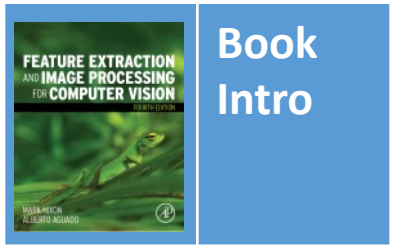
COMP3204 Computer Vision

Welcome!

Jonathon Hare and Xiaohao Cai



Book Intro

Department of Electronics and Computer Science

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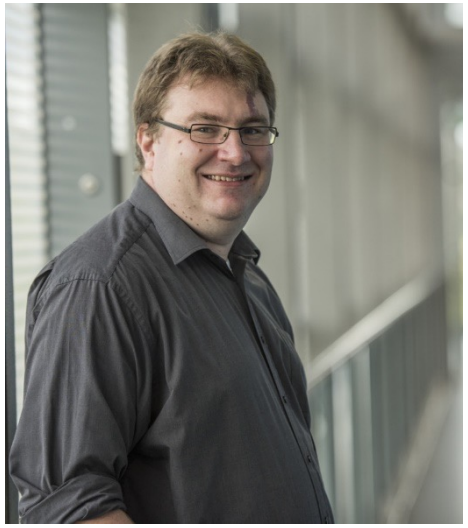
We are back in person…



Jon Hare

Xiaohao Cai

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Welcome to Computer vision

- It’s a great subject
- Covers wide area
- We really enjoy it
- We shall try and impart the same to you!!

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We are back in person…

Universities are learning communities in a research-led culture

That means we chat

….. We've been given lecture theatres to use and need **you** to help us make the most use of them

…. **You** asking questions is what makes this much more interesting for everyone

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What will the course include?

- Live lectures

  Mon 12-1; Tuesday 2-3; and Fri 4-5

  …. which will also be recorded and placed on Panopto

  (but please remind us! It's easy to forget to hit record)
- Live Demonstrations in the lectures
- Plenty of time for Q&A
- … and bits we haven't thought of yet!

http://comp3204.ecs.soton.ac.uk/

Maintained by Dr Jonathon Hare and Dr Xiaohao Cai.

Welcome to the homepage for the ECS COMP3204 "Computer Vision" module.

The challenge of computer vision is to develop a computer based system with the capabilities of the human eye-brain system. It is therefore primarily concerned with the problem of capturing and making sense of digital images. The field draws heavily on many subjects including digital image processing, artificial intelligence, computer graphics and psychology.

This course will explore some of the basic principles and techniques from these areas which are currently being used in real-world computer vision systems and the research and development of new systems.

Lectures & Teaching

The lectures for this course will be given by Dr Xiaohao Cai (email) and Dr Jonathon Hare (email). Xiaohao will give the lectures for the first part of the course, and Jon will finish with the second half.

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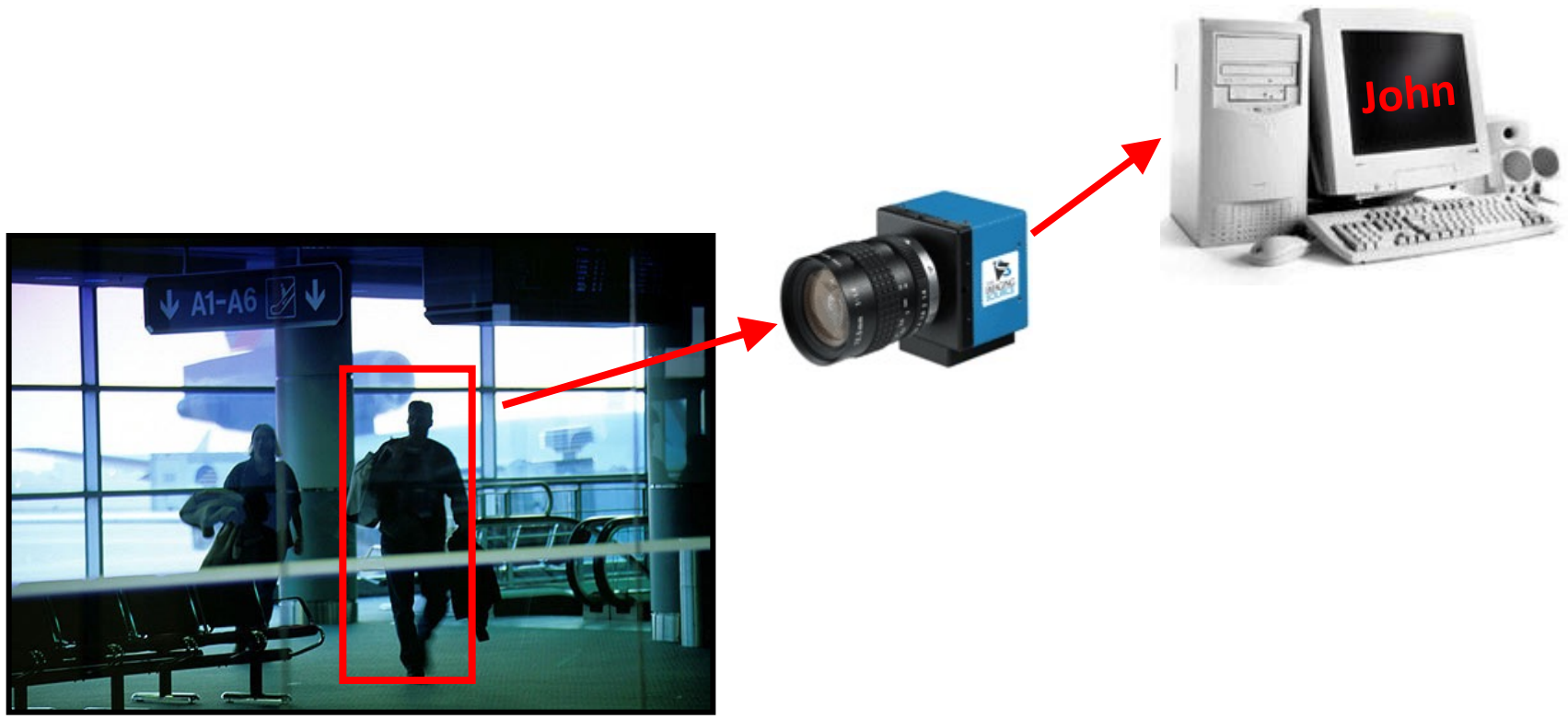
Vision based biometrics



