World Association of Newspapers and News Publishers

Automatic Image Processing

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What's wrong with Adobe Photoshop?

- Photoshop is subjective. Results depend on the training, experience and condition of the operator.
- Adobe Photoshop is dependent on the quality, condition and calibration of the monitor.
- Photoshop's ICC colour management is complicated.
- Photoshop is manipulative of IPTC metadata and EXIF metadata that can hinder an **a**utomatic **i**mage **p**rocessing (**AIP**) program.

Exif Print (in photo kiosks und photo printers)

Image metadata path

Image data path

Photographic parameter information

Photographic scene informationen

Analyse photographic information

Correction processing set by analysing photographic information specifying no need for "Brightness correction" for underexposure

JPEG image data

Analyse image data

Process and print out image

Camera records that image was taken in "Night scene mode"

Optimal processing is applied to faithfully reproduce the photographer's intentions

What is Exif metadata?

Canon 1D Mk IV

Tag Name	Content
	---- EXIF ----
Make	Canon
Model	Canon EOS-1D Mark IV
Orientation	Horizontal (normal)
XResolution	300
YResolution	300
ResolutionUnit	inches
Software	Adobe Photoshop CS4 Windows
ModifyDate	2010:12:31 20:09:47
ExposureTime	1/2000
FNumber	8.0
ExposureProgram	Manual
ISO	800
ExifVersion	0221
DateTimeOriginal	2010:12:27 14:05:20
CreateDate	2010:12:27 14:05:20
ShutterSpeedValue	1/2000
ApertureValue	8.0
ExposureCompensation	0
MaxApertureValue	5.7
SubjectDistance	35.6 m
MeteringMode	Spot
Flash	Off, Did not fire
FocalLength	800.0 mm
SubSecTime	49
SubSecTimeOriginal	49
SubSecTimeDigitized	49
ColorSpace	Uncalibrated
ExifImageWidth	800
ExifImageHeight	533
FocalPlaneXResolution	3795.348837
FocalPlaneYResolution	3904.30622
FocalPlaneResolutionUnit	inches
CustomRendered	Normal
ExposureMode	Manual
WhiteBalance	Auto
SceneCaptureType	Standard
Compression	JPEG (old-style)
XResolution	72
YResolution	72
ResolutionUnit	inches

Nikon D3S

Tag Name	Content
	---- EXIF ----
Make	NIKON CORPORATION
Model	NIKON D3S
Orientation	Horizontal (normal)
XResolution	72
YResolution	72
ResolutionUnit	inches
Software	Adobe Photoshop CS4 Windows
ModifyDate	2011:01:03 21:24:27
ExposureTime	5
FNumber	22.0
ExposureProgram	Aperture-priority AE
ISO	800
ExifVersion	0221
DateTimeOriginal	2010:12:31 16:08:19
CreateDate	2010:12:31 16:08:19
ShutterSpeedValue	5
ApertureValue	22.0
ExposureCompensation	-1
MaxApertureValue	4.0
SubjectDistance	4294967295 m
MeteringMode	Multi-segment
LightSource	Tungsten (Incandescent)
Flash	No Flash
FocalLength	155.0 mm
SubSecTime	73
SubSecTimeOriginal	73
SubSecTimeDigitized	73
ColorSpace	Uncalibrated
ExifImageWidth	850
ExifImageHeight	566
SensingMethod	One-chip color area
FileSource	Digital Camera
SceneType	Directly photographed
CFAPattern	[Red,Green][Green,Blue]
CustomRendered	Normal
ExposureMode	Auto
WhiteBalance	Manual
DigitalZoomRatio	1
FocalLengthIn35mmForr	155 mm
SceneCaptureType	Standard

