

Quantifying the shape of barley

using Topological Data Analysis

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Barley across the world

Tjøtta
(Nordland,
Norway)

Kiliskoye
(Chelyabinsk,
Russia)

Marchouch
(Rabat,
Morocco)

Bagdad
(Iraq)

Aksum
(Tigray,
Ethiopia)

Hanumangarh
(Rajasthan,
India)

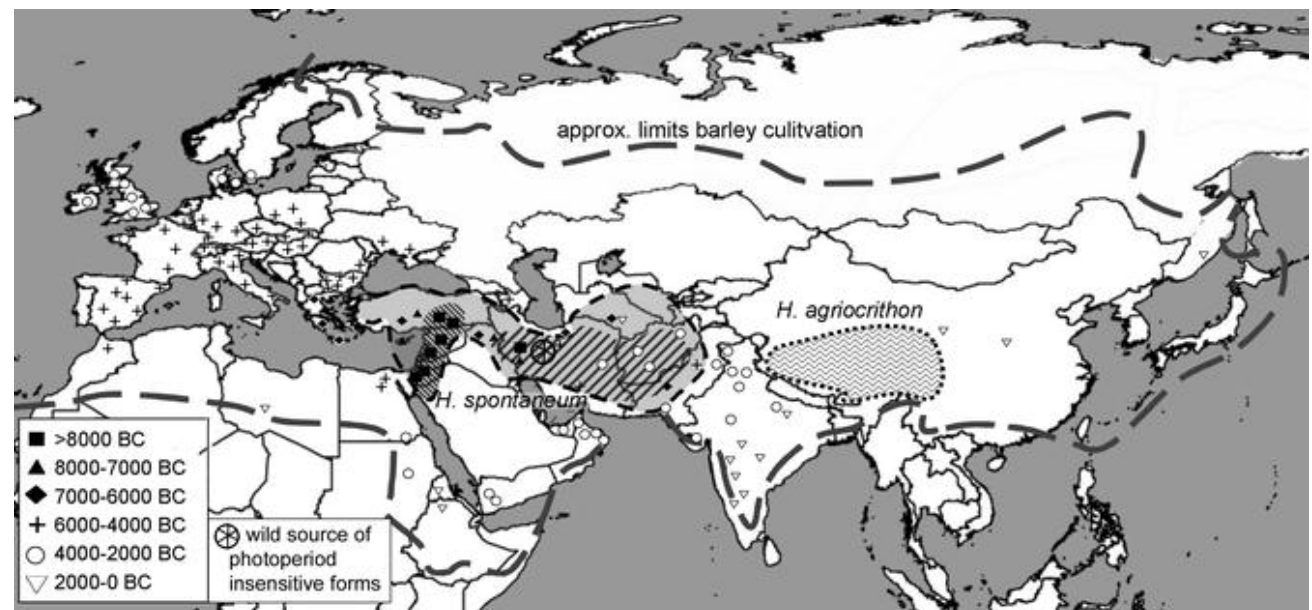
Click on any
picture for
more
details and
credits



Two young men harvesting barley in northern Ethiopia.



