

Automatic classification of brightfield microscopy pollen samples using a Tchebichef moment-based texture descriptor

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INTRODUCTION

PALYNOLOGY

Palynologists are the experts responsible for the study of pollen grains produced by seed plants and spores.

WHY AUTOMATED POLLEN IDENTIFICATION?

Currently, pollen identification is based on **visual inspection of each microscopy image**:

1. Time-consuming and costly procedure.
2. Subjective result depending on the expert's criterion.

STRATEGY

The classification of pollen grains captured through a microscope is modelled as a **pattern recognition** task, which encompasses two main stages:

1. **Image processing** techniques are used to extract relevant pollen features forming a pattern.
2. A group of pollen samples is used to infer the statistical properties of each taxa onto a **classification algorithm**.

METHODS

PATTERN RECOGNITION APPROACH

1. **Feature extraction.** Texture signature based on Tchebichef moments (Marcos and Cristobal, 2013).

$$M(s) = \sum_{p+q=s} |T_{pq}|, \quad (s = 0, 1, \dots, 2L - 2). \quad (1)$$

2. **Classification.** *K*-nearest neighbour algorithm.

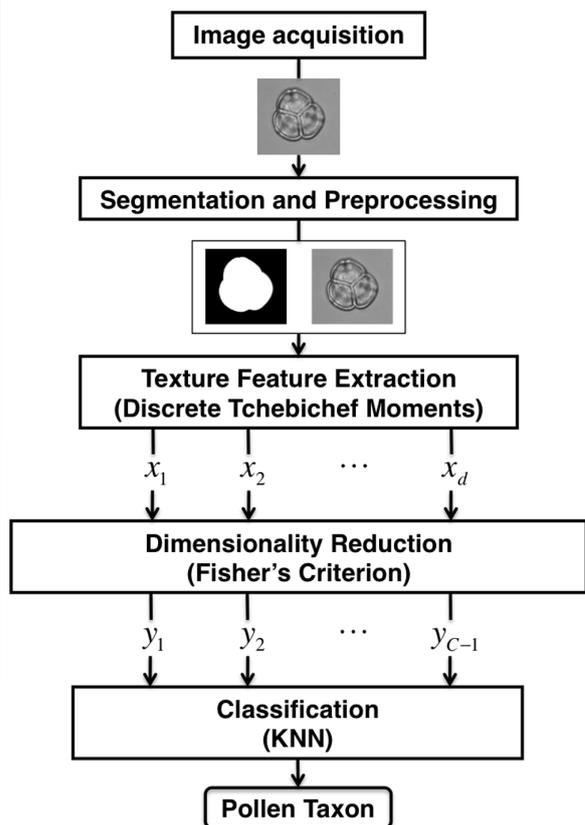


Fig. 2. Scheme of the methodology for automated pollen identification.

DATA

EQUIPMENT

Pollen images were captured using a NIKON E200 microscope and a camera NIKON DS Fi1 (x40 magnification).

DATASET

Brightfield microscopy images from **15 honey-bee pollen taxa**: 120 images/taxon.

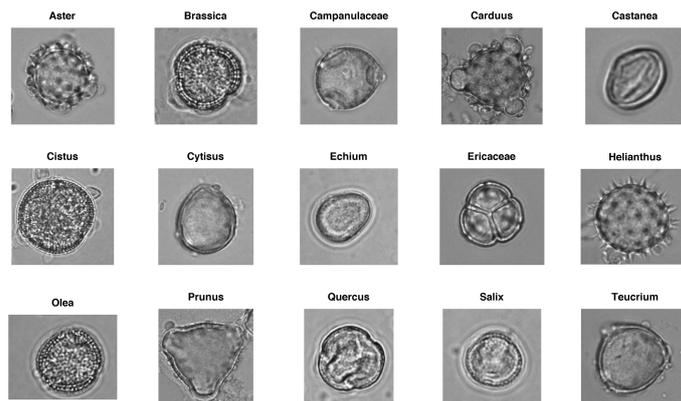


Fig. 1. Microscopy images of the 15 pollen taxa considered in our study.

RESULTS

TEXTURE SIGNATURES

The **signature** summarizes the properties of the **pollen texture**.

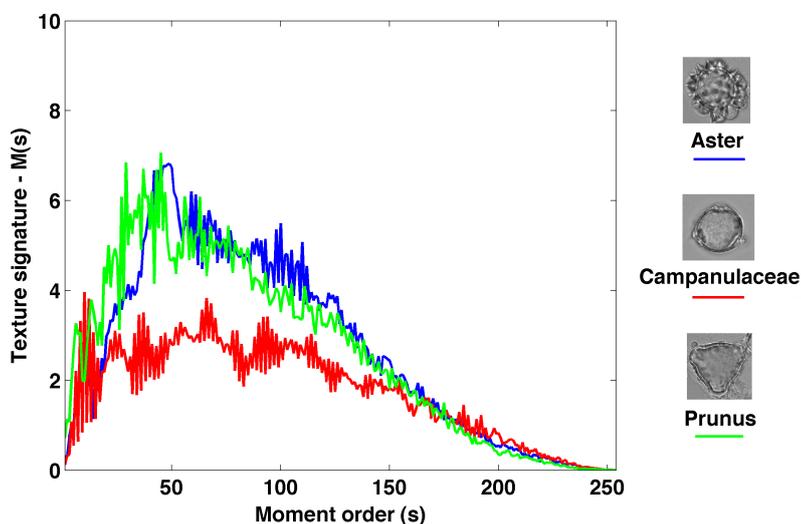


Fig. 3. Texture signatures obtained for three pollen samples.

Classification accuracy of 92.06%

CONCLUSIONS

1. Texture is a **distinguishing property** of the pollen taxon
2. Texture should be considered in **image-based applications** pursuing **automatic pollen identification**.

REFERENCES

- [1] J.V. Marcos and G. Cristobal, Texture classification using discrete Tchebichef moments, J. Opt. Soc. Am. A, vol. 30, pp. 1580–1591 (2013)