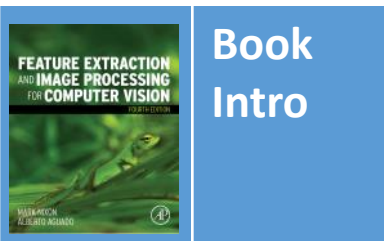


# COMP3204 & COMP6223

## Computer Vision

**Welcome!**

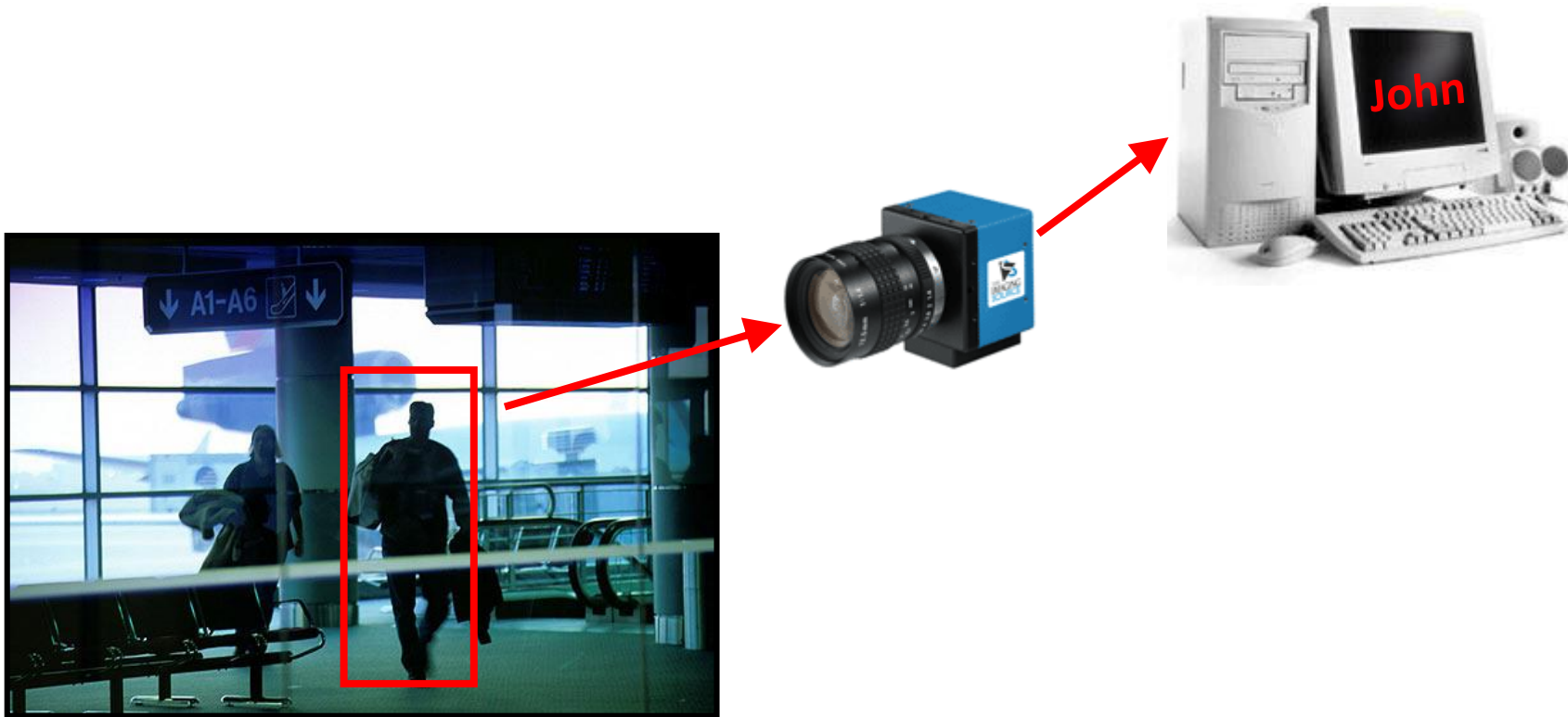
Mark Nixon and Jonathon Hare