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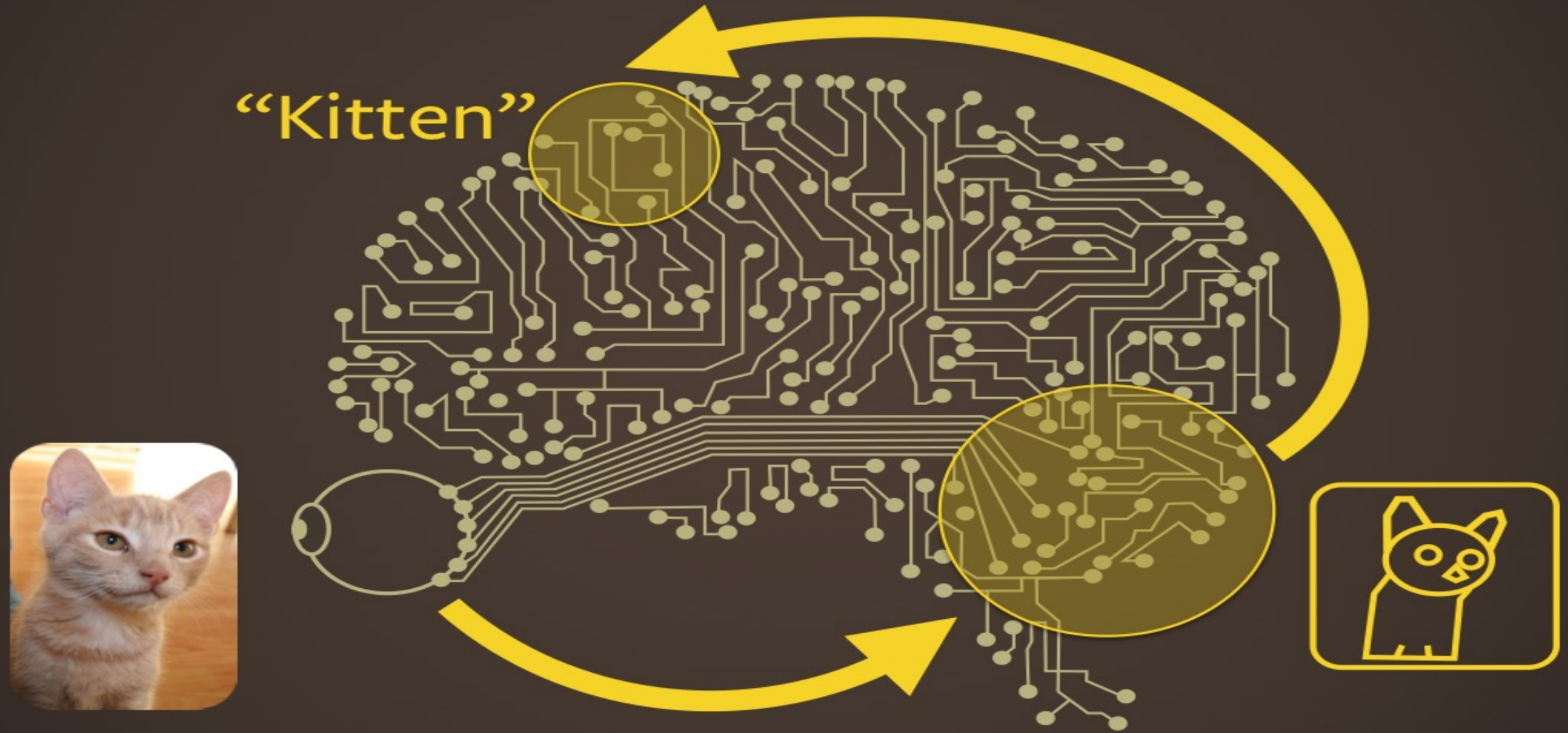
“Kitten”

What can image analysis achieve?

