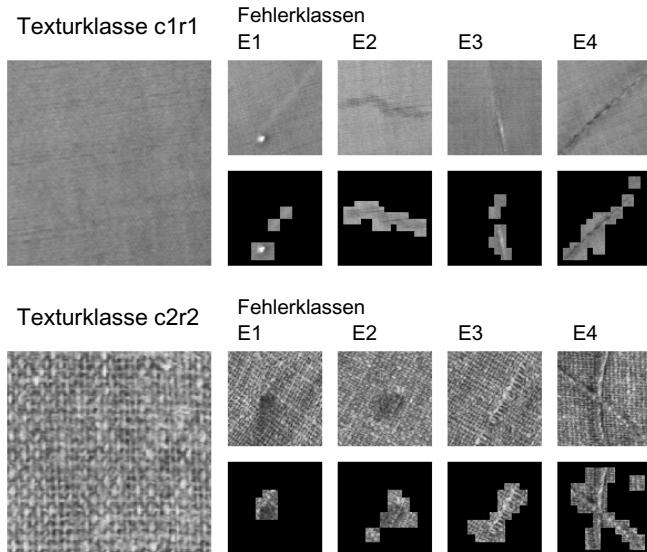


Anwendungen: Invarianten über Gruppenmittel

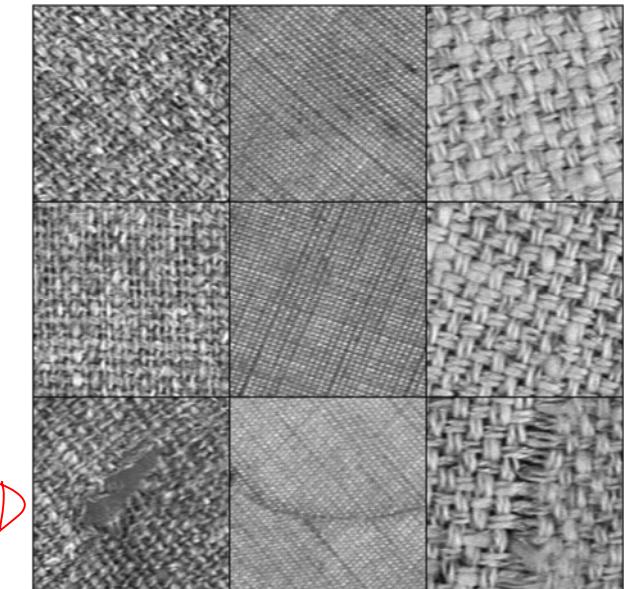
- Sichtprüfungsaufgaben (Textilien)
- Bildsuchmaschinen (query by example)
SIMBA und MICHELSCOPE
- Automatische Klassifikation von Blütenpollen

Texturdefektdetektion bei Textilstoffen

Segmentierung der Defekte



Visual inspection of
textiles with
anisotropic texture



Textildatenbank TILDA

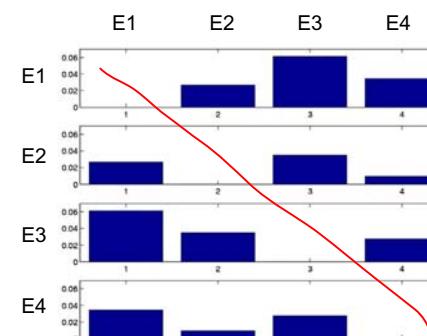
<http://www.informatik.uni-freiburg.de/~lmb/tilda> (ca. 3200 images)



