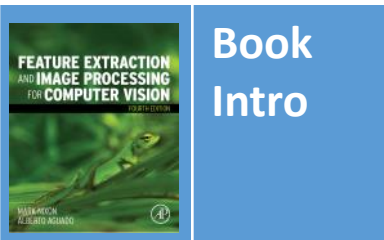


COMP3204 Computer Vision

Welcome!

Mark Nixon and Jonathon Hare



Department of
Electronics and
Computer Science

UNIVERSITY OF
Southampton
School of Electronics
and Computer Science

We are online...



Jon Hare



Mark Nixon

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!!

We are online...

Universities are learning communities in a research-led culture

That means we chat

..... so we would prefer to be in a lecture theatre and on campus

..... but, well, d'oh, dammit,

..... so we've had a good think about it, and here we are

What will the course include?

- Live **lectures** via Teams

Mon 1-2; Fri 11-12; and Fri 1-2

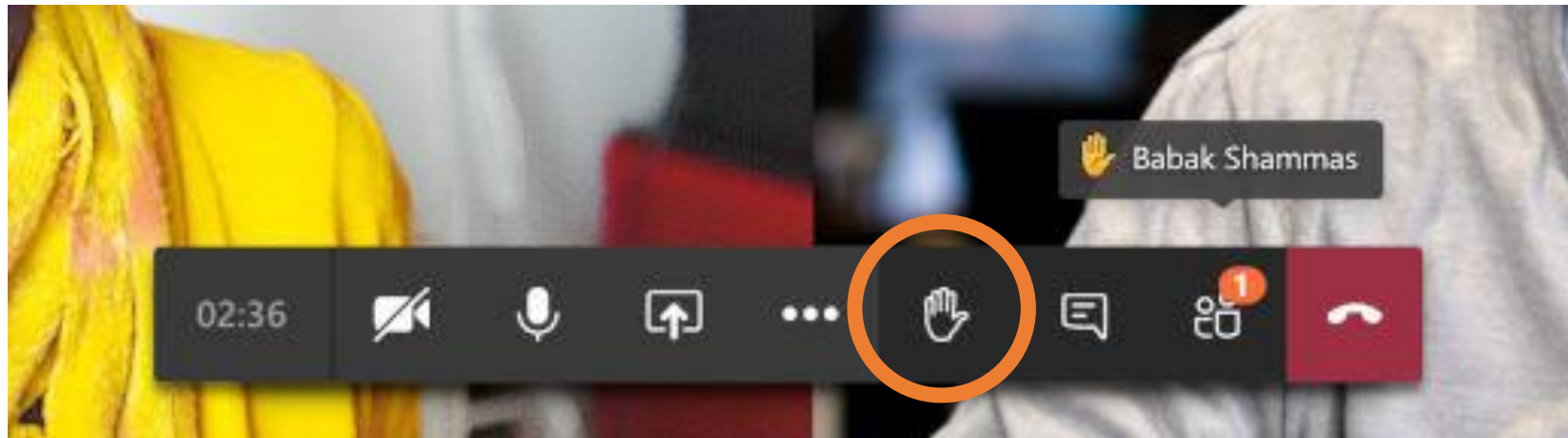
.... which will be recorded and placed on **Panopto**

- **Demonstrations**
- **Surgeries**
- ... and bits we haven't thought of yet!

Since we are online ...