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Key to our slides

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

We expect you to remember this stuff

If neither of these are there, this is stuff to illuminate the course material (this doesn't mean it's not examinable, but the level of detail required is less than the "remember it" bits)

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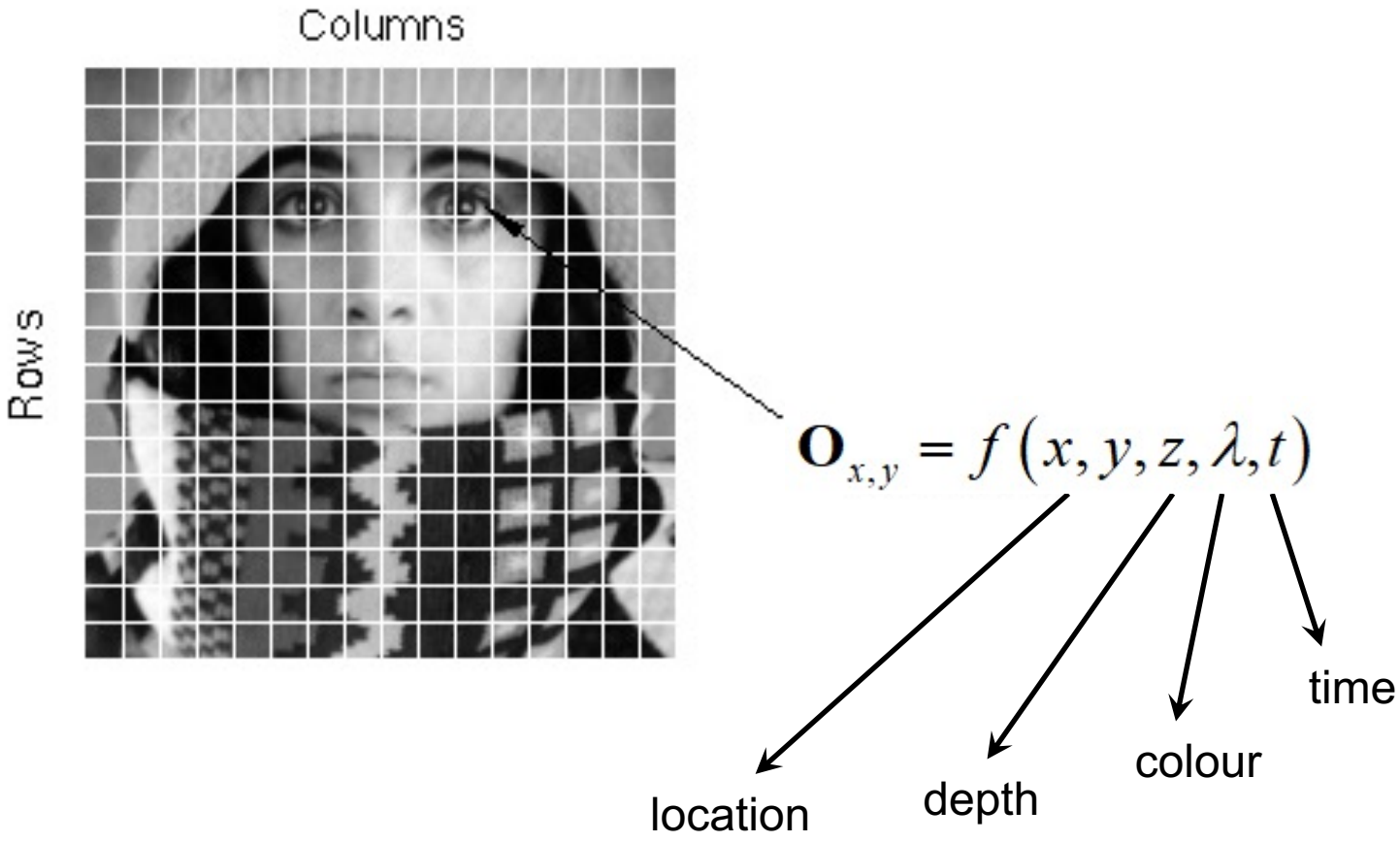
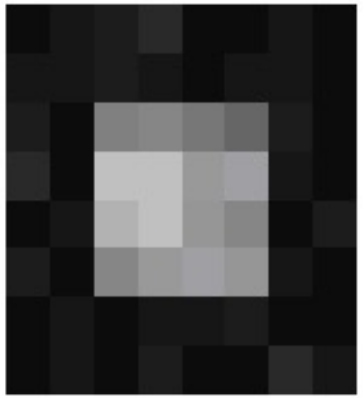
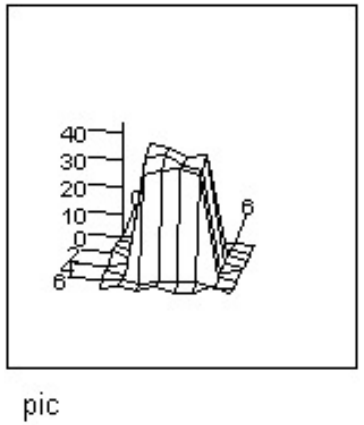
Images consist of picture elements known as “pixels”



