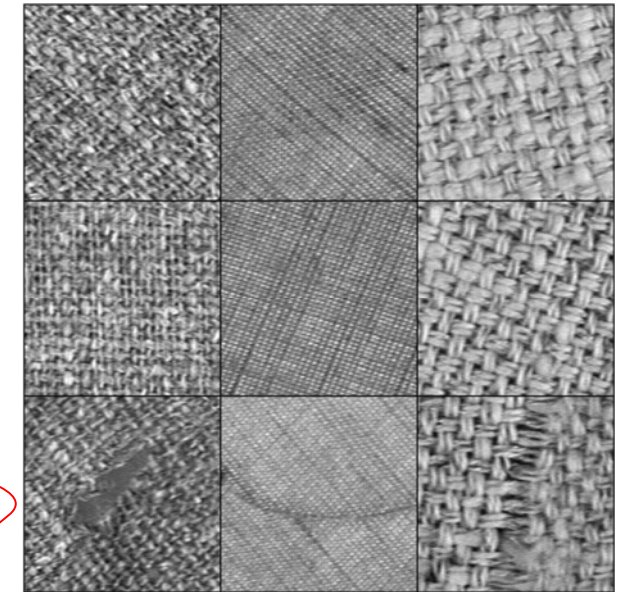


Anwendungen: Invarianten über Gruppenmittel

- Sichtprüfungsaufgaben (Textilien)
- Bildsuchmaschinen (query by example)
SIMBA und MICHELScope
- Automatische Klassifikation von Blütenpollen

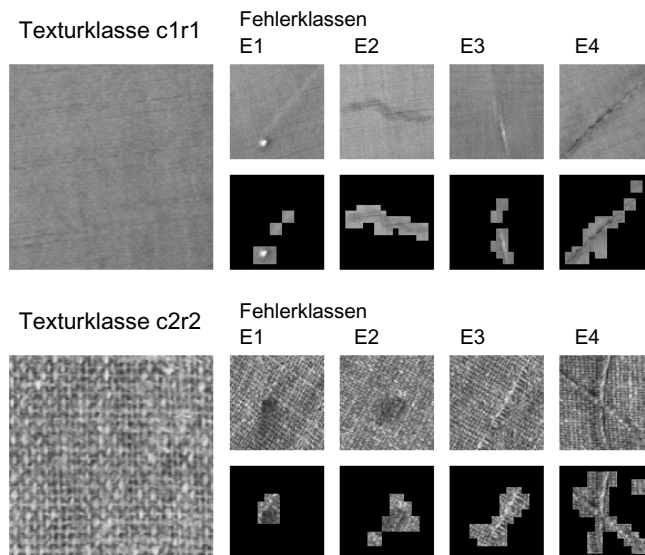
Visual inspection of
textiles with
anisotropic texture



Textildatenbank TILDA

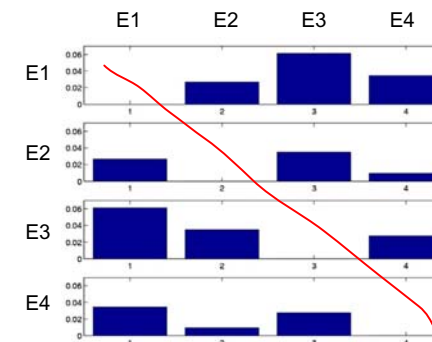
<http://www.informatik.uni-freiburg.de/~lmb/tilda> (ca. 3200 images)