Microsoft Teams

1) Everybody: please raise your hand



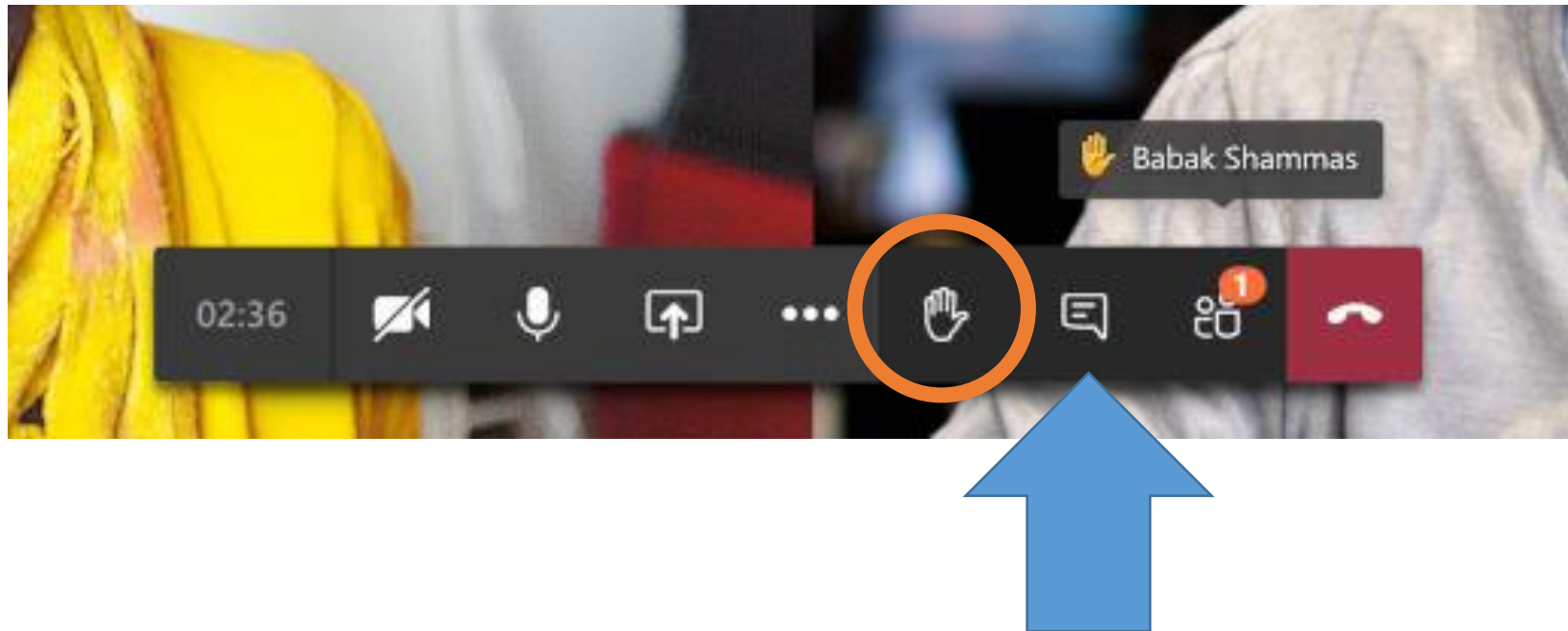
2) Now lower your hand...

- ...and raise it again if you **CANNOT** see or hear us

Since we are online ...

Microsoft Teams

1) Everybody: please use chat to ask questions



Since we are online...

- Please **DO**:
 - Turn off your microphone (unless asking a question)
 - Turn off your camera (unless asking a question, though if you don't want to or fail to, worry not)
 - Engage/interact
- Please **DON'T**:
 - Hide/be passive



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



Maintained by [Dr Jonathon Hare](#) and [Professor Mark Nixon](#).

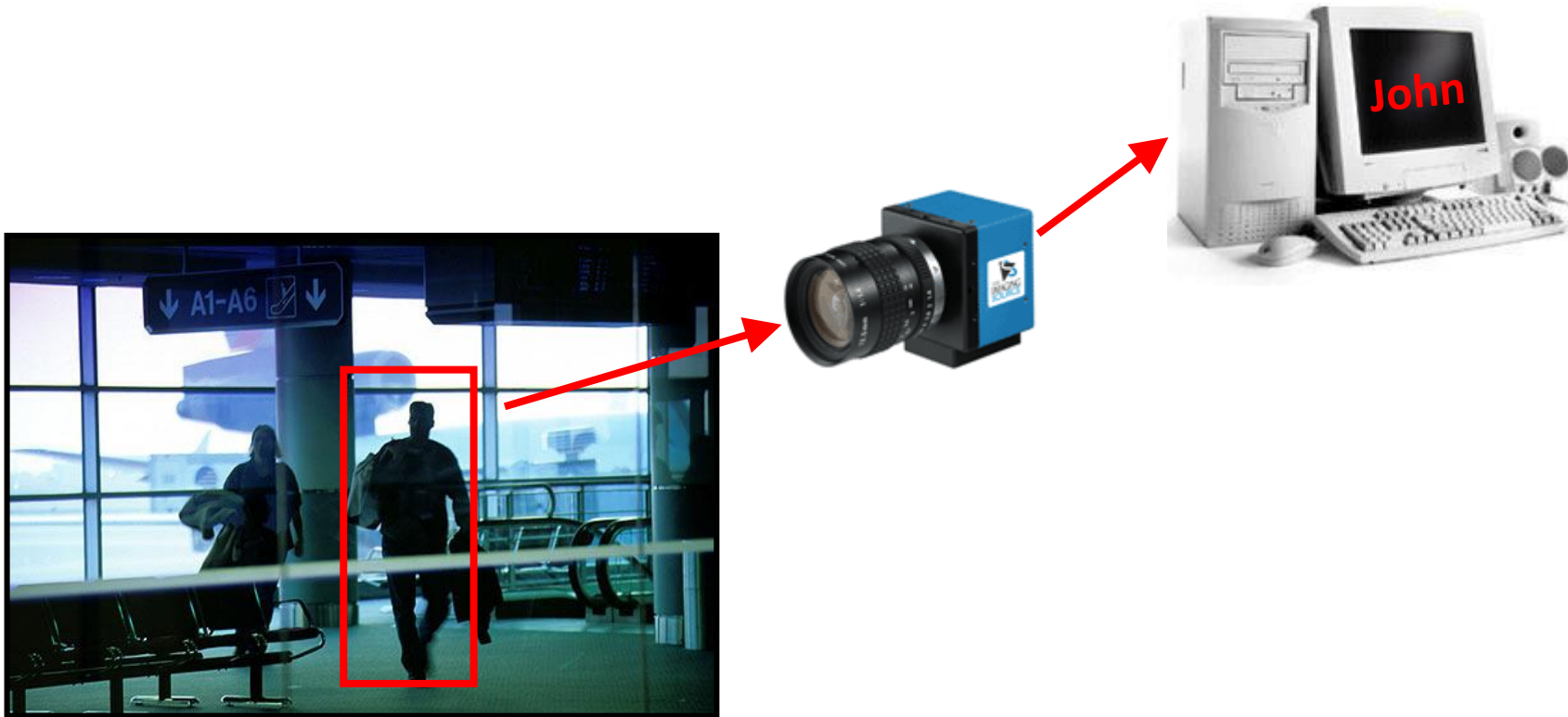
Welcome to the homepage for the ECS [COMP3204 "Computer Vision"](#) module.