Morphological seed diversity of lines

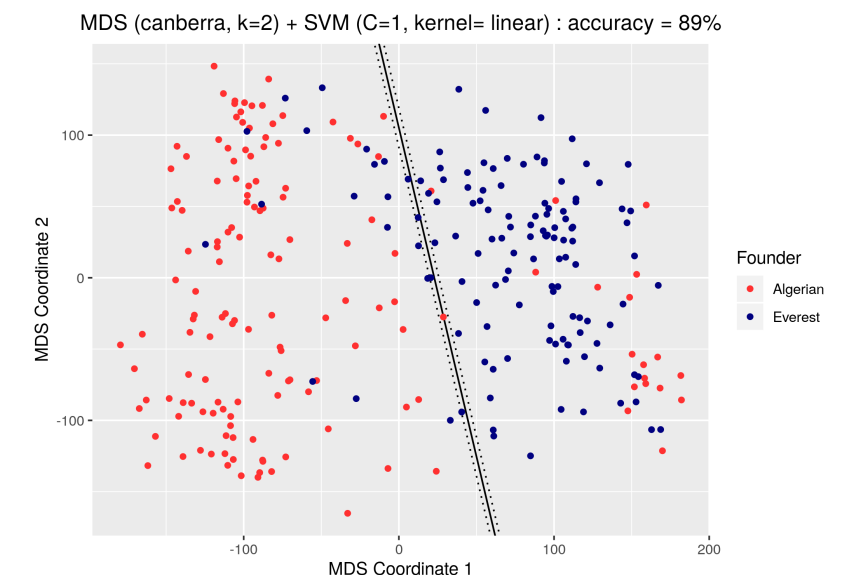
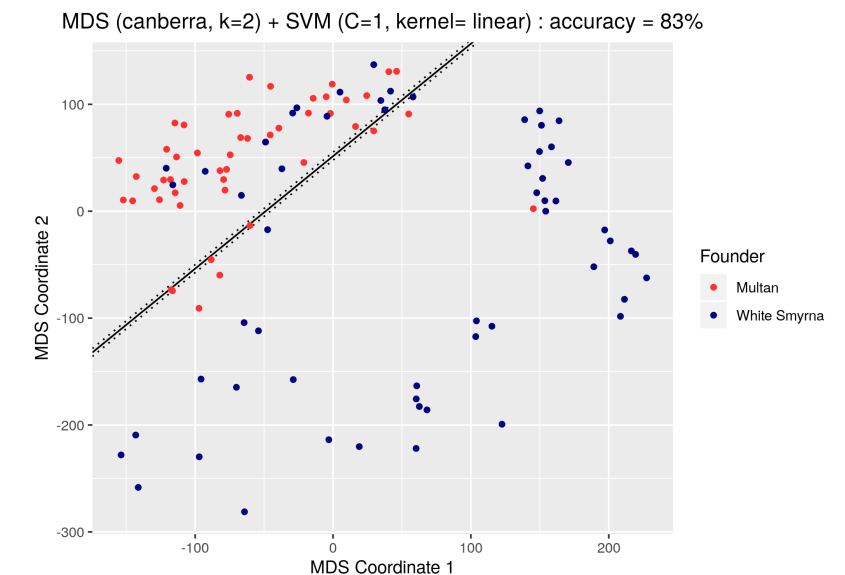
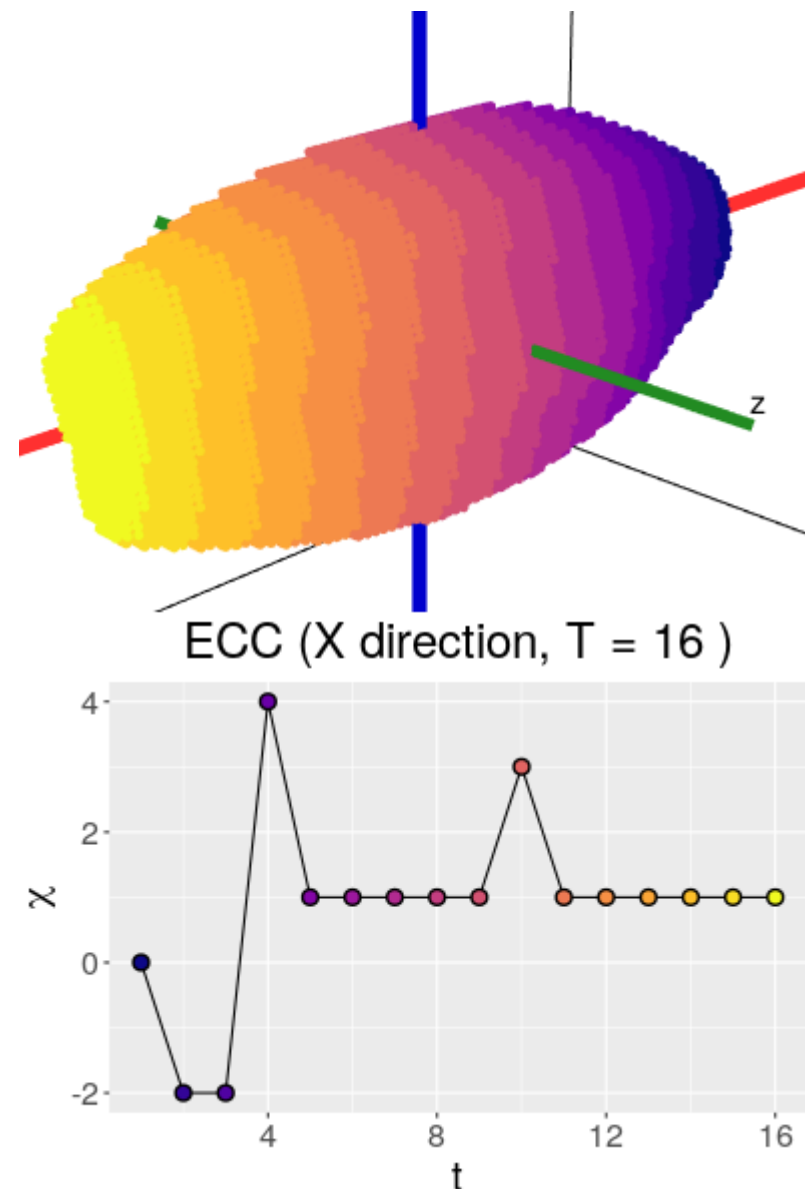