Texturdefektdetektion bei Textilstoffen Segmentierung der Defekte

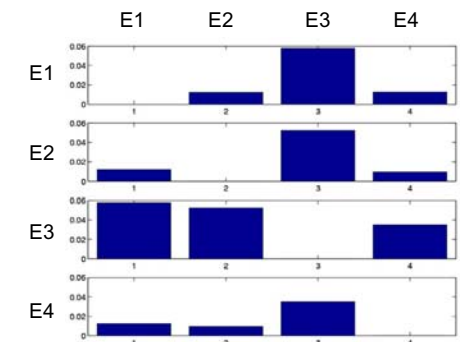


Texturdefektdetektion bei Textilstoffen Diskriminierung der Defektklassen

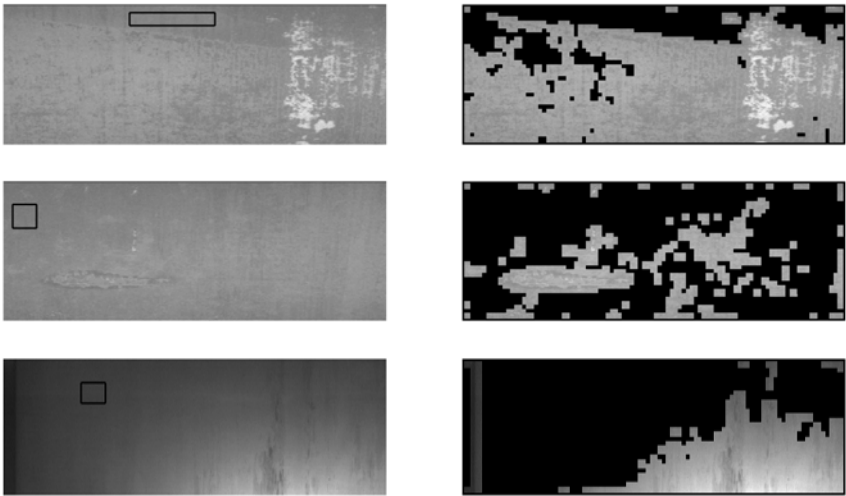
Klassendistanzen Texturklasse c1r1



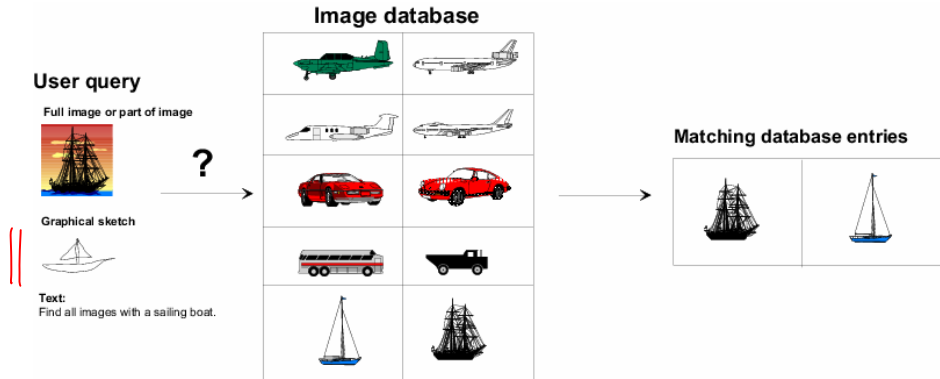
Klassendistanzen Texturklasse c2r2



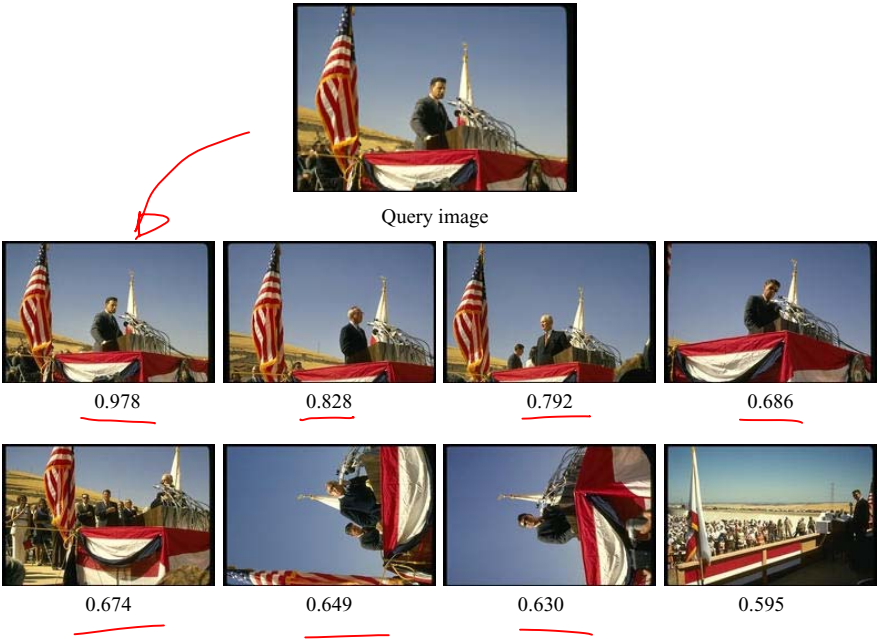
Texturdefektdetektion auf Stahloberflächen
 Segmentierung der Defekte