2D Images are matrices of numbers



Grey level image



3D view

$$pic := \begin{bmatrix} 1 & 2 & 3 & 4 & 1 & 1 & 2 & 1 \\ 2 & 2 & 3 & 2 & 1 & 2 & 2 & 1 \\ 3 & 1 & 38 & 39 & 37 & 36 & 3 & 1 \\ 4 & 1 & 45 & 44 & 41 & 42 & 2 & 1 \\ 1 & 2 & 43 & 44 & 40 & 39 & 1 & 3 \\ 2 & 1 & 39 & 41 & 42 & 40 & 2 & 1 \\ 1 & 2 & 1 & 2 & 2 & 3 & 1 & 1 \\ 1 & 2 & 1 & 3 & 1 & 1 & 4 & 2 \end{bmatrix}$$

Corresponding Matrix

Pixel

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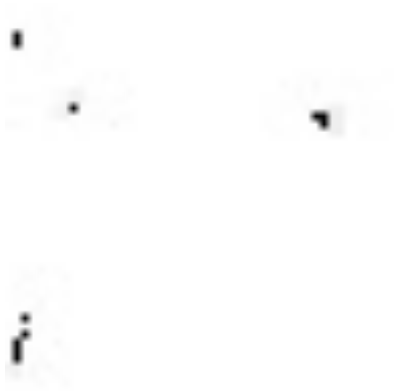
Point Operations

Recalculate point values



Modify brightness

Find Intensity

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Group Operations

Process neighborhoods

Image filtering

Edge detection

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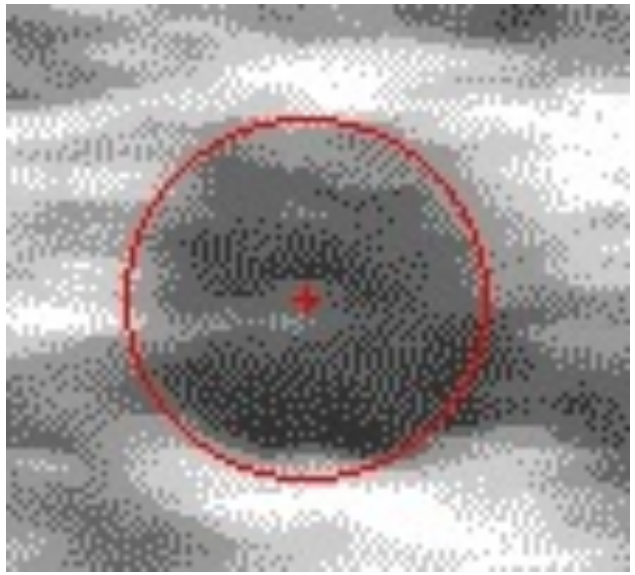
Feature Extraction