Exif “Illumination” & “ White Balance” Tags

Exif “SceneCaptureType” Tag

WAN IFRA
World Association of Newspapers and News Publishers

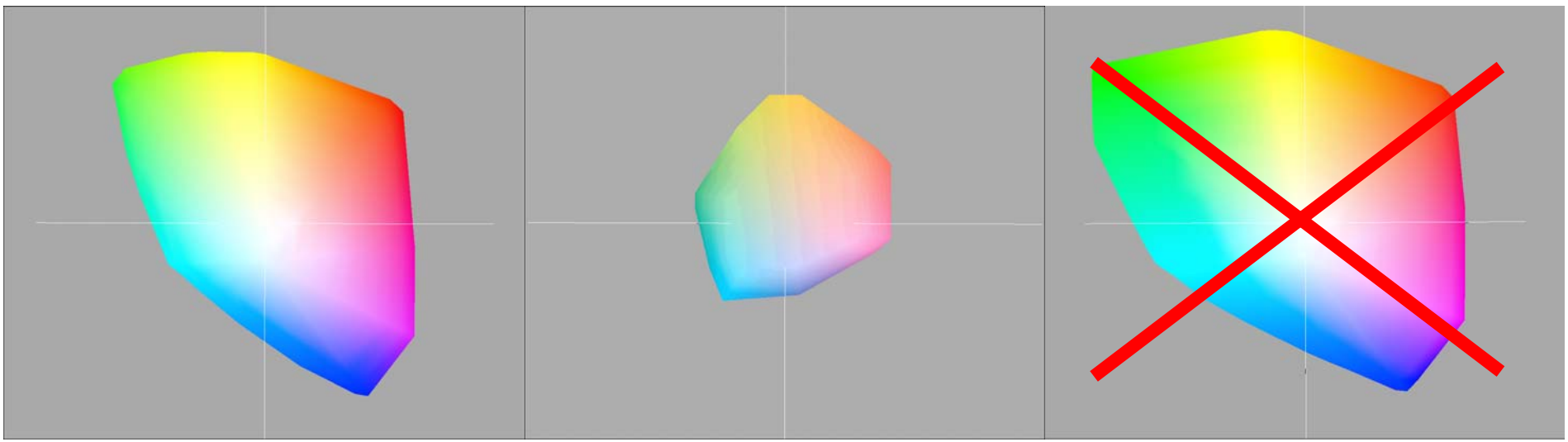
Large News Groups ≈ 12,000 Images/Day

Colour Spaces

sRGB + software

Newspapers

AdobeRGB 1998



(Gamut vol. x 7)

(Gamut vol. x 1)

(Gamut vol. x 10)

Choosing sRGB means the best quality for the news media and a wider selection of AIP software

Objective Image Enhancement

Optimising pictures means first understanding the contents.