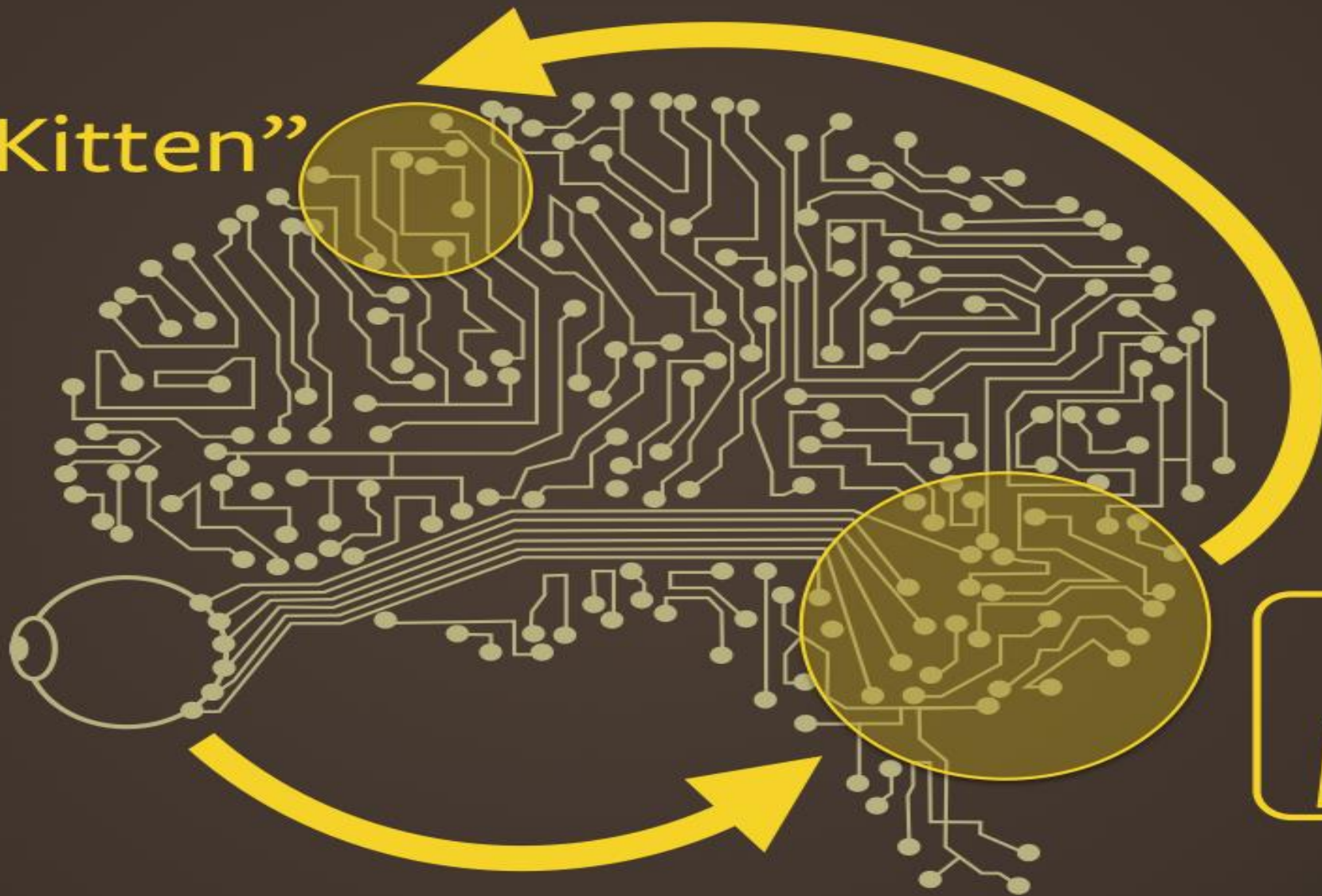
Department of  
Electronics and  
Computer Science

UNIVERSITY OF  
**Southampton**  
School of Electronics  
and Computer Science

# Vision based biometrics



“Kitten”