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.

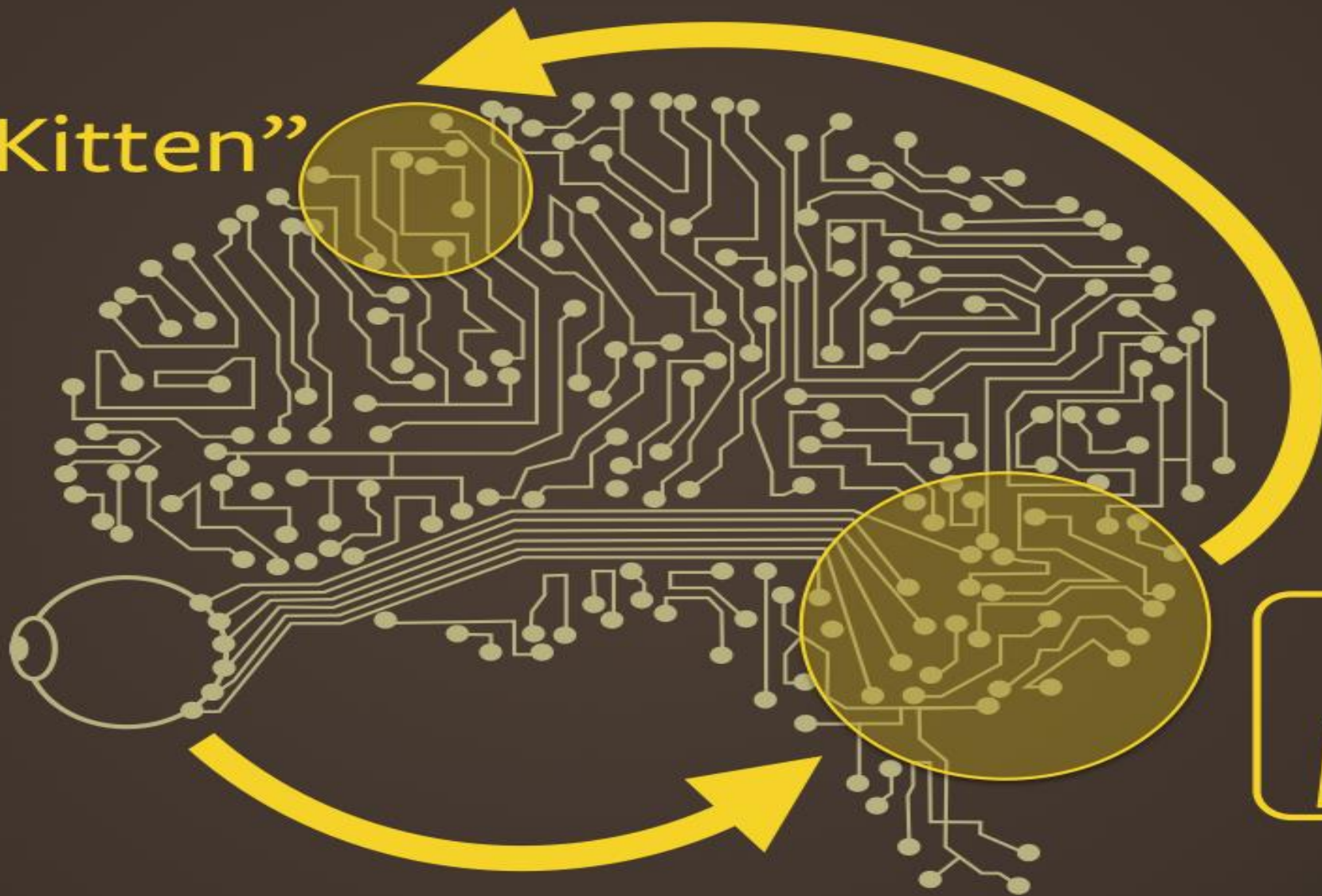
This course will explore some of the basic principles and techniques from these areas which are currently being used in real-world computer vision systems and the research and development of new systems.