This is best done with **image analysis** and **Exif metadata**.

Image analysis is complex

The analysis may take several forms:

- Histogram analysis
- Frequency analysis
- Segmentation
- Scene classification analysis.

Within each of these categories is an enormous range of different algorithms to try.

3-D Histogram Analysis

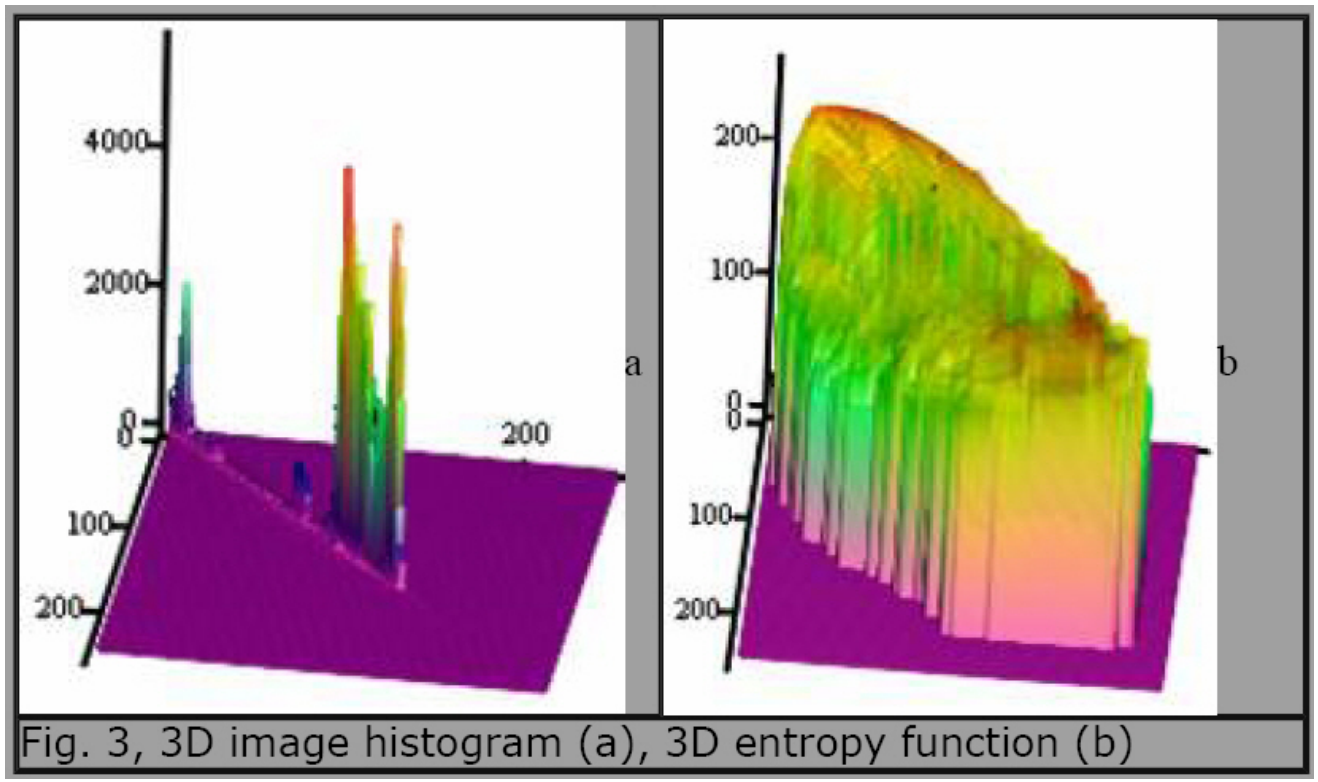
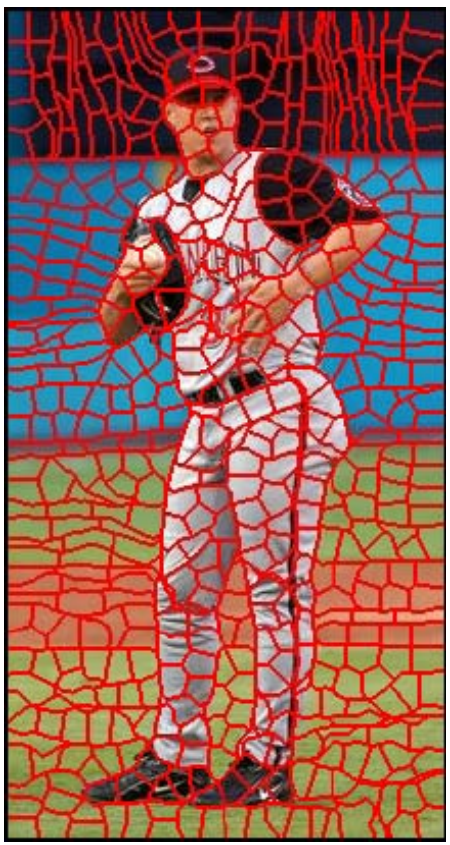
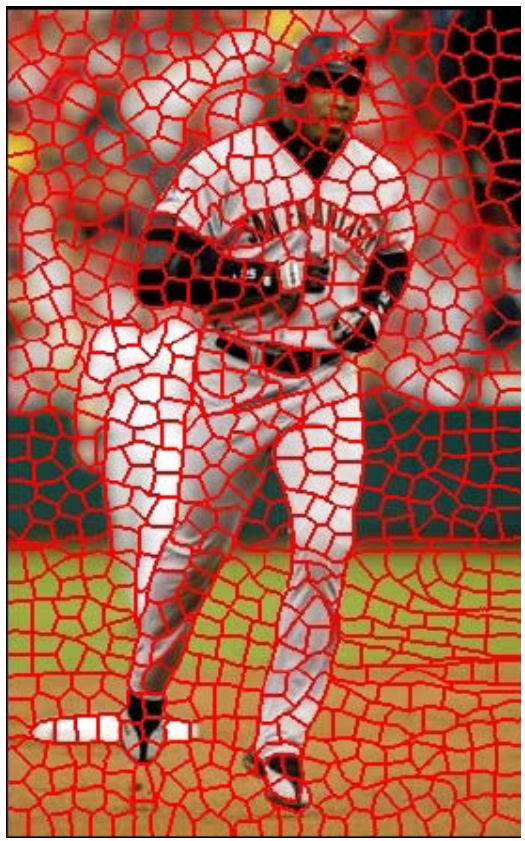


