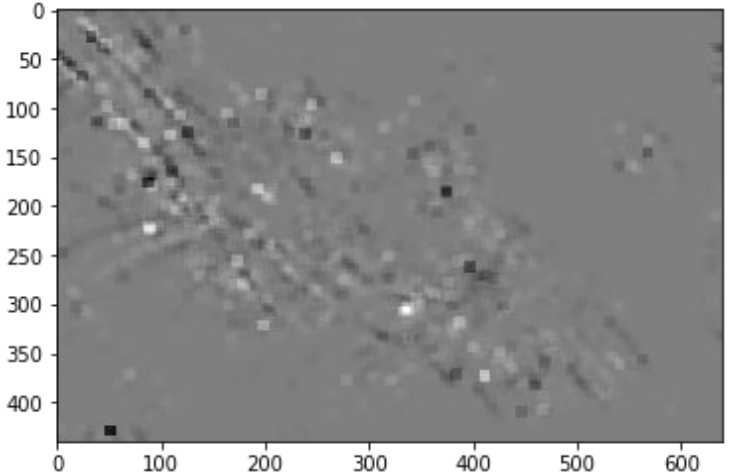
- Ran 30-dimensional feature extraction on a few images
  - ~500 points of radial symmetry
- K nearest neighbors classification
  - ~90% success in classifying
- Issue with RST detection
  - Imprecise
- **Could definitely serve as component/foundation of yield estimation system**


0
50
100
150
200
250
300
350
400
0
100
200
300
400
500
600

n=15

n=10

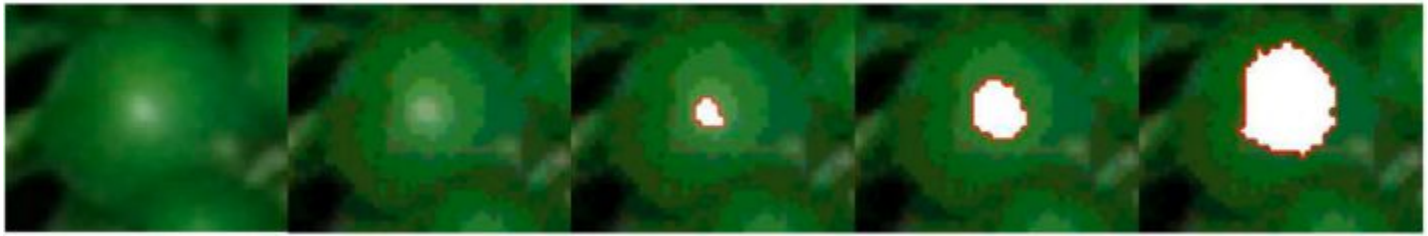

0
50
100
150
200
250
300
350
400
0
100
200
300
400
500
600


0
50
100
150
200
250
300
350
400
0
100
200
300
400
500
600

n=20

Thoughts/Conclusions

- Nuske et al's pivots from 2011 to 2015 make sense:
  - Gabor filters not good for classifying
    - SIFT
  - FRST probably not *best* way to find grape centers
    - Invariant maximal detector - lose flexibility



- **Cluster counting**
  - Less work, more gain?