The following short video gives an overview of what to expect in the module.

Vision based biometrics



“Kitten”



What can image analysis achieve?



Key to our slides

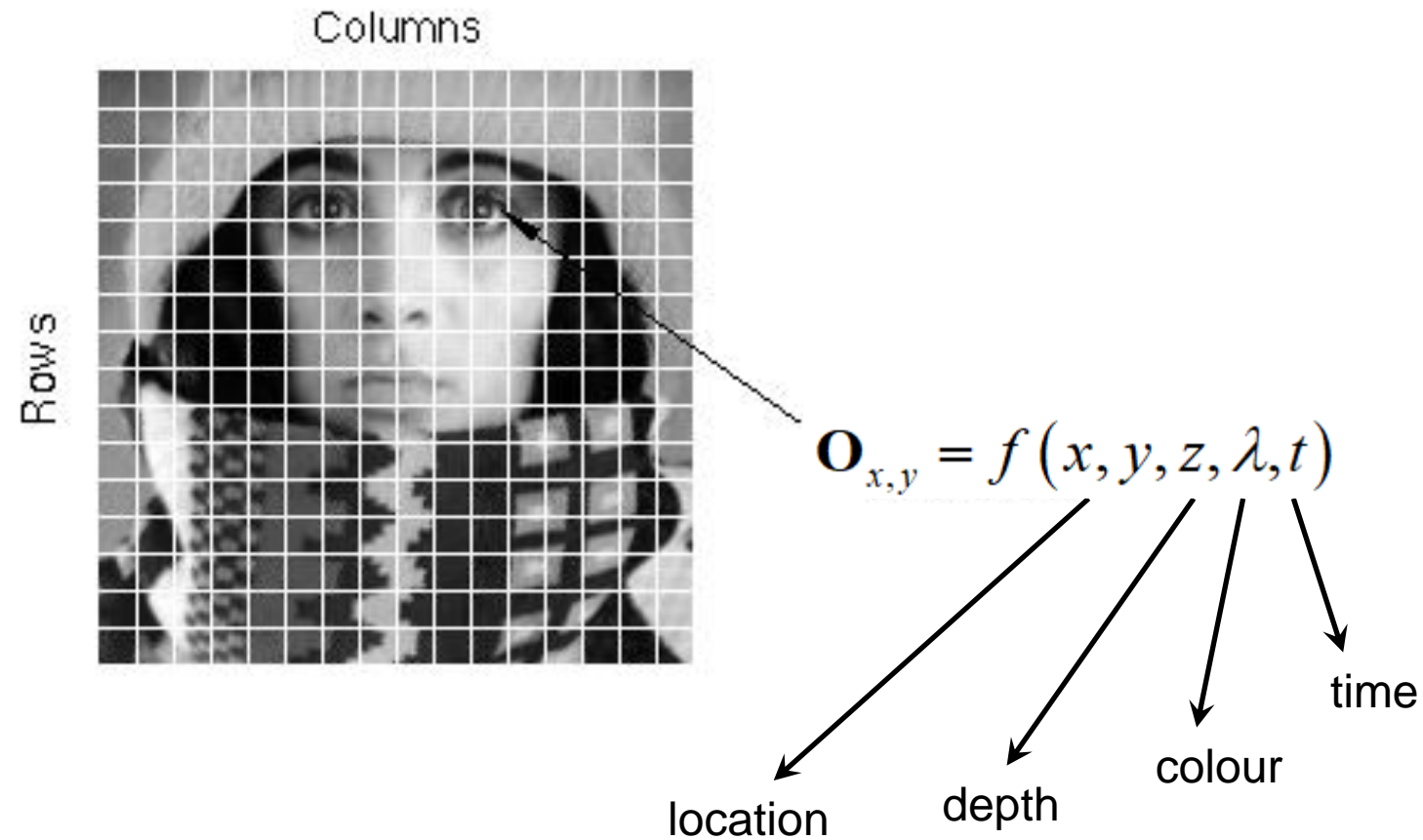
This bit is to be found in **Mark's book**