Fig. 3, 3D image histogram (a), 3D entropy function (b)

Image analysis of a) pixel brightness b) relative pixel 'energy' with x,y location

Image Analysis – Segmentation

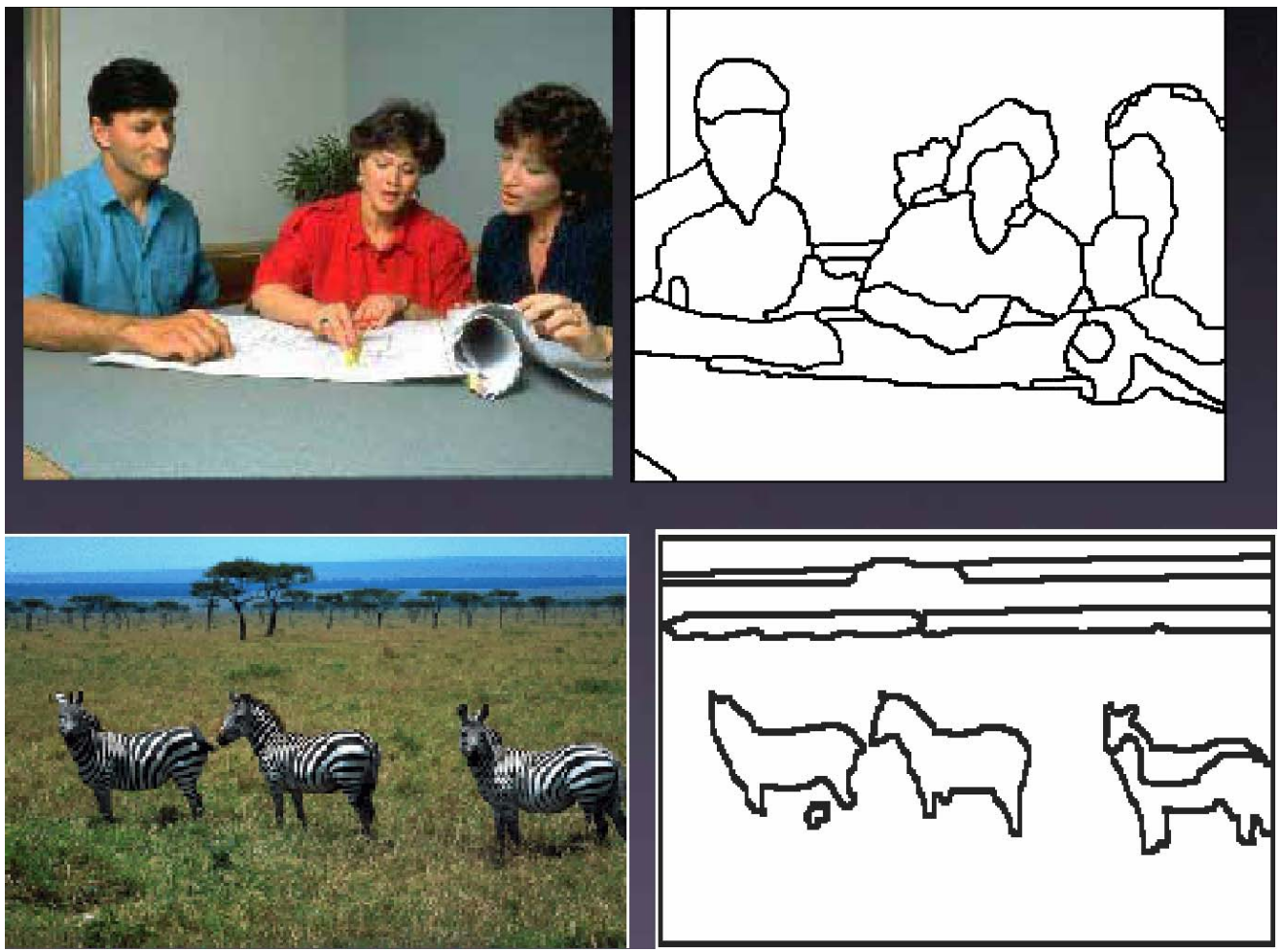




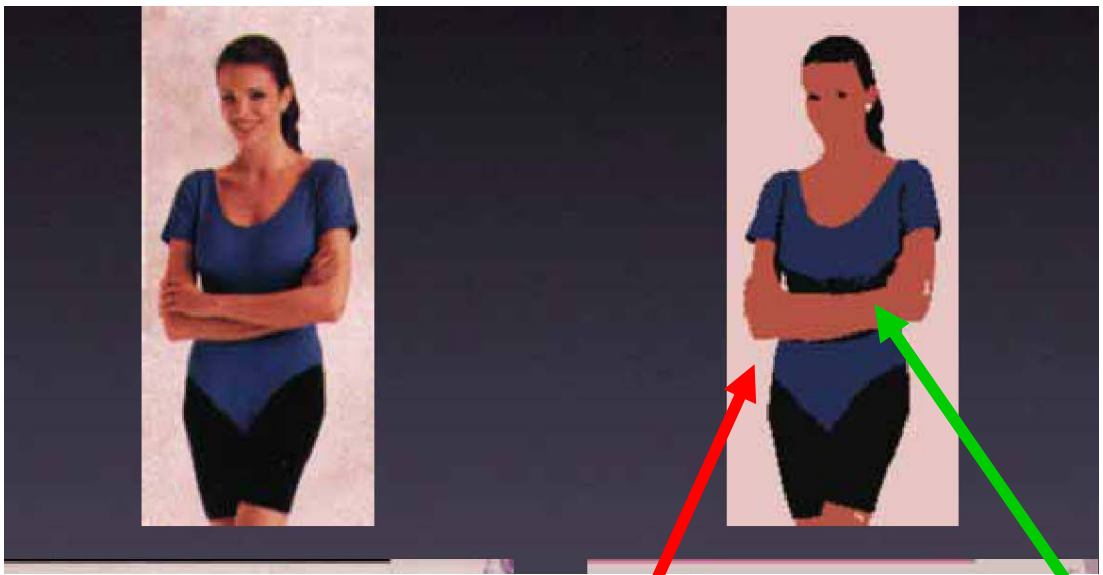
Firstly, over-segment sample into clusters of similar pixels

Image Analysis – Region Segmentation

Use colour, texture and edges to merge similar segments into a small number of regions.