Finds shapes

Roads in remotely-sensed image



Artery in ultrasound image

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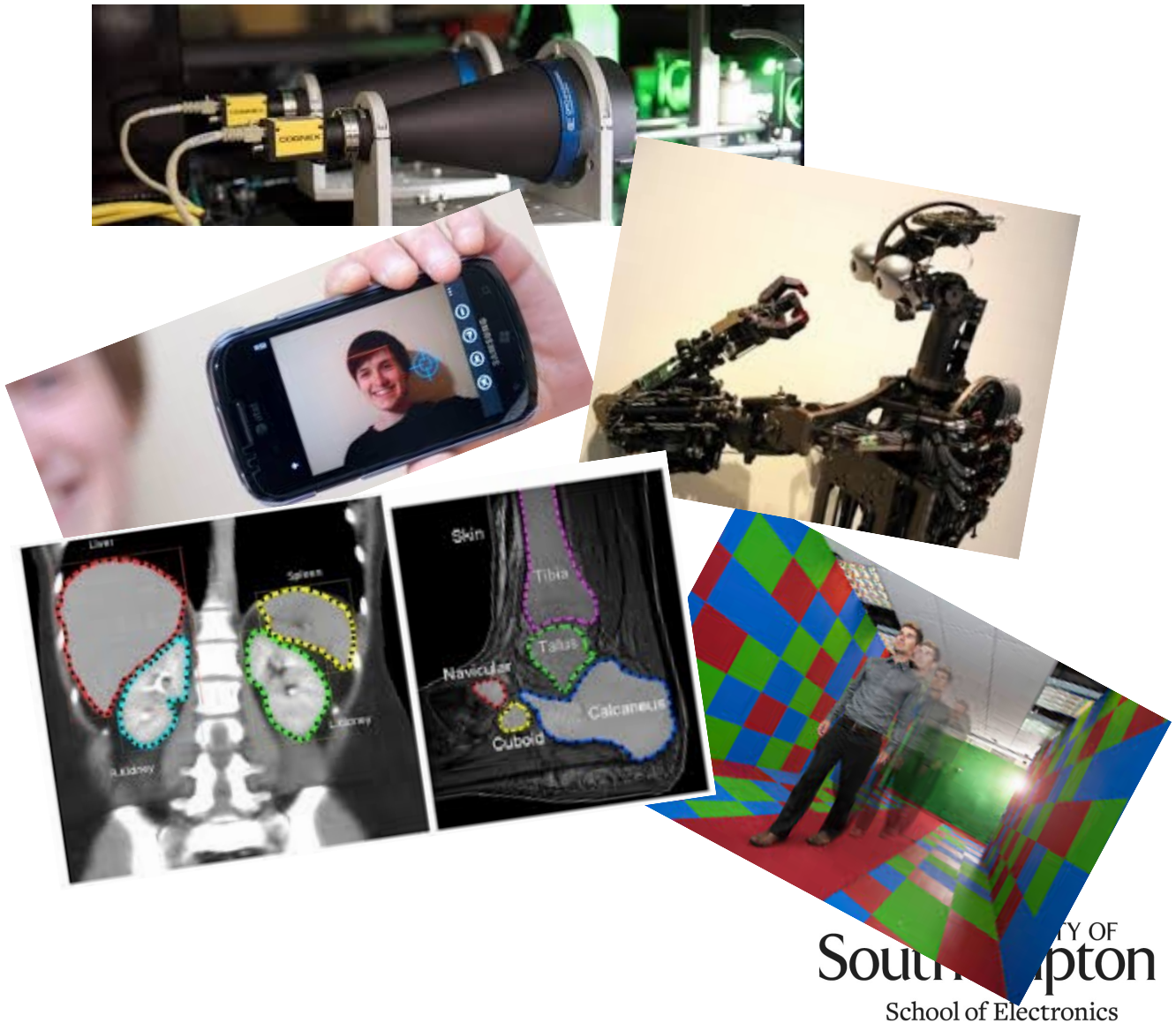
Applications of Computer Vision

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



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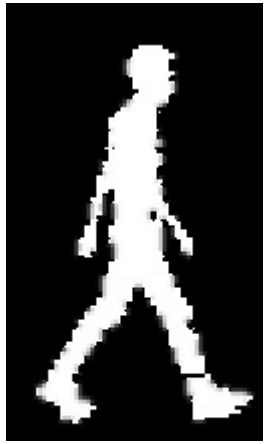
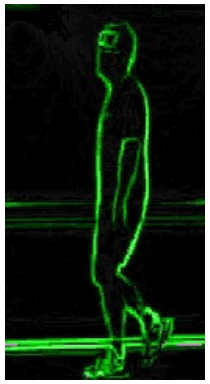
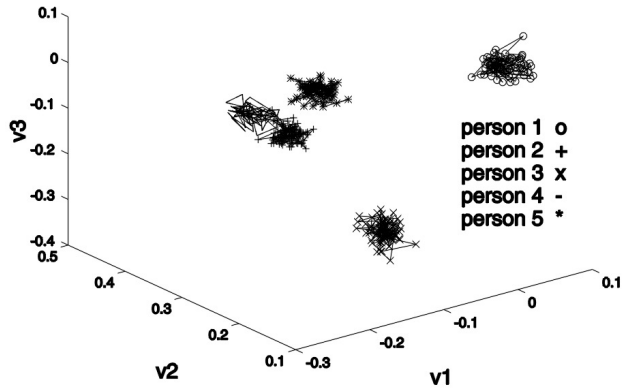
Gait Recognition