# What can image analysis achieve?



# Key to our slides

This bit is to be found in **Mark's book**

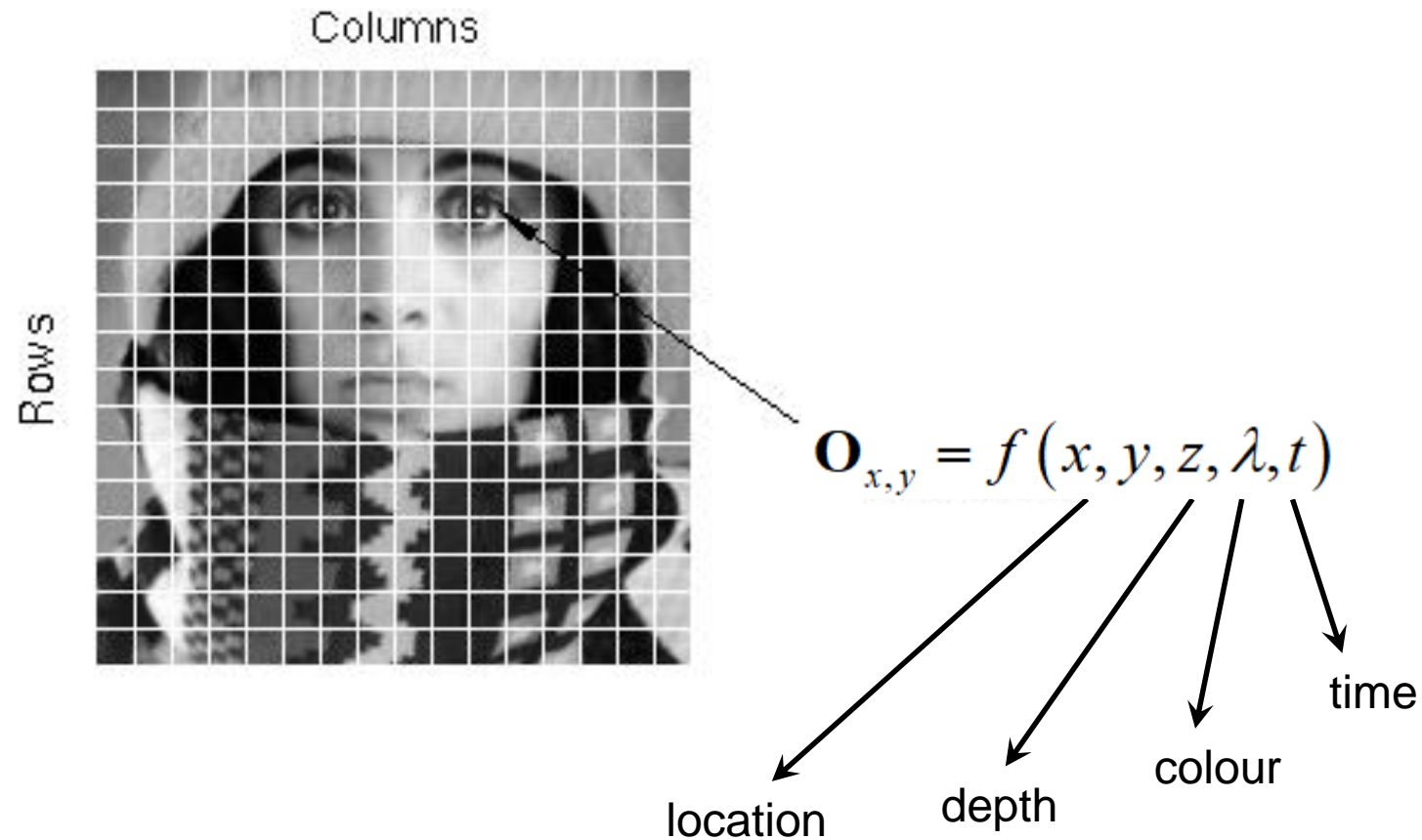
We expect you to **remember** this stuff

If **neither** of these are there, this is stuff to illuminate the course material





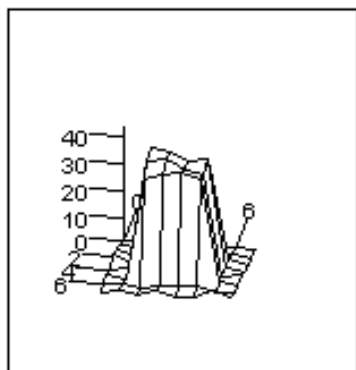
# Images consist of picture elements known as “pixels”



# 2D Images are matrices of numbers



Grey level image



pic

3D view

pic :=

1	2	3	4	1	1	2	1
2	2	3	2	1	2	2	1
3	1	38	39	37	36	3	1
4	1	45	44	41	42	2	1
1	2	43	44	40	39	1	3
2	1	39	41	42	40	2	1
1	2	1	2	2	3	1	1
1	2	1	3	1	1	4	2