Segmentation - Regions



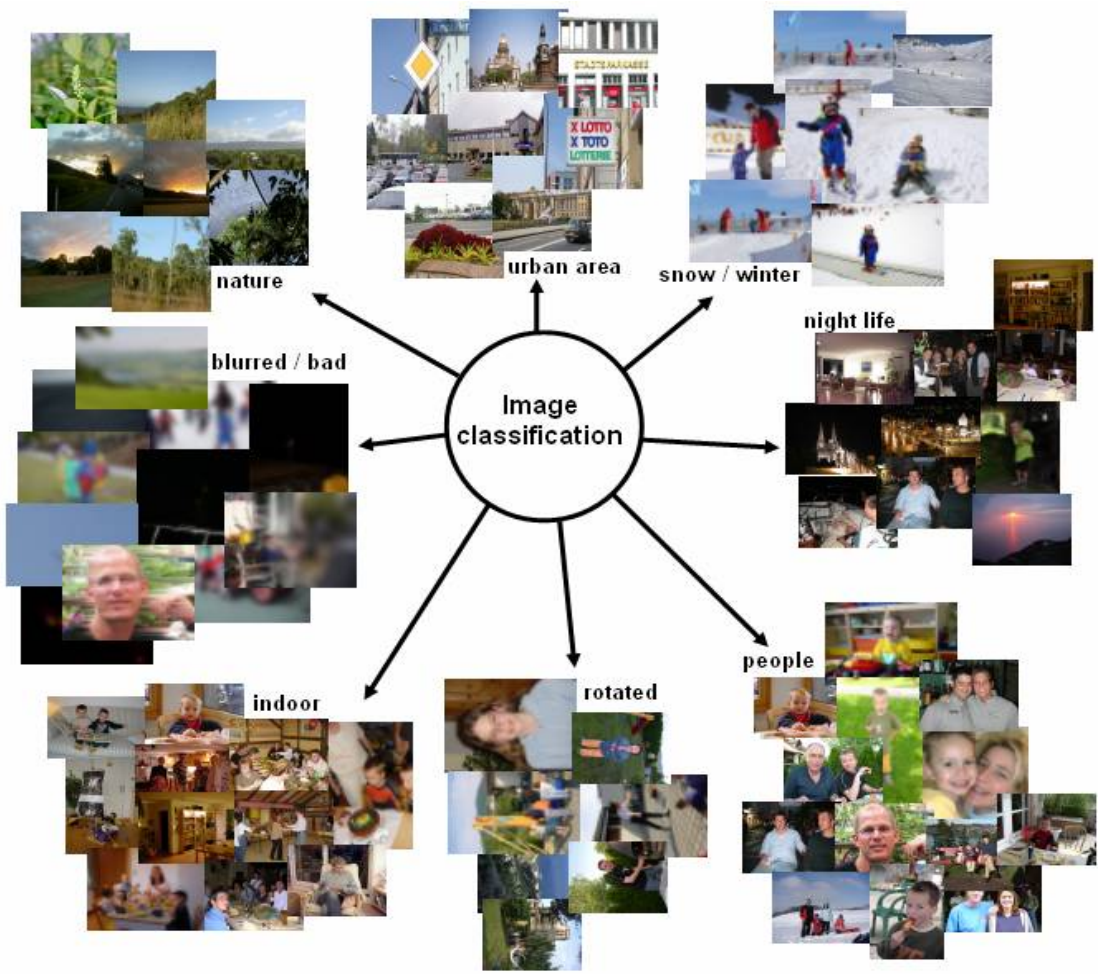
Segmented sample image ready for skin and face detection

Background region detected

Subject region detected

Regions of interest can be optimised independently of each other

Automatic Image Classification



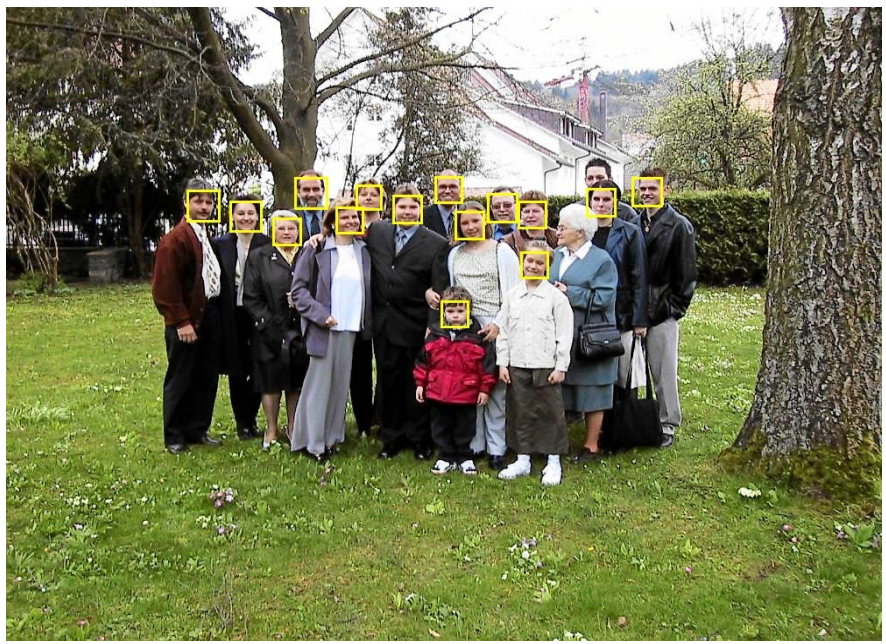
The content of the image is analysed using different object and feature recognition algorithms.