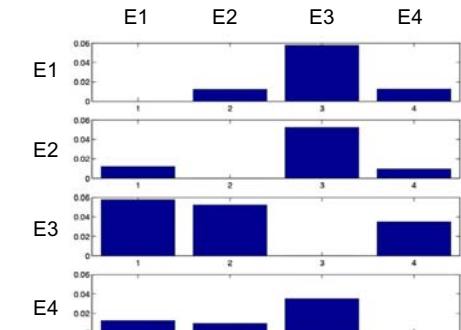
Texturdefektdetektion bei Textilstoffen

Diskriminierung der Defektklassen

Klassendistanzen Texturklasse c1r1

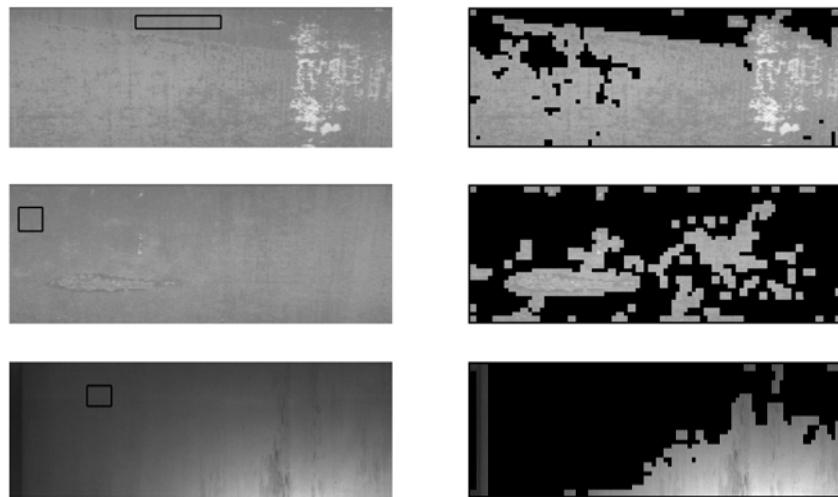


Klassendistanzen Texturklasse c2r2

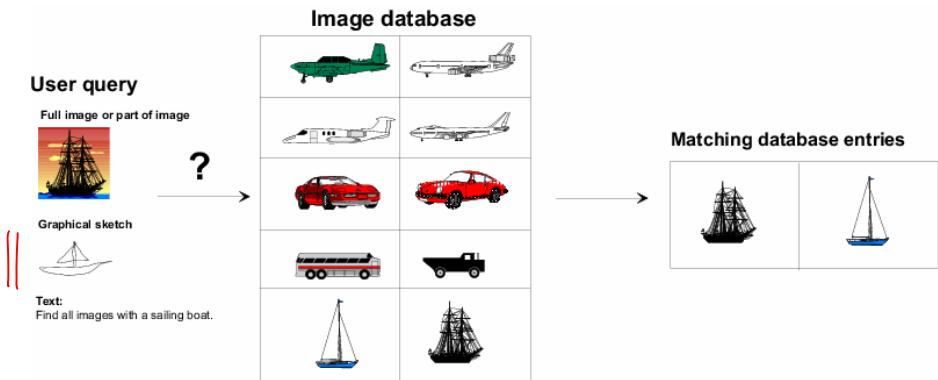


Texturdefektdetektion auf Stahloberflächen

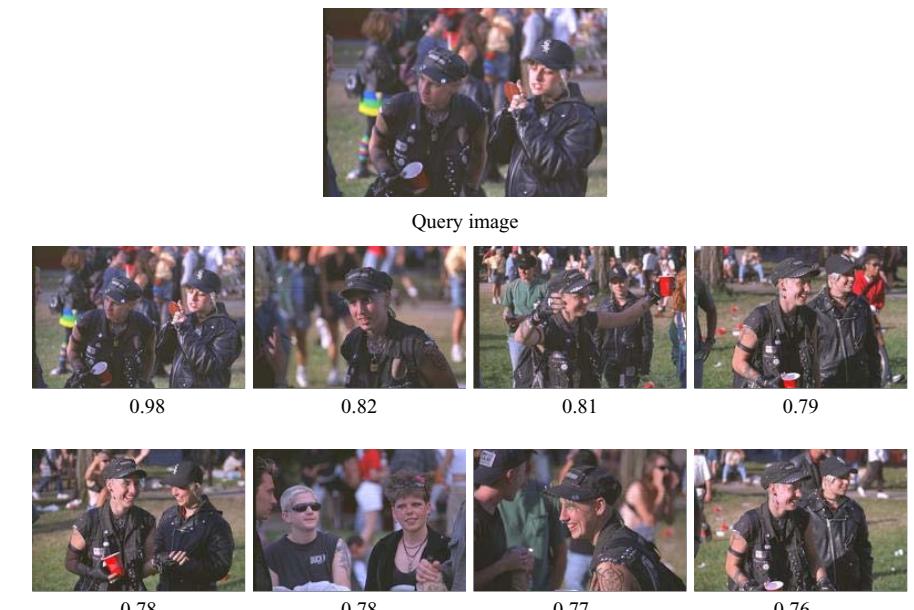
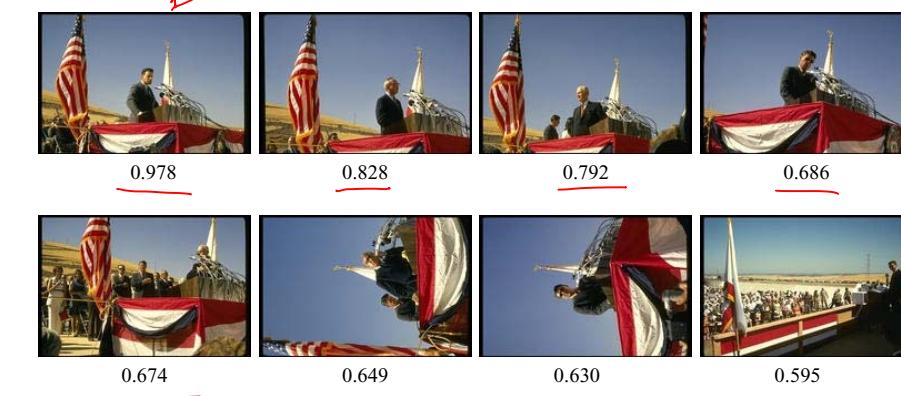
Segmentierung der Defekte