Corresponding Matrix

Pixel



# Point Operations

Recalculate point values



**Modify** brightness



**Find** Intensity

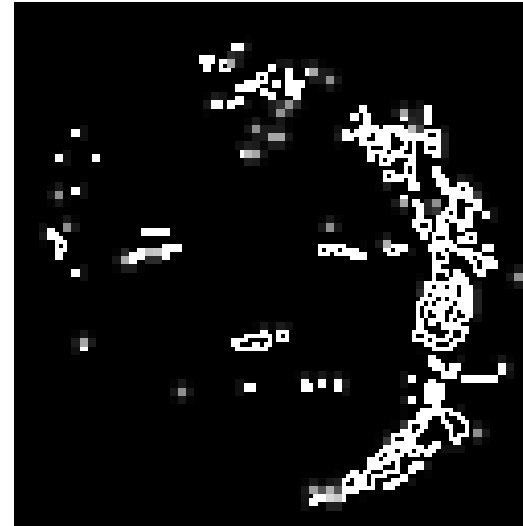


# Group Operations

Process neighborhoods



Image filtering



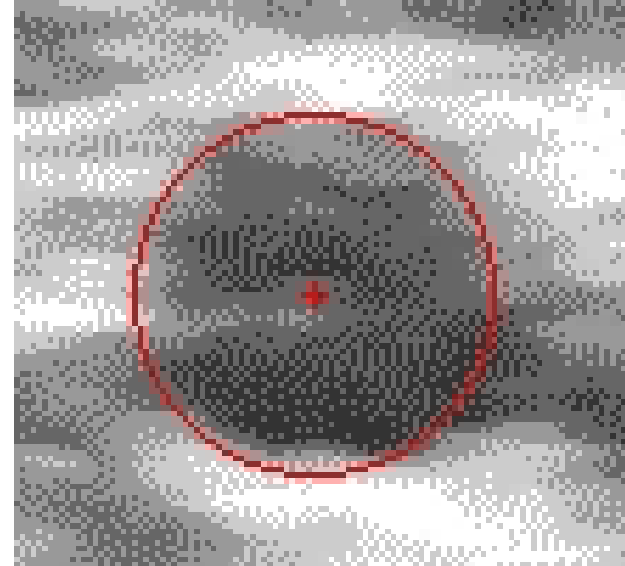
Edge detection

# Feature Extraction

Finds **shapes**



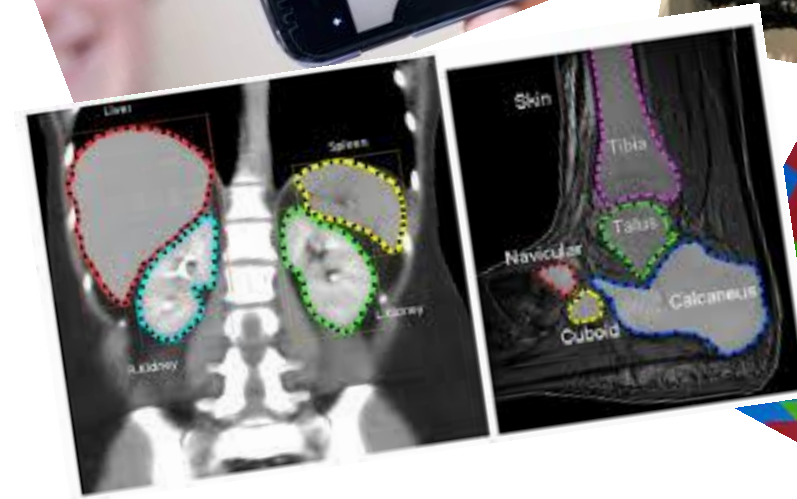
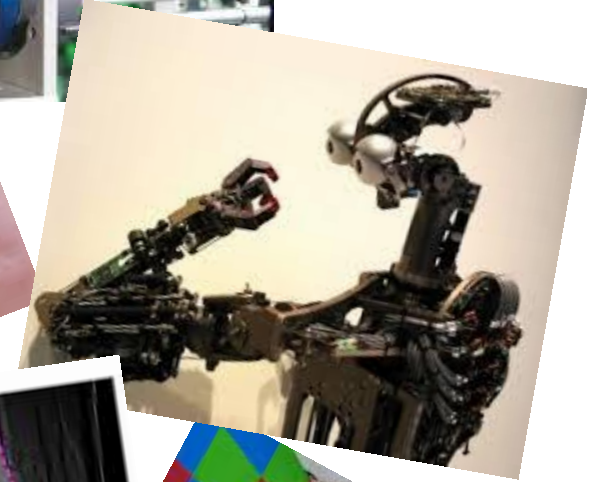
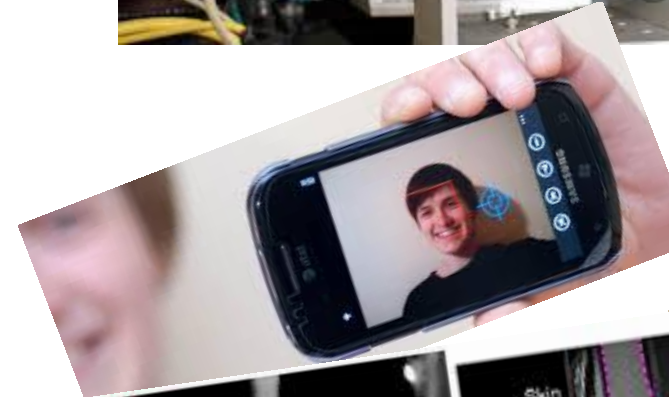
**Roads** in remotely-sensed image