The images are then automatically classified in:

- Urban area / city
- Nature
- Snow / winter
- Nightlife
- People
- Indoor /outdoor
- Rotation ±90°,180°
- Quality / blurred

Now the content of images can be described. This opens new interesting possibilities in image retrieval, sorting or browsing!

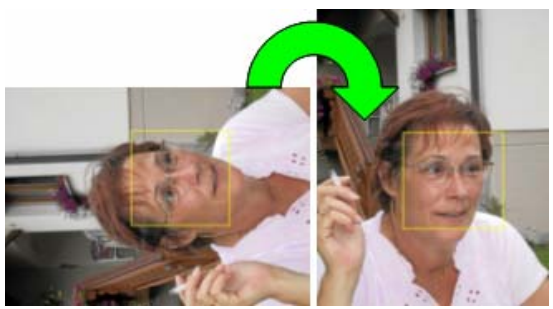
Face and Eye Detection



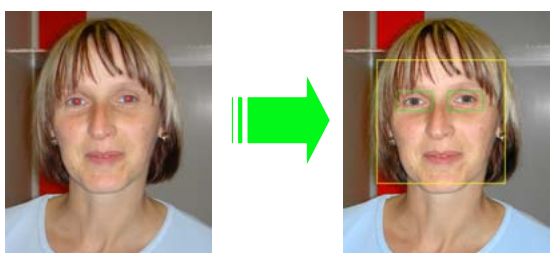
The Colour-Science face database contains about 40’000 faces.

1. “face” centered density and colour correction

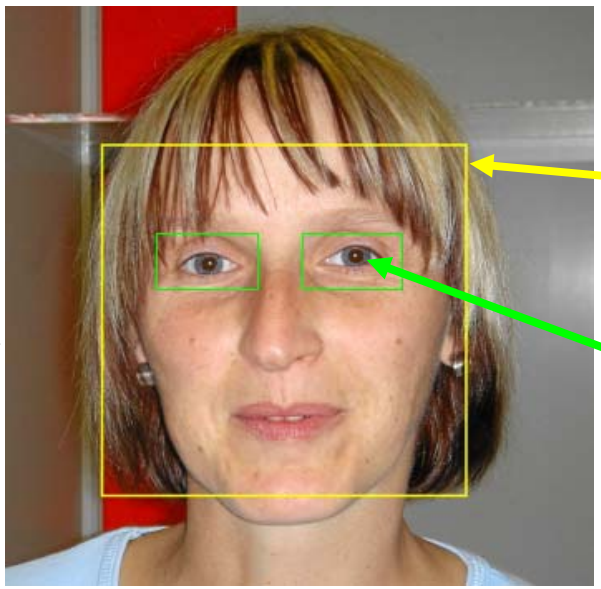
2. Automatic portrait image rotation



3. Advanced red eye reduction



Advanced Red Eye Reduction Using Face and Eye Recognition



Steps:

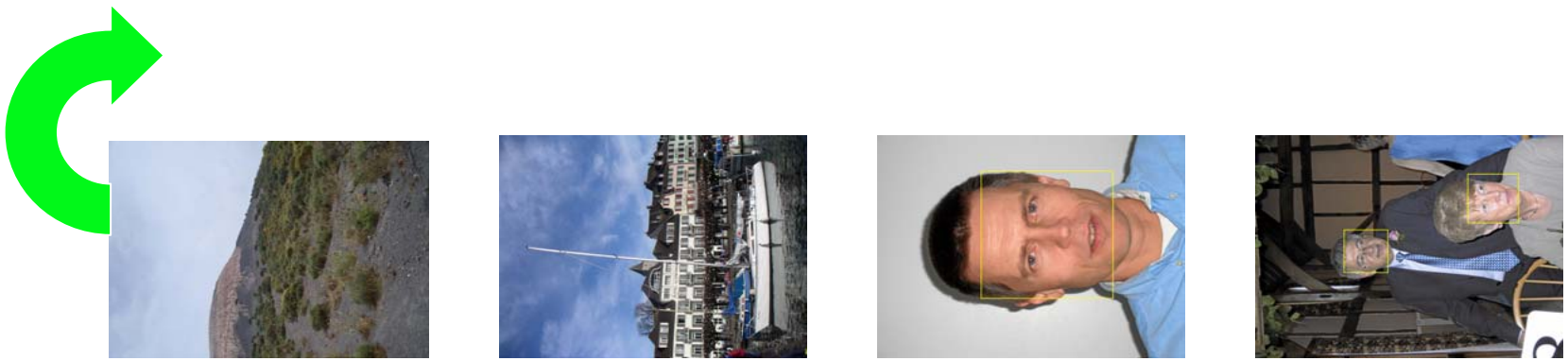
1. Face and eye detection
2. Red eye removal

Extremely low error rate because red eye reduction is only applied to eye regions and not to the whole image

No more removed lips, noses and ears!

Automatic Image Rotation

Not all images are upright!