Content based image retrieval



<http://simba.informatik.uni-freiburg.de/>

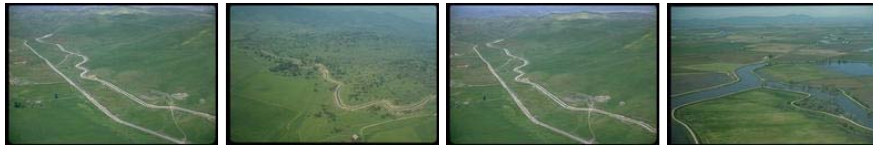




Query image



0.99 0.79 0.77 0.68



0.68 0.66 0.66 0.66



Query image



0.98 0.82 0.79 0.77



0.74 0.73 0.71 0.71



Query image



0.98 0.79 0.77 0.68



0.68 0.65 0.65 0.63



Query image



0.98 0.80 0.78 0.74



0.70 0.60 0.59 0.57

SIMBA – Search IMages By Appearance

COLOR only



Search template



96827

63939.4

62383.7

60840.3



59997.4

59316.6

59061

58323.8

SIMBA – Search IMages By Appearance



Search template

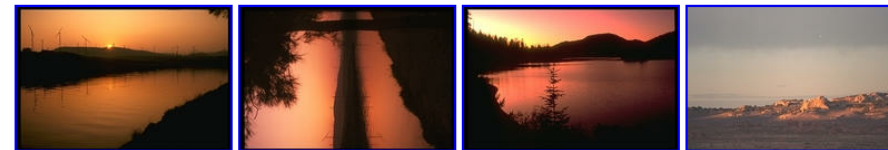


87948.7

85491.7

85163

84896.4



84603.2

84379.5

84065.4

83475.7

SIMBA – Search IMages By Appearance



Search template



96689.4

81479.3

77883.8

71489.1



70400.4

67864.2

66298.7

66249.5



SIMBA – Search IMages By Appearance



Search template



92393.05

81203.6

77685.85

75091.55



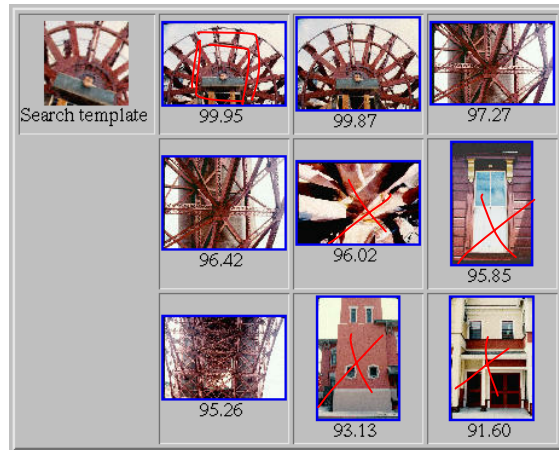
71376.85

70761.3

69292.6

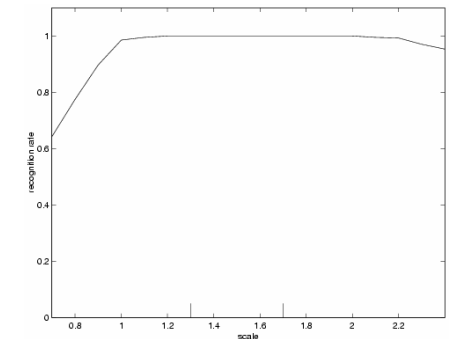
68030.95

Experiments



Robustness to scaling

- Database as before, grayvalue features only
- Kernels $M(1,0)M(0,2)$, $M(2,0)M(0,4)$
- Images reduced/zoomed (bilinear interpolation) to scales from 0.7 to 2.4
- Database contains scales 1.3 and 1.7 only