**Artery** in ultrasound image

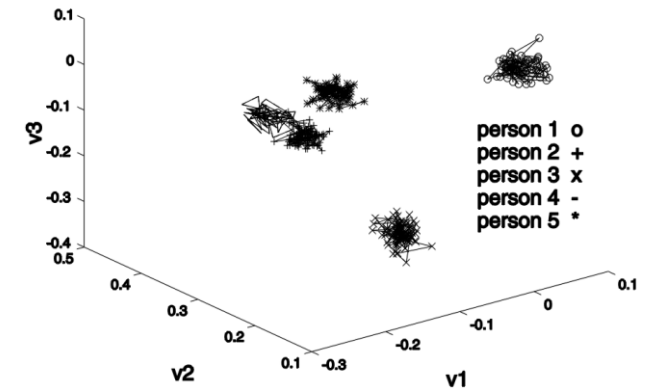
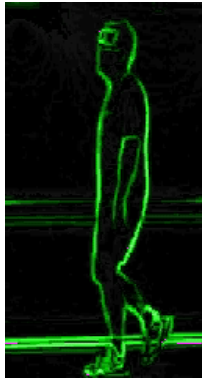
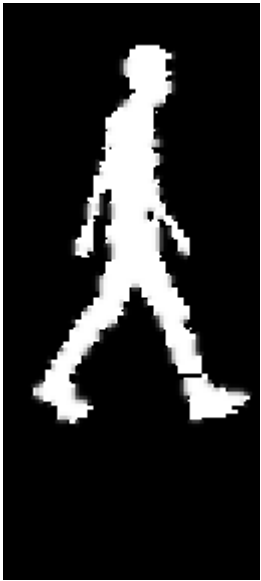
# Applications of Computer Vision

- Image **coding** (MPEG/JPEG)
- Product **inspection**
- **Robotics**
- **Modern cameras/ phones**
- **Medical** imaging
- **Demography** (applied politics?)
- **Biometrics** (recognising people)



# Gait Recognition

Recognising people from the motion of the **whole** body



silhouette

flow

edges

symmetry

acceleration

feature space





# Gait Recognition

natural walking (well....)



# Ear biometrics

- Person identification from ear image
- Uniqueness: used in forensics
- Unique advantage: age invariant
- Unique disadvantage: hair!
- Much smaller field than gait recognition