We expect you to **remember** this stuff

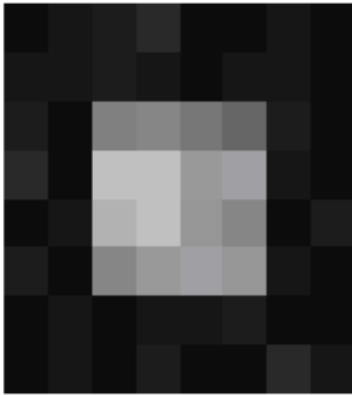
If **neither** of these are there, this is stuff to illuminate the course material



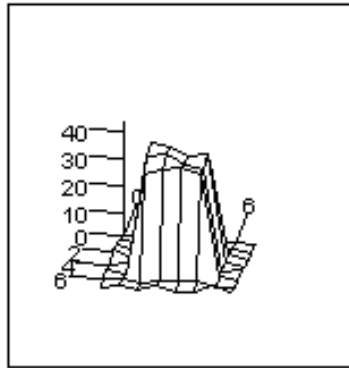
Images consist of picture elements known as “pixels”



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



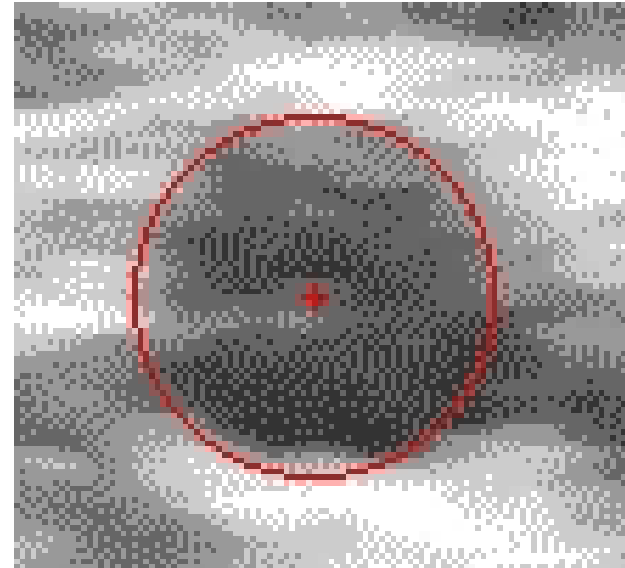
Edge detection

Feature Extraction

Finds **shapes**



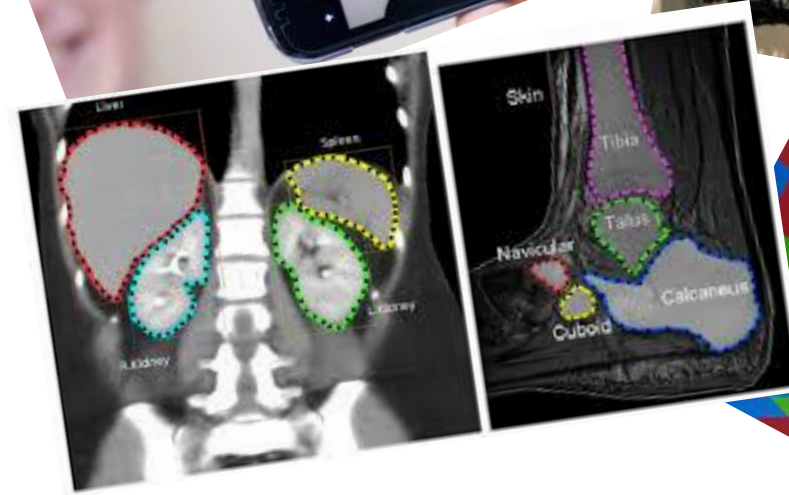
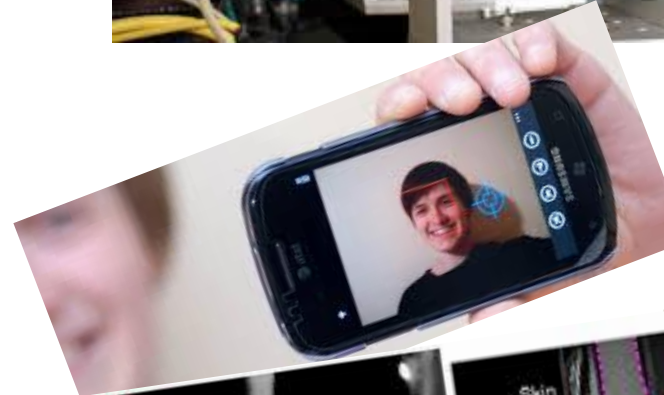
Roads in remotely-sensed image