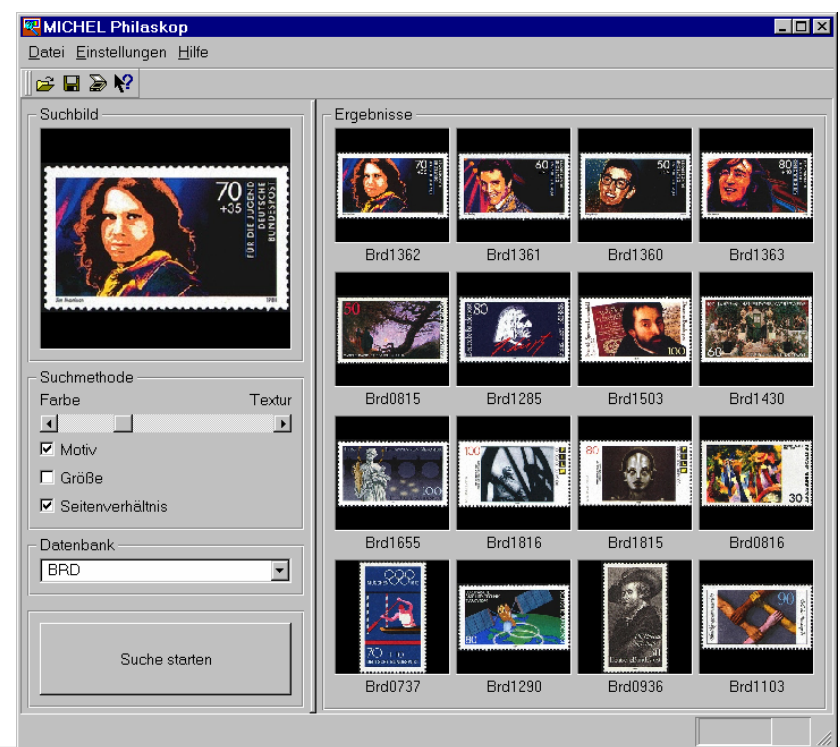
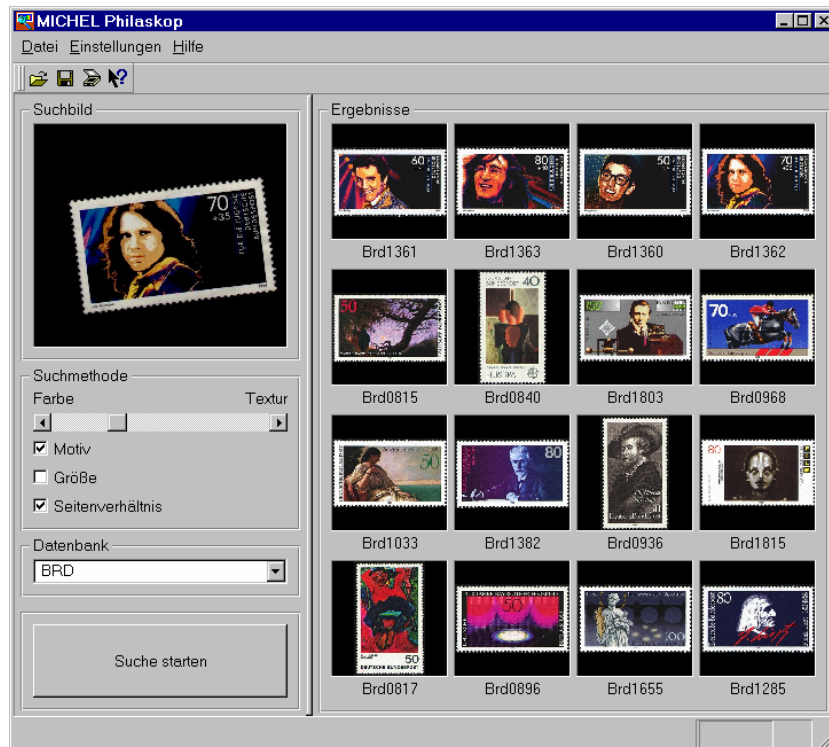
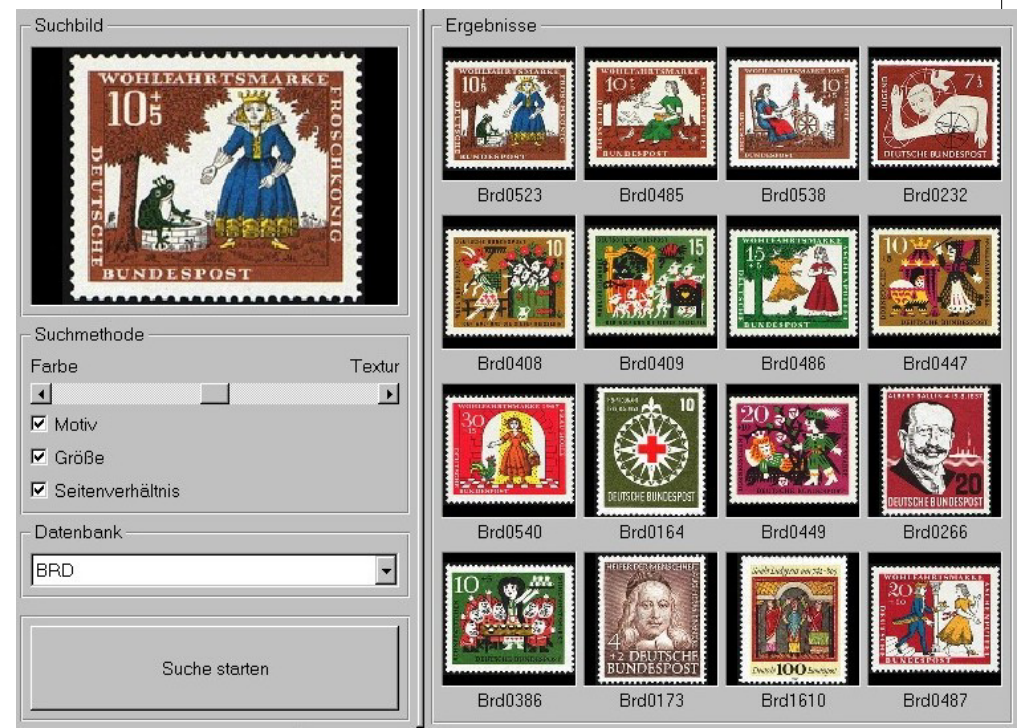