Recognising people from the motion of the whole body





silhouette flow edges symmetry acceleration feature space

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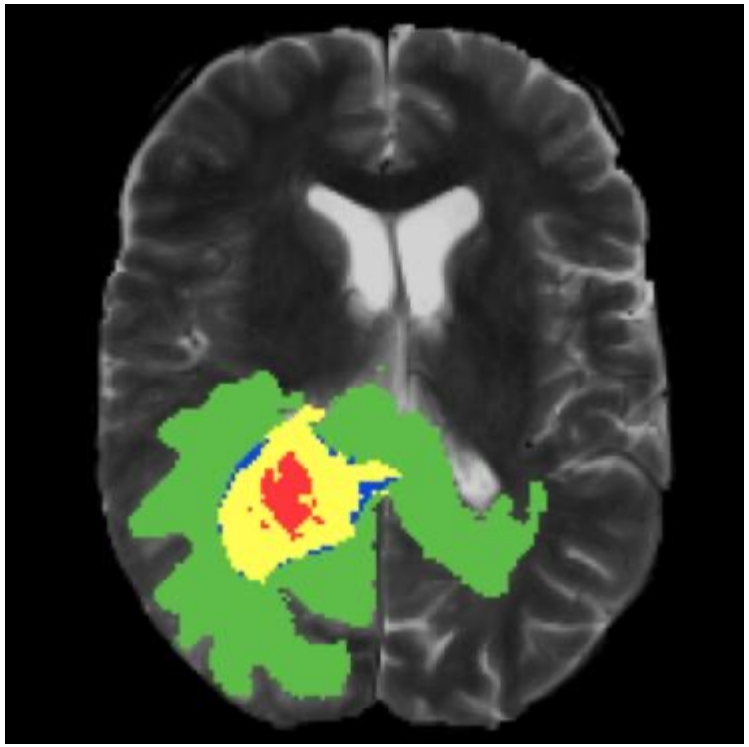
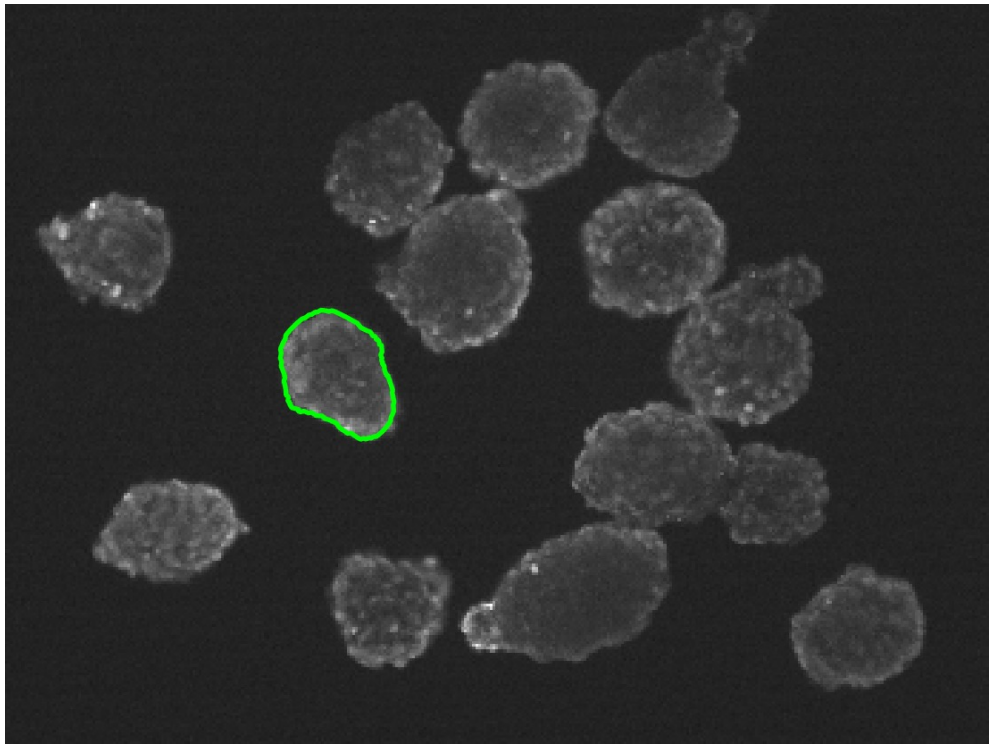
Medical imaging





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Digital videofluoroscopic Imaging

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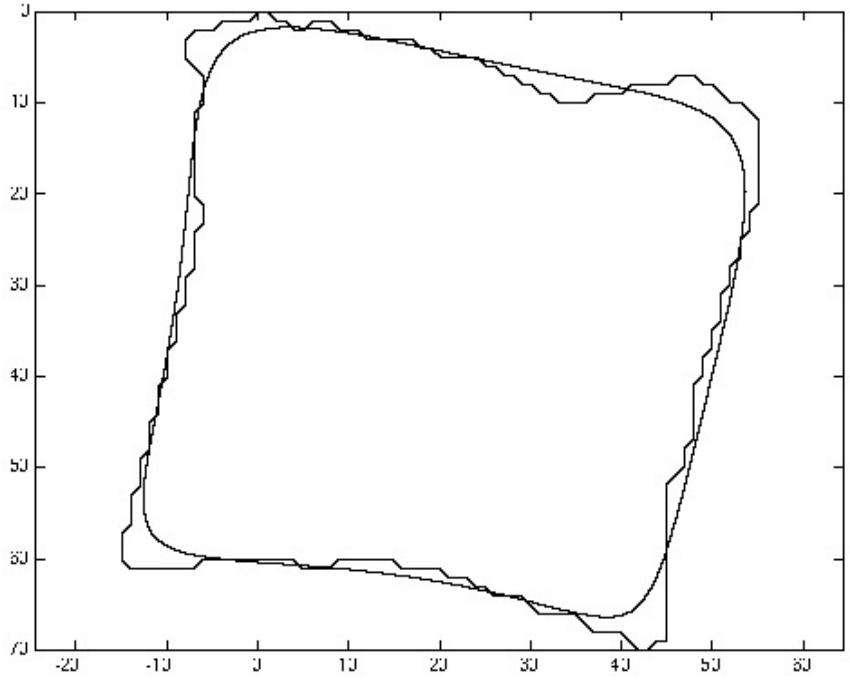
High level feature extraction