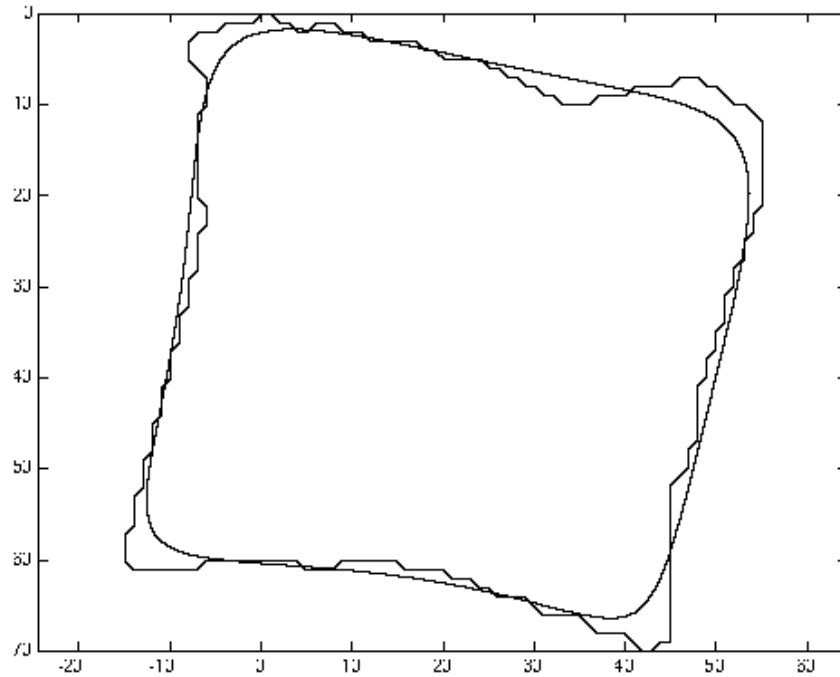
Thanks, BBC1



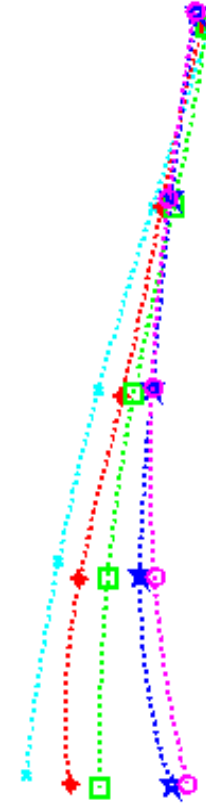
# Digital videofluoroscopic Imaging



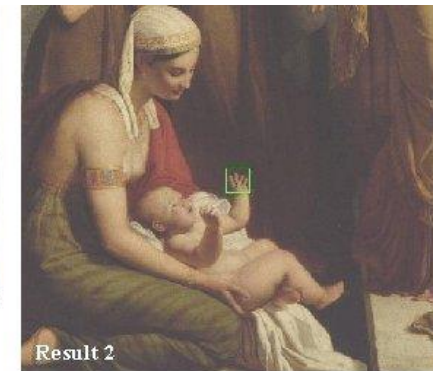
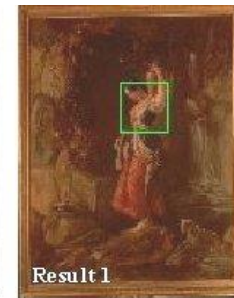
# High level feature extraction



# Animated extraction

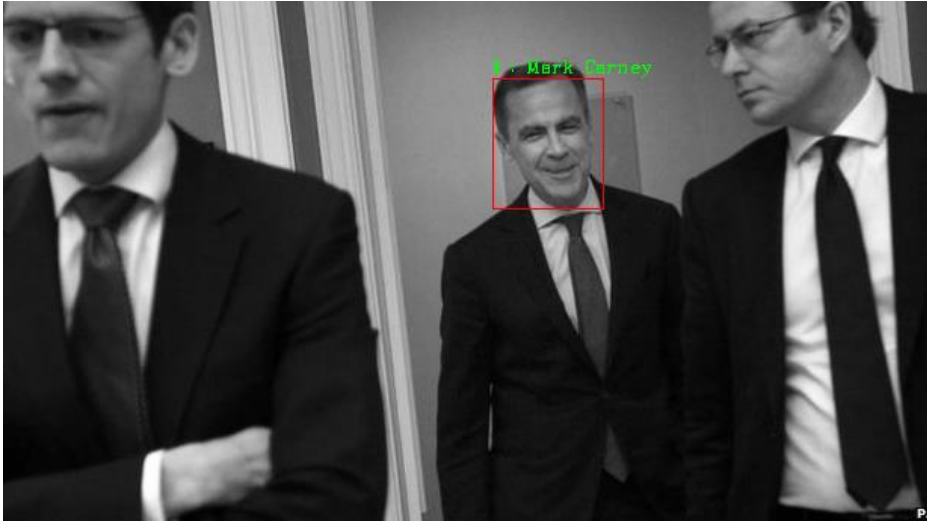


# Content-based retrieval and image matching





# Higher level visual cognition



Who?