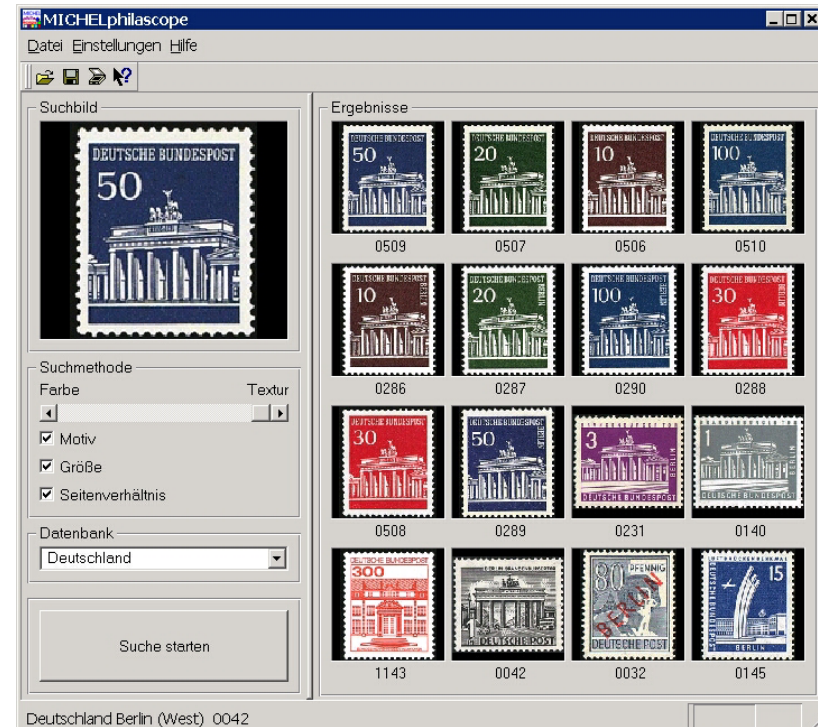
→ Good recognition from scale 1 to 2.2, i.e. scale 4.8 in area