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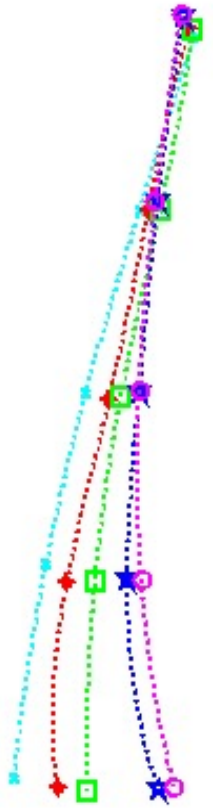
Animated extraction



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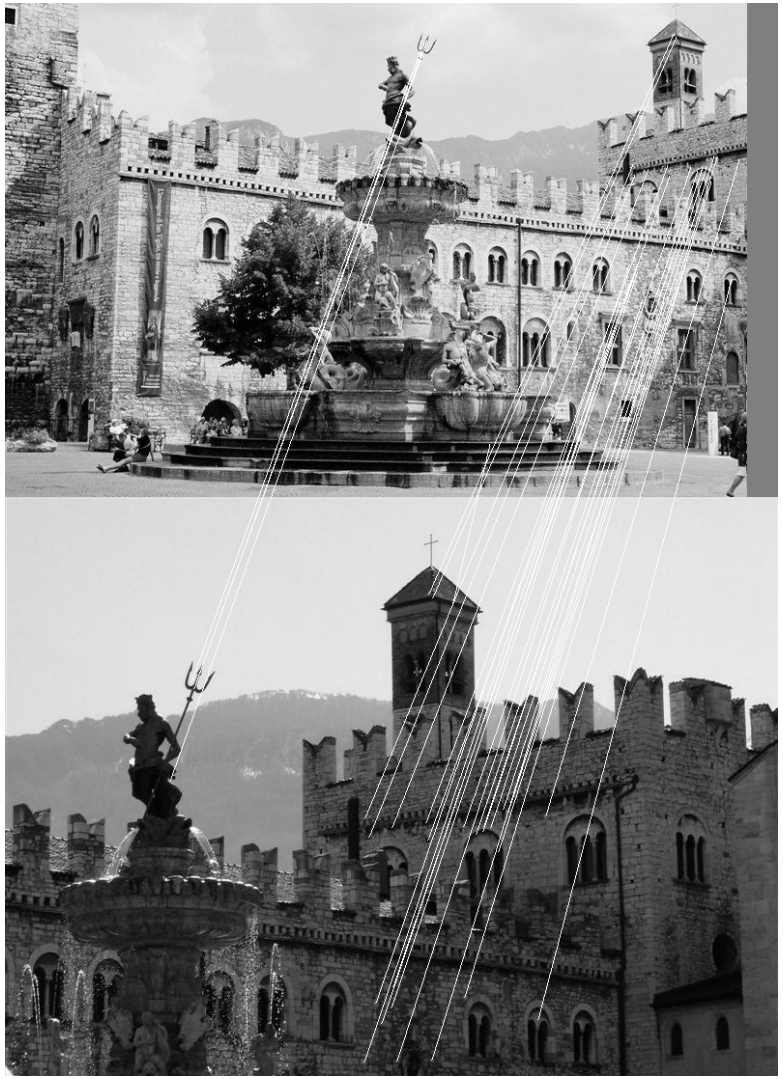
Content-based retrieval and image matching