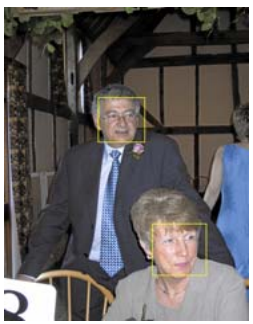
Nature image with sky and vegetation is detected

Rotation of portrait images using face detection technology

Automatic Image Rotation

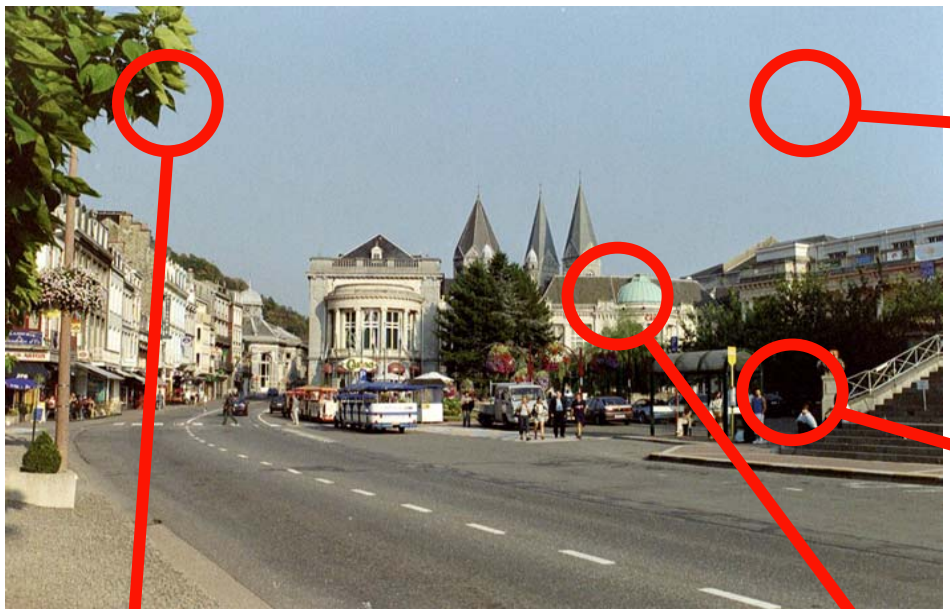
Now all images are upright!

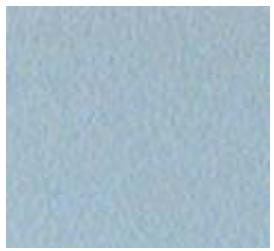


Using object detection technology, it is possible to detect ±90° and 180° rotated images and put them automatically in an upright position.

Adaptive Local Sharpening or Smoothing

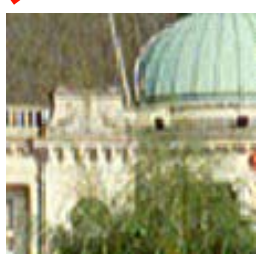




The sky needs to be smoothed to remove noise and jpeg artefacts

The shadows need to be smoothed to remove noise

Foliage needs to be sharpened to look crisper



Details and edges need to be sharpened

Adaptive Lighting Correction

DSC Images Can Be Improved!