SIMBA Searching Images by Appearance

<http://simba.informatik.uni-freiburg.de/>







Automated Pollen Recognition in Air Samples by Digital Microscopy

O. Ronneberger, U. Heimann, V. Dietze, E. Schultz

► Motivation

- Time-consuming, but still inaccurate visual pollen counting

► Demand

- Reliable pollen data for pollen forecast

► Approach

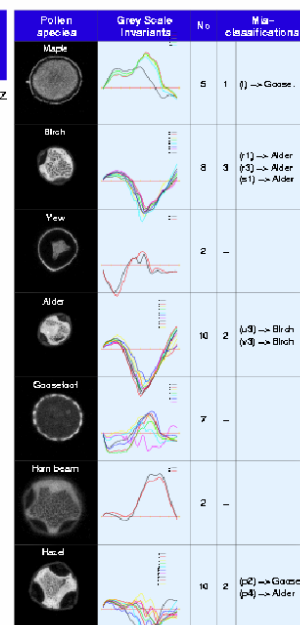
- 3D fluorescence imaging (tomography) instead of 2D conventional translucent microscopy
- Image recognition based on general »grey scale invariants«, instead of traditional object specific features

► First results (see table on the right)

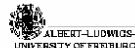
- »Grey scale invariants« have characteristic shapes for different pollen species
- Recognition rate of 82% already in a first run

► Outlook

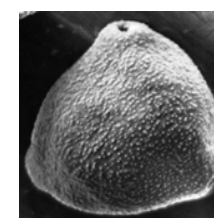
- Employment of digital microscopy for automated particle analysis in general.



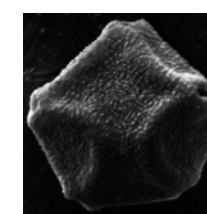
Collaborating institutions



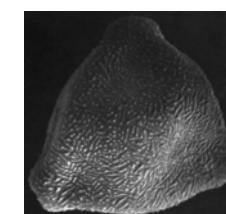
Pollen examples



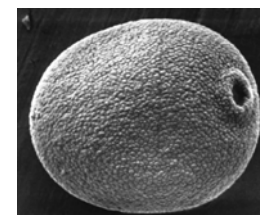
Hasel



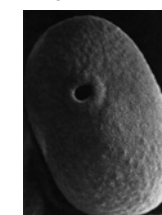
Erle



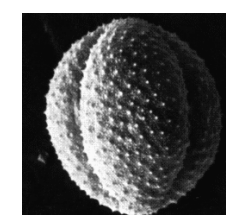
Birke



Gräser



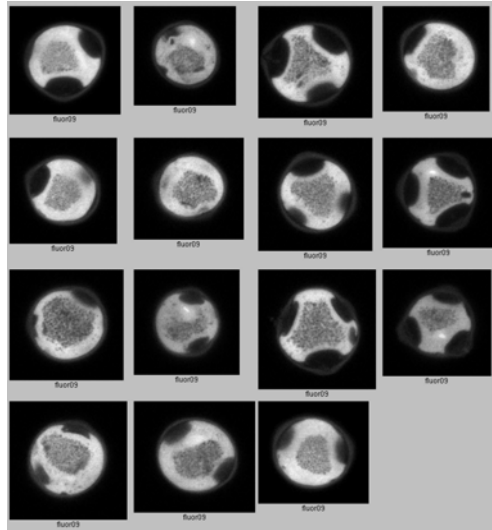
Roggen



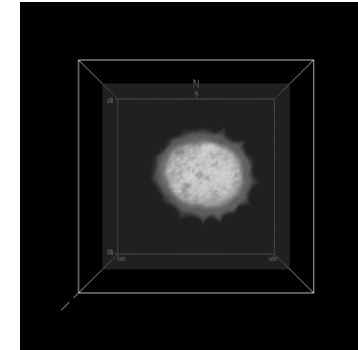
Beifuß

+ 33 further species (not relevant for allergies)