Content based image retrieval



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





Query image



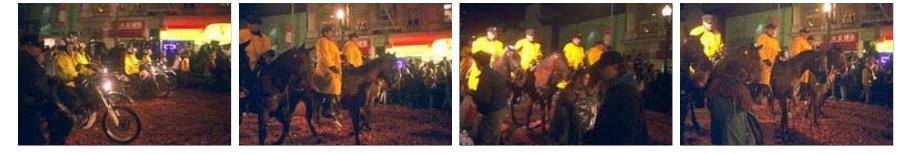
Query image



Query image



Query image



SIMBA – Search IMages By Appearance

COLOR only



Search template



96827

63939.4

62383.7

60840.3

59997.4

59316.6

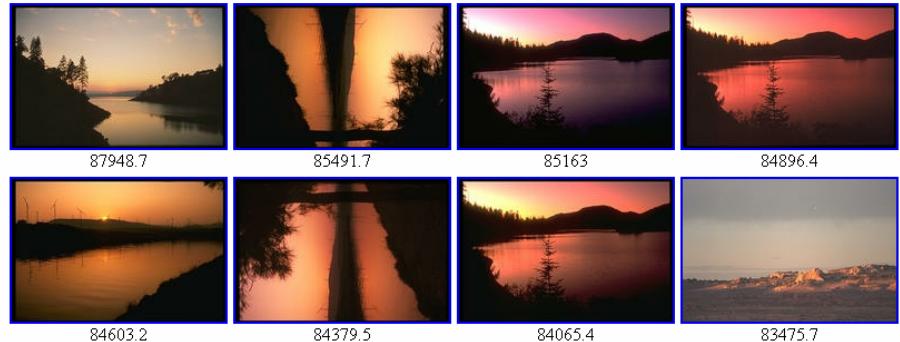
59061

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

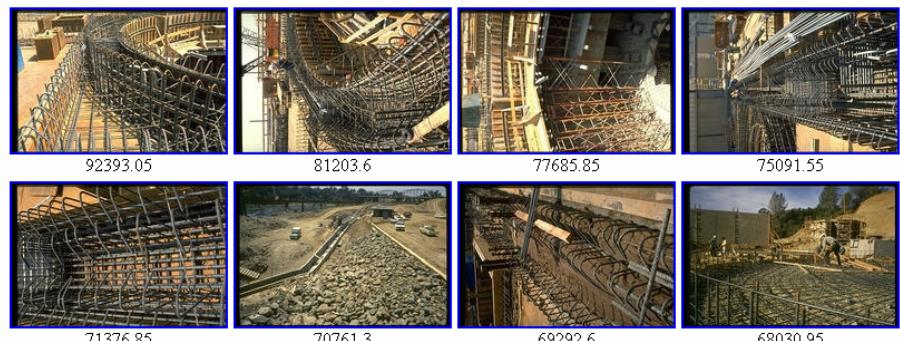
66249.5

↑
↑
↑

SIMBA – Search IMages By Appearance



Search template



92393.05

81203.6

77685.85

75091.55

71376.85

70761.3

69292.6

68030.95

Experiments

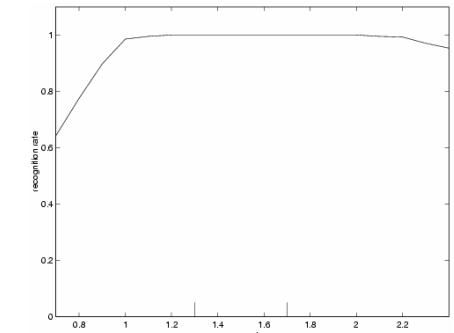


SIMBA
Searching Images by Appearance

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

Robustness to scaling

- Database as before, grayvalue features only
- Kernels $\mathbf{M}(1,0)\mathbf{M}(0,2)$, $\mathbf{M}(2,0)\mathbf{M}(0,4)$
- 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