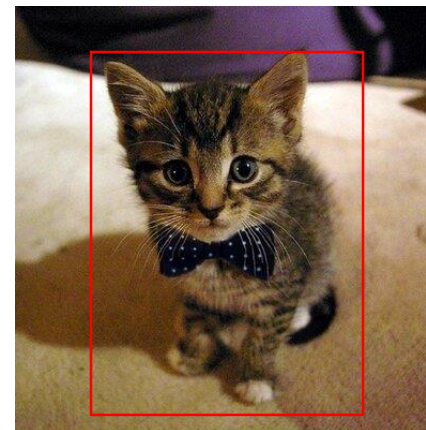


Where?



Why?

What?



# Computer vision support

- WWW homepages

<http://comp3204.ecs.soton.ac.uk> (for 3204 and 6223)

- Lecture **support** materials

- **Links**

- **Notes**

- **Tutorials** (on demand)

- **Book**



# Computer vision support

<http://www.ecs.soton.ac.uk/~msn/book>



## CONTENTS

1. Introduction
2. Images, sampling and frequency domain processing
3. Basic image processing operations
4. Low-level feature extraction (including edge detection)
5. Feature extraction by shape matching
6. Flexible shape extraction (snakes and other techniques)
7. Object description
8. Region Based Analysis
9. Moving Object Extraction and Description
10. Camera Geometry Fundamentals
11. Colour Images
12. Distance, Classification and Learning

1<sup>st</sup> Edition 2002; 2<sup>nd</sup> Edition 2008, 3<sup>rd</sup> Edition 2012 in Library

4<sup>th</sup> Edition 2019 (Current price ~ £50 Amazon)

# Direct from the Library!!

In webcat <https://www-lib.soton.ac.uk/> I have searched for your book

## Quick Search

☒ Keyword ☐ Browse ☐ Exact

library:

☐ Search only Electronic Books


medium:

material type:

If off campus the students need to use the VPN or Southampton virtual environment - then click on the highlighted link to access the full text of the book. This is not available on kindles etc

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1. ☐ Mark



**Feature extraction & image processing for computer vision [electronic resource] 3rd ed.**  
Nixon, Mark S.  
Internet  
2012  
1 copy available in Our Online Collection  
**Online link to document**

# Lecture Support (Mark)

- Slides (pdf) available online
- The 4<sup>th</sup> Edition is out now so
  - Matlab and Python from Book
  - Used in lectures
  - Bonus is for you only!!!

# Lecture Support (Jon)

- **Interactive** slides with many **demos**  
(often using a webcam to capture images)
  - **Available for you** to download and run
  - **Source** code on github
  - (more info when you get to Jon's lectures)
- Handouts\*

# Assessment

- Mixture of coursework and final exam
- COMP3204: 60% exam; 40% coursework
- COMP6223: 55% exam; 45% coursework
- (exam questions are the same! The exams are concurrent)

# Coursework

- Three courseworks
  - 2 individual
  - 1 in pairs (competition format)
- Much requested feature!
- Designed to support learning
  - Has worked really well since introduced
- **Different coursework assignments for COMP3204 and COMP6223 students**



- COMP3204:
  - **No 1: Set today! handin wk 9; fb by wk 11**
  - No 2: Set wk 2; handin wk 6; fb by wk 9
  - No 3: Set wk 7; handin wk 11; fb by wk 12 (In pairs)
- COMP6223:
  - No 1: Set wk 2; handin wk 6; fb by wk 9
  - No 2: Set wk 3; handin wk 8; fb by wk 11
  - No 3: Set wk 7; handin wk 11; fb by wk 12 (In pairs)

# Lecture Timetable

This course has 24 lectures of stuff

- Mark will start next tomorrow for 3 weeks [8 lectures]
- Jon will then take over for 5 weeks
- Mark will reappear in week 6
- We'll run revision lectures after Xmas

# Finally

✓ Enjoy!

- Mark Nixon
  - [msn@ecs.soton.ac.uk](mailto:msn@ecs.soton.ac.uk)
  - Office: 32/4043
- Jonathon Hare
  - [jsh2@ecs.soton.ac.uk](mailto:jsh2@ecs.soton.ac.uk)
  - Office: 32/3019