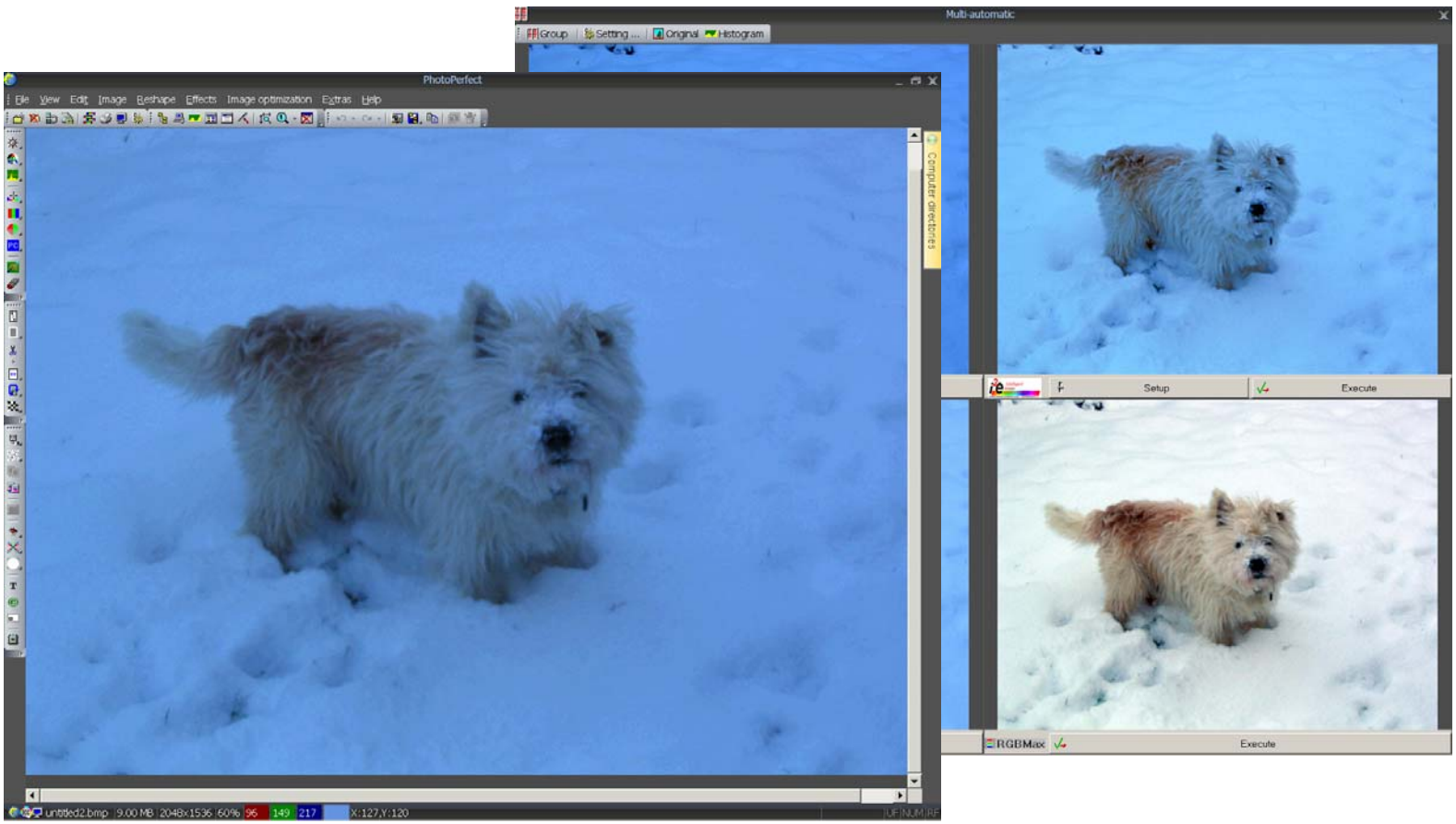
DSC Images Can Be Improved!

Canon EOS-1D MkII

DCE AutoEnhance

DSC Images Can Be Improved!

AIP’s performance varies with extreme cases



Exif “SceneCaptureType” metadata needed!

Conclusions

- Give photojournalists the latest cameras.
- It's becoming much easier to take good photos.
  Automatic image processing can easily handle improvements to good news photos.
- Image analysis that can identify faces are a step higher in the evolution of AIP software.
  Face detection assists:
  - Correct image orientation
  - Skin-smoothing algorithms
  - Red-eye removal
  - Eventually, face recognition.

Conclusions

- AIP's can be tested using 'problem' images. However, exceptions are by definition not normal work. AIP's should handle 80+% of the work, 'one-click' manual software the rest.
- Newspapers need server software with 'hot folders'. The functionality of the server is another key area that differentiates the software.
- AIP software is constantly improving.

Conclusions

- Quality development is sometimes limited by our technical understanding of human vision.
- Advances in image processing speeds are more predictable: AIP software is now written for multi-core parallel processing CPU's and soon for graphic processor units GPU's.
- **There are now more choices of AIP's:**

  In 1995 1 package

  In 2011 **12** packages (CMS + ICC profile-aware)

  and **15** packages (sRGB dependent)

- **The performance:cost ratio of an AIP is decreasing.**

Automatic Image Processing Software

Company	ICC Colour-Managed Product
Agfa	:Arkitex IntelliTune
Anygraaf	Doris32 ImageEd
Arcadia Software	PhotoPerfect[1]
binuscan	IPM
Caramba	Caramba Image Server
Colour-Science	i2e, Q-Enhancer
Elpical	Claro Premedia Server
FotoWare	Colour Factory – SmartColour[2]
Fujifilm	XMF C-Fit, Image Intelligence
KlearVision	Photo-D Pro
Morris DigitalWorks	BluMunKee
OneVision	Amendo[2]

Prices (subject to confirmation)

Company	ICC Colour-Managed Product	Approximate Prices
Agfa	:Arkitex IntelliTune	€ 20,000
Anygraaf	Doris32 ImageEd	€ 3,000–12,000
Arcadia Software	PhotoPerfect[1]	€ 210
binuscan	IPM	€ 8,000
Caramba	Caramba Image Server	Available on request
Colour-Science	i2e, Q-Enhancer	€ 7–11,000
Elpical	Claro Premedia Server	€ 7,000
FotoWare	Color Factory – SmartColor[2]	€ 6,000
Fujifilm	XMF C-Fit, Image Intelligence	€ 6–16,000
KlearVision	Photo-D Pro	€ 5,000–11,000 modules, each € 995
OneVision	Amendo[2]	Available on request
Morris DigitalWorks	BluMunKee	$25,000

Realised Savings/Improvements

- Reduced demand on resources of time and expertise
- Consistent quality
- Control over the process

Thank you

for your attention

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