Stamps	Identifiers
1 DM DEUTSCHE BUNDESPOST	Brd0644, Brd0638, Brd0732, Brd0689
10 DM DEUTSCHE BUNDESPOST	Brd0729, Brd0636, Brd0727, Brd0637
20 DM DEUTSCHE BUNDESPOST	Brd0645, Brd0640, Brd0642, Brd0635
30 DM DEUTSCHE BUNDESPOST	Brd0691, Brd0730, Brd0639, Brd0643

Suchbild

Ergebnisse

Brd0644	Brd0637	Brd0689	Brd0636

Brd1138	Brd0489	Brd0727	Brd0502

Brd0494	Brd0854	Brd193	Brd0492

Brd0191	Brd0635	Brd0168	Brd0857

Suchmethode

Farbe Textur

Motiv

Größe

Seitenverhältnis

Datenbank

BRD

Suche starten

Suchbild

Ergebnisse

Brd0523	Brd0485	Brd0538	Brd0232

Brd0408	Brd0409	Brd0486	Brd0447

Brd0540	Brd0164	Brd0449	Brd0266

Brd0386	Brd0173	Brd1610	Brd0487

Suchmethode

Farbe Textur

Motiv

Größe

Seitenverhältnis

Datenbank

BRD

Suche starten

MICHEL Philaskop

Datei Einstellungen Hilfe

Suchbild

Ergebnisse

Brd1361	Brd1363	Brd1360	Brd1362

Brd0815	Brd0840	Brd1803	Brd0968

Brd1033	Brd1382	Brd0936	Brd1815

Brd0817	Brd0896	Brd1655	Brd1285

Suchmethode

Farbe Textur

Motiv

Größe

Seitenverhältnis

Datenbank

BRD

Suche starten

MICHEL Philaskop

Datei Einstellungen Hilfe

Suchbild

Ergebnisse

Brd1362	Brd1361	Brd1360	Brd1363

Brd0815	Brd1285	Brd1503	Brd1430

Brd1655	Brd1816	Brd1815	Brd0816

Brd0737	Brd1290	Brd0936	Brd1103

Suchmethode

Farbe Textur

Motiv

Größe

Seitenverhältnis

Datenbank

BRD

Suche starten

Suchbild

Ergebnisse

Brd0700	Brd0694	Brd0697	Brd0773

Brd0703	Brd0702	Brd0698	Brd0696

Brd0701	Brd1623	Brd1140	Brd0695

Brd1379	Brd1137	Brd0699	Brd1038

Suchmethode

Farbe Textur

Motiv Größe Seitenverhältnis

Datenbank

BRD

Suche starten

MICHELphiloscope

File Einstellungen Hilfe

Suchbild

Ergebnisse

0509	0507	0506	0510

0286	0287	0290	0288

0508	0289	0231	0140

1143	0042	0032	0145

Suchmethode

Farbe Textur

Motiv Größe Seitenverhältnis

Datenbank

Deutschland

Suche starten

Deutschland Berlin (West) 0042

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

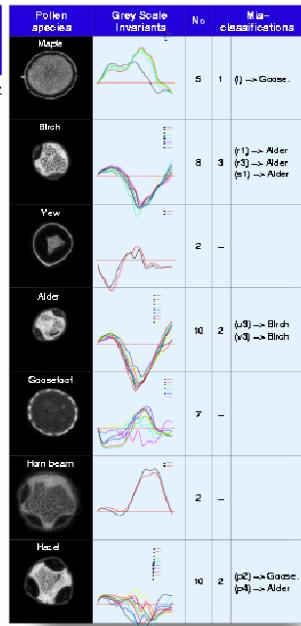
- 3D fluorescence imaging (tomography) instead of 2D conventional translucent microscopy
- Image recognition based on general »grey scale invariants«, instead of traditional object specific features

First results (see table on the right)

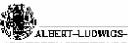
- »Grey scale invariants« have characteristic shapes for different pollen species
- Recognition rate of 82% already in a first run

Outlook

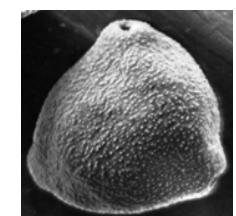
- Employment of digital microscopy for automated particle analysis in general.