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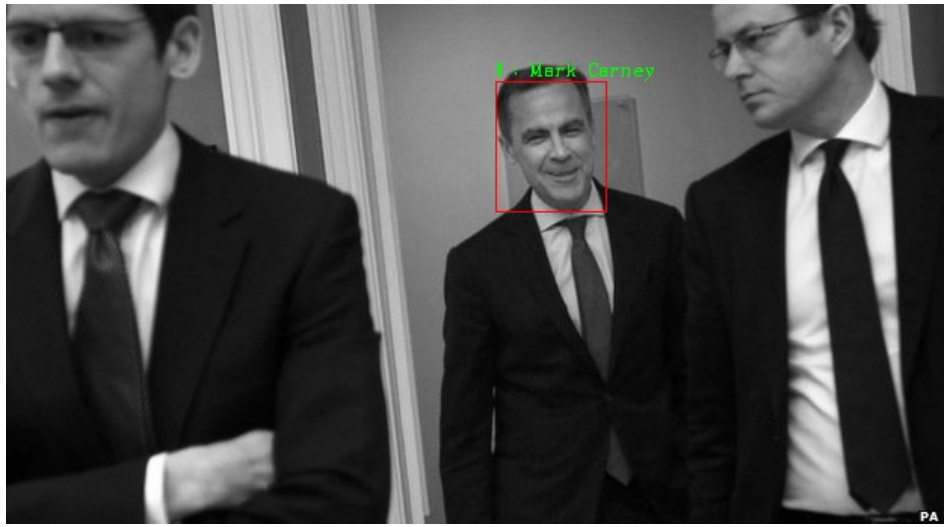
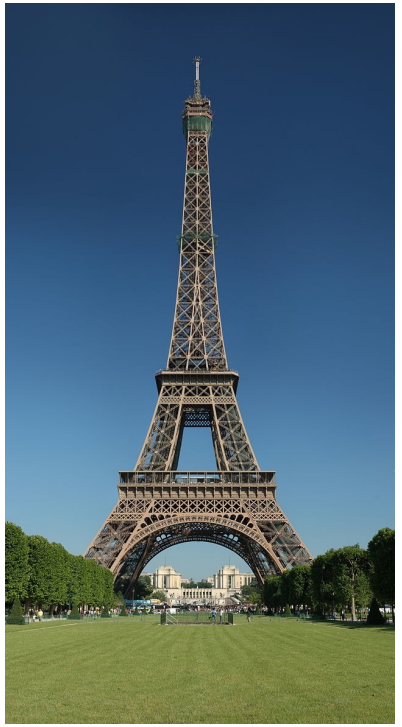
Higher level visual cognition



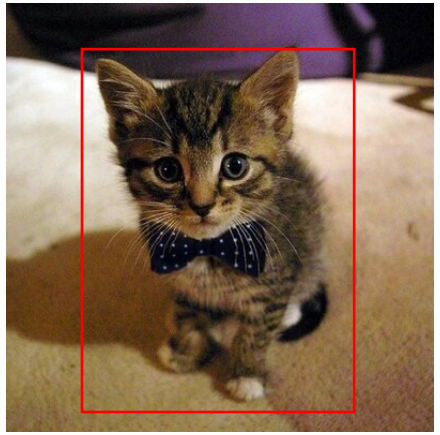
Who?



Where?

Why?

What?



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Computer vision support

- WWW homepages

  http://comp3204.ecs.soton.ac.uk

- Lecture support materials
- Links
- Notes
- Extra Tutorials (on demand – we should have time near the end)
- Mark's Book

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Computer vision support

https://www.southampton.ac.uk/~msn/book/

CONTENTS

1st Edition 2002; 2nd Edition 2008, 3rd Edition 2012 in Library (and electronic)

4th Edition 2019 in Library (and electronic)

(Current price ~£50 Amazon, Elsevier, etc.)

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Title	**Feature extraction and image processing for computer vision 4th ed.**
Author	Nixon, Mark S.
ISBN:	9780128149775
Link:	Click for access

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Lecture Support (Xiaohao)

- Slides available online
- Highlighted copy of book sections available
- Demos available

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

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Assessment

- Mixture of coursework and final ‘exam’ (format TBC – it will be ‘short duration’, but unclear yet if physical or online)

- 60% exam; 40% coursework

Coursework

- Three courseworks:
  - 2 individual. One is automatically marked and requires you follow the spec…
  - 1 in groups of 4 (competition format)

  - Much requested feature!
  - Designed to support learning
  - Has worked really well since introduced

Coursework schedule

- **Coursework 1**. Set today 4th October. Due Friday 26th November, 16:00. Feedback by 17th December
- **Coursework 2**: Set Monday 15th October. Due Friday 12th November, 16:00. Feedback by 4th December
- **Coursework 3**: Set Tuesday 16th November. Due Thursday 16th January, 16:00. Feedback by 16th January

Note the overlap in deadlines; you are responsible for planning appropriately!

Lecture Timetable

This course has 24 lectures of stuff

- Xiaohao will lead next from tomorrow for 3 and a bit weeks [9 lectures]
- Jon will then take over the lead for 4/5 weeks starting mid week 4
- Xiaohao will reappear later
- We'll run surgeries/revision lectures after Xmas

A word on content

- You'll probably have read a lot about how "deep learning" is changing computer vision
  - This is only partially true… applications like industrial inspection still use traditional techniques and are unlikely to change
  - Those traditional techniques are still generally important because they can (and are) be used in combination with deep learning techniques
    - Just ask anyone building self-driving cars!
  - This module predominantly focusses on the traditional approaches, but we'll talk a little about deep learning right at the end (and you can try it for part of the final coursework if you want)
  - Jon teaches a "deep learning" module in the fourth year if you want to learn more…

Finally

✓ **Enjoy!**

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  - Office: 32/4043

- Xiaohao Cai
  - xc1f20@ecs.soton.ac.uk
  - Office: 32/3011

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