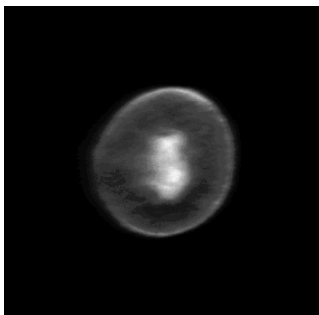
Haselpollen



Gänseblümchen/daisy pollen grain



Eibe/Taxus



Reference Data Base Description

- 26 pollen species directly sampled from the plants
 - Correctly assigned species
 - Maybe less variation in size and shape compared to airborne pollen (no different sub-species, no regional variation)
 - No deformation or contamination or agglomeration
- Recording 3D volumes of about 15 samples of each species with a Confocal Laser Scanning Microscope
 - No distortions of the data due to imperfect imaging of a usual microscope

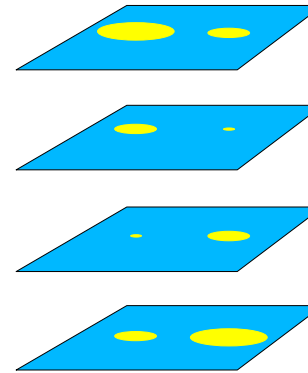
Classification Results using 3D LSM Data

(leave-one-out Classification)

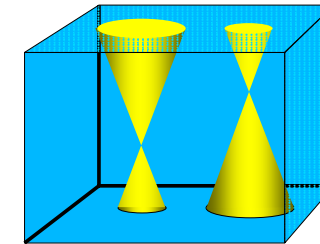
	Correct	Wrong classifications
<i>Artemisia:</i>	13	1 -> <i>Compositae</i> , 1 -> <i>Platanus</i>
<i>Alnus:</i>	15	-
<i>Alnus viridis:</i>	12	-
<i>Betula:</i>	13	2 -> <i>Plantago</i>
<i>Corylus:</i>	13	1 -> <i>Alnus</i>
<i>Gramineae/Poaceae:</i>	15	-
<i>Secale:</i>	11	3 -> <i>Fagus</i> , 1 -> <i>Tilia</i>
Allergolocial irrelevant*:	282	2 -> <i>Gramineae</i>
Total:	97.4%	2.6%

* *Acer*, *Carpinus*, *Chenopodium*, *Compositae*, *Cruciferae*, *Fagus*, *Quercus*, *Aesculus*, *Juglans*, *Fraxinus*, *Plantago*, *Platanus*, *Rumex*, *Populus*, *Salix*, *Taxus*, *Tilia*, *Ulmus*, *Urtica*

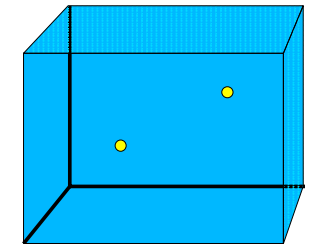
Gewinnung von tomographischen 3D-Daten mit einem normalen Fluoreszenz-Mikroskop



Aufnahme eines Bildstapels mit einem normalen Mikroskop

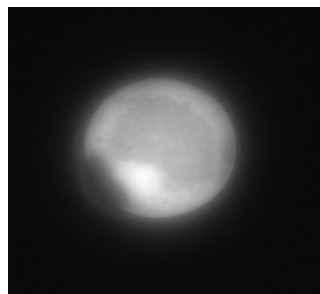


Zusammensetzen der Bilder im Computer zu einem Volumen

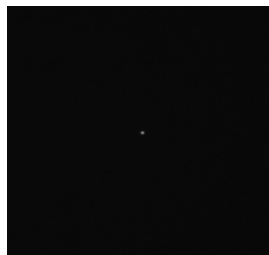


Nach Entfaltung mit der Punktbildfunktion sind alle unscharfen Bereiche entfernt

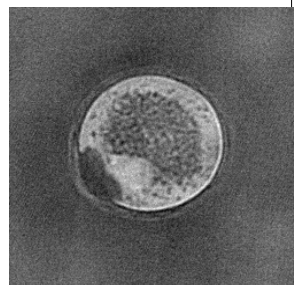
Deconvolution of a Pollen (Hasel/Corylus)



volume



point-spread function



deconvolved volume