Artery in ultrasound image

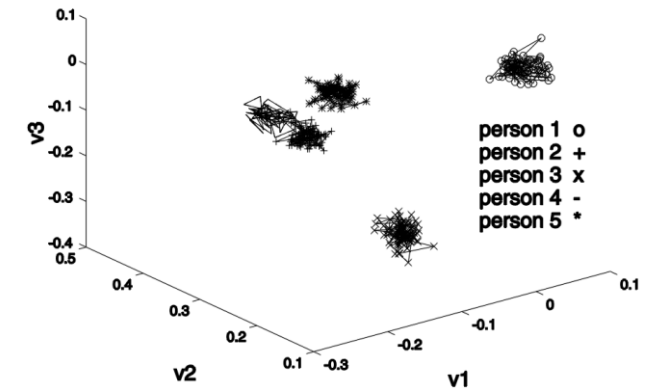
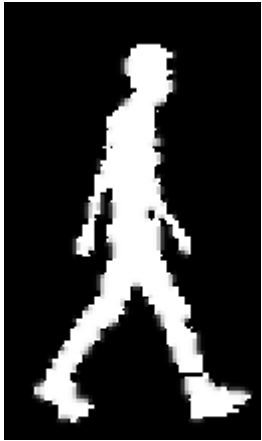
Applications of Computer Vision

- 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

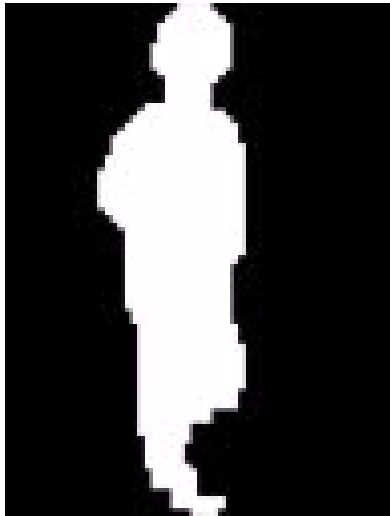
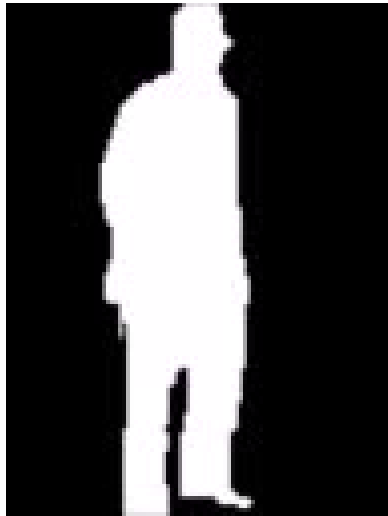
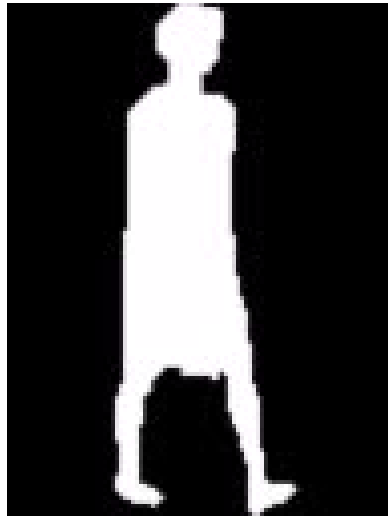
acceleration

feature space



Gait-based Age Estimation using a Whole-generation Gait Database

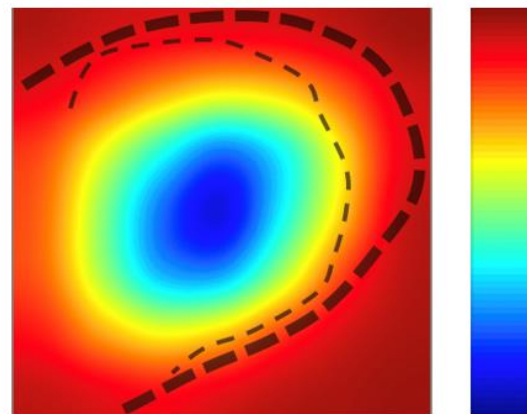
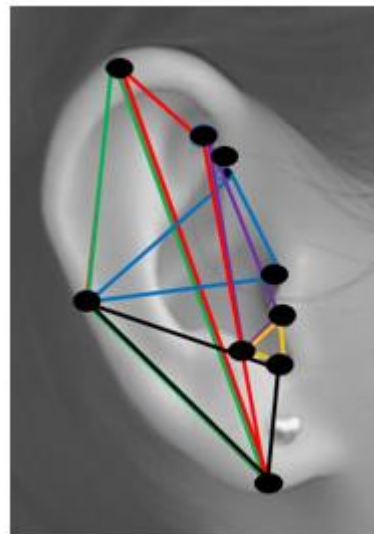
- How old is he/she?