Barley seeds from Scotland and Tibet.

Historical expansion of the barley as a crop.

Click on any picture for more details and credits

Topological Data Analysis (TDA)



Raw Data

- X-ray CT
- Point clouds
- Time series

Topological Summary

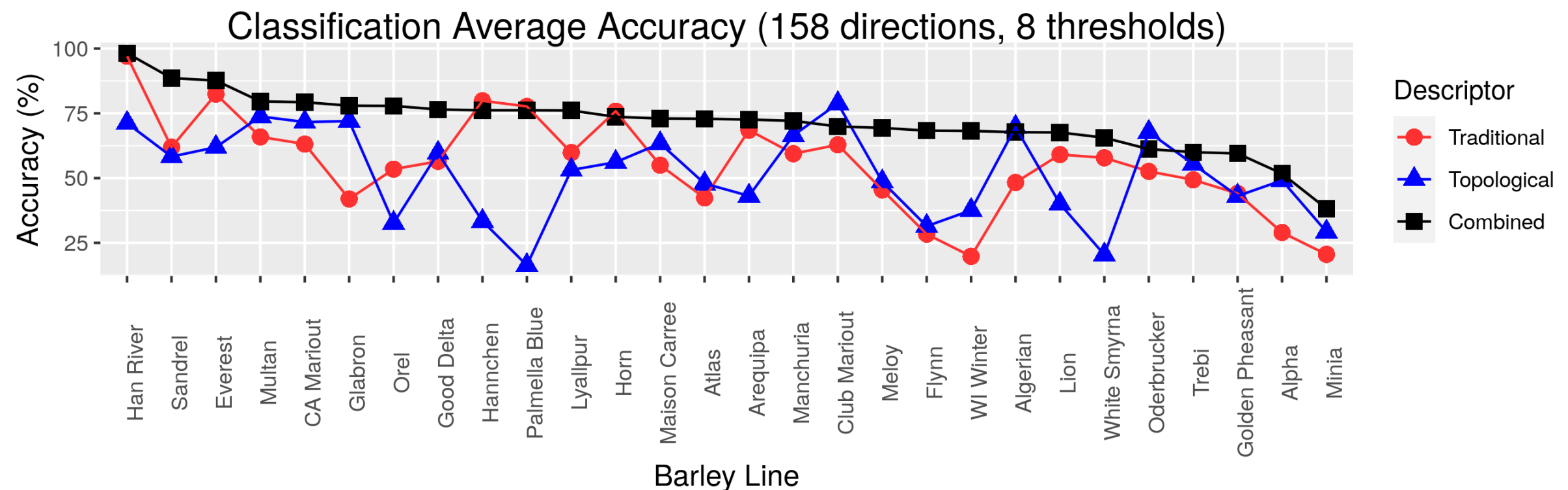
- Euler Characteristic
- Persistence diagrams
- Mapper/Reeb graphs

Analysis

- Statistics
- Machine learning
- Classification/prediction

Classification of 28 lines with SVM

Shape descriptors	No. of descriptors	Classification accuracy
Traditional	11	54.7% --- 57.1%
Topological (ECT + KPCA)	12	53.9% --- 56.9%
Combined (Traditional + Topological)	23	70.0% --- 72.4%



Grab the animated slides at bit.ly/nappn21_barley