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# Deep Learning Applications for Computer Vision

Lecture 1: Introduction



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# What is Computer Vision?