Subject	1	2	3
Gait			
Age	<p>A. 4 years old B. 14 years old C. 24 years old</p>	<p>A. 62 years old B. 72 years old C. 82 years old</p>	<p>A. 24 years old B. 34 years old C. 44 years old</p>

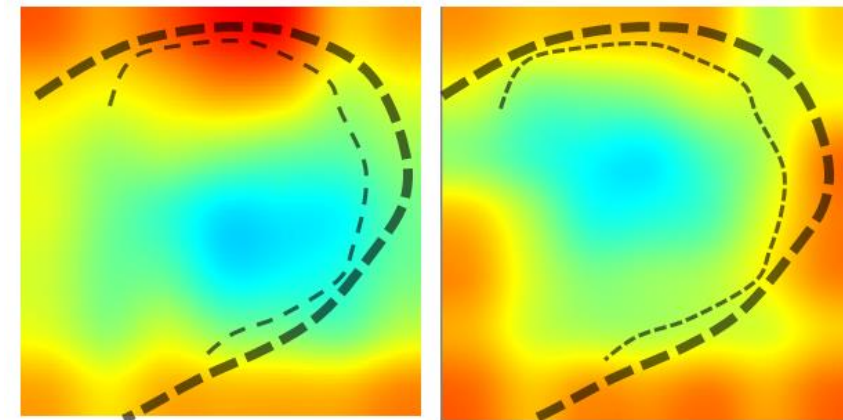
Makihara, Okumura, Iwama,
and Yagi, *Proc. IJCB 2011*