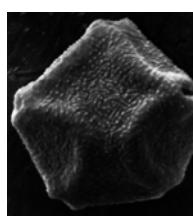
Collaborating institutions



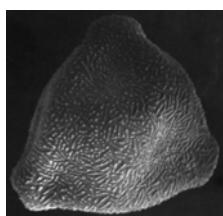
Pollen examples



Hasel



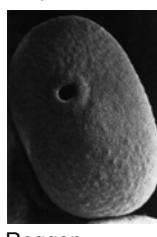
Erle



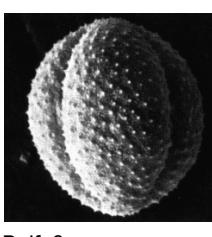
Birke



Gräser



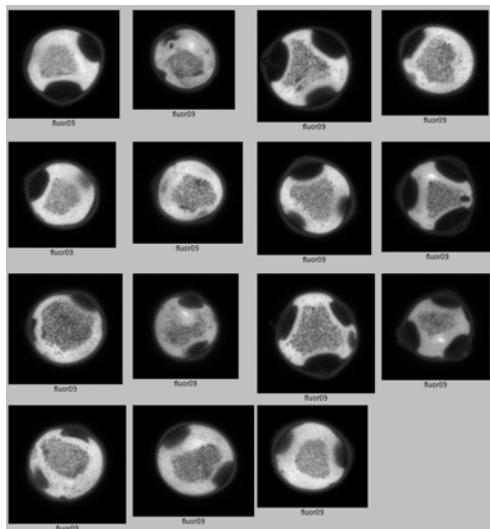
Roggen



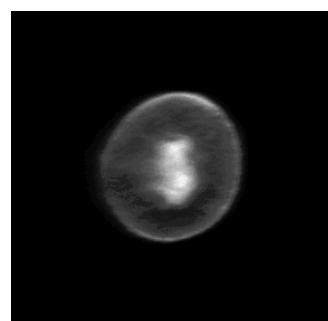
Beifuß

+ 33 further species (not relevant for allergies)

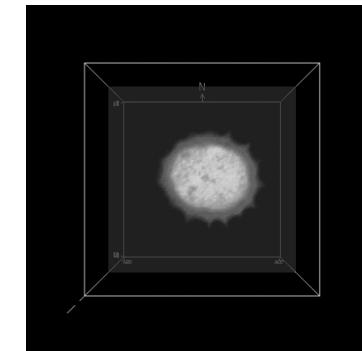
Haselpollen



Eibe/Taxus



Gänseblümchen/daisy pollen grain



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

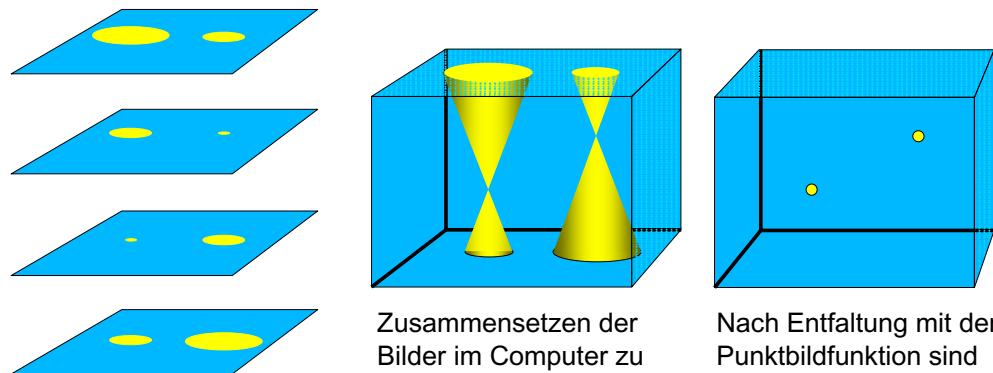
Classification Results using 3D LSM Data

(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>
Allergological 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



Zusammensetzen der Bilder im Computer zu einem Volumen

Nach Entfaltung mit der Punktbiolfunktion sind alle unscharfen Bereiche entfernt

Aufnahme eines Bildstapels mit einem normalen Mikroskop

Deconvolution of a Pollen (Hasel/Corylus)