Ear biometrics

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



Average heatmap for ear identification



male

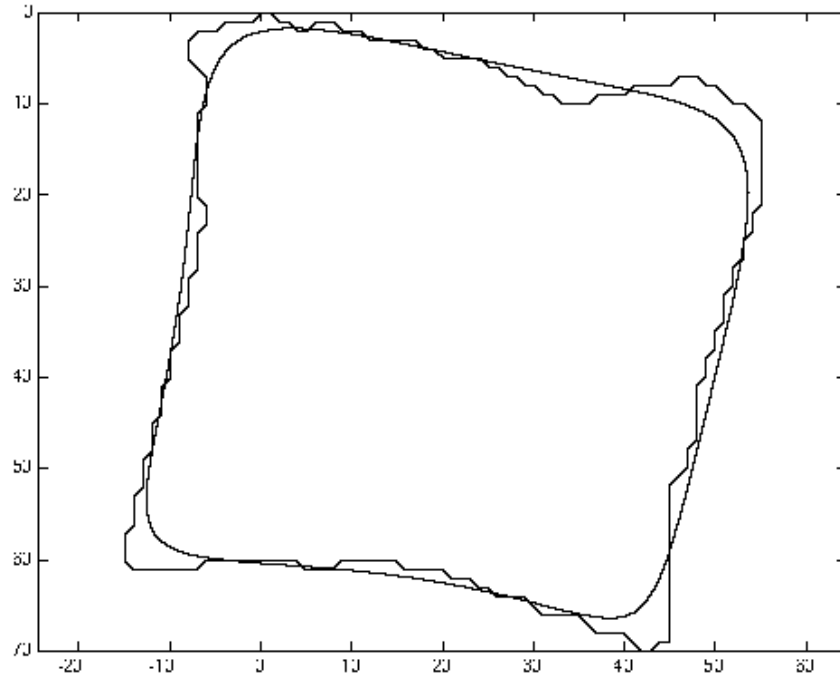
female

Average heatmaps for different genders

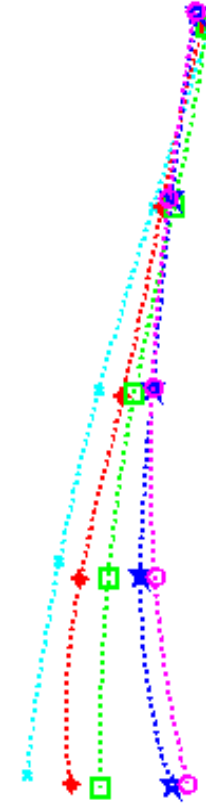
Digital videofluoroscopic Imaging



High level feature extraction



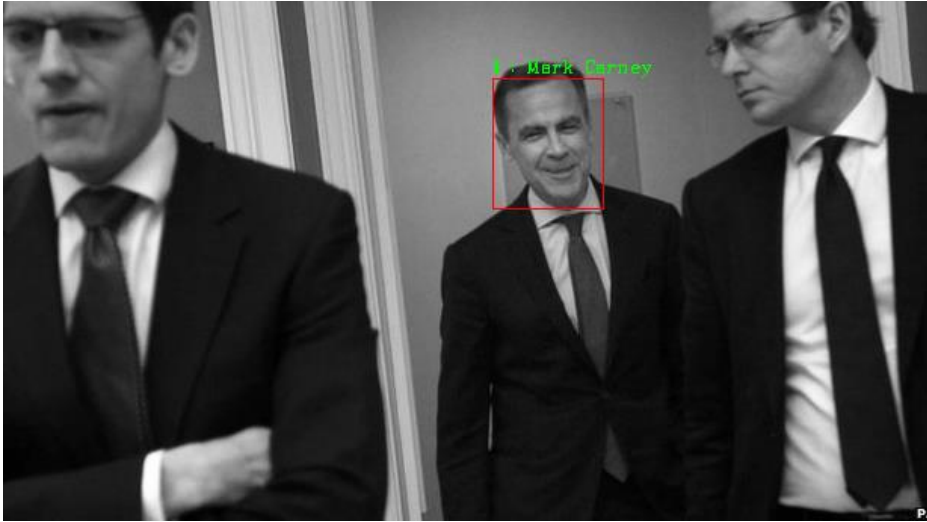
Animated extraction



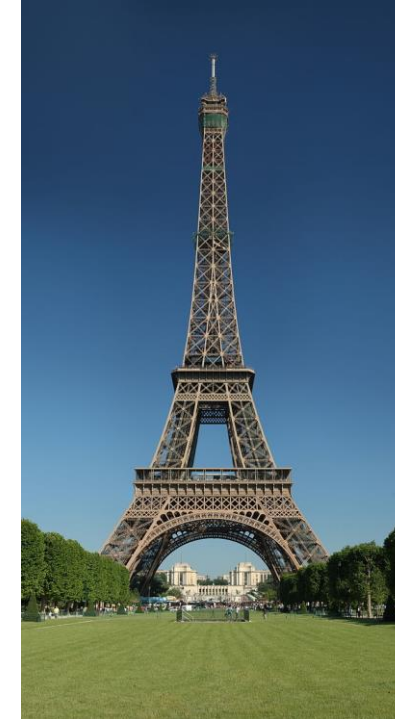
Content-based retrieval and image matching



Higher level visual cognition



Who?

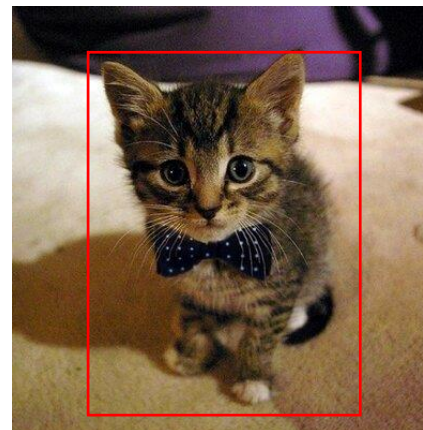


Where?

Why?



What?



Computer vision support

- WWW homepages

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

- Lecture **support** materials

- **Links**

- **Notes**

- **Tutorials** (on demand)

- **Book**

Computer vision support

<https://www.southampton.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

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

4th Edition 2019 in Library (and electronic)

(Current price ~£58 Amazon) It has dropped. Is this the Brexit price?

Direct from the Library!!

record 5 of 13 for search **keywords** "nixon feature"

Item Details

☐ Mark



Copy details

[Contents/Summary](#)

[Full Catalogue Details](#)

Title Feature extraction and image processing for computer vision 4th ed.
Author Nixon, Mark S.
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Link: [Click for access](#)

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Lecture Support (Mark)

- Slides available online
- Highlighted copy of book sections available
- Demos available
- The 4th 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'
- 60% exam; 40% coursework

Coursework

- Three courseworks:
 - 2 individual
 - 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** 5th October. Due Friday 27th November, 16:00. Feedback by 11th December
- **Coursework 2:** Set Monday 20th October. Due Friday 13th November, 16:00. Feedback by 4th December
- **Coursework 3:** Set Tuesday 19th November. Due Wednesday 6th January, 16:00. Feedback by 22th January

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

Lecture Timetable

This course has 24 lectures of stuff

- Mark will lead next from Friday for 3 and a bit weeks [10 lectures]
- Jon will then take over the lead for 4/5 weeks starting week 5
- Mark will reappear later
- We'll run surgeries and revision lectures before and after Xmas

Finally

✓ Enjoy!

- Mark Nixon
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 - Office: 32/3011
- Jonathon Hare
 - jsh2@ecs.soton.ac.uk
 - Office: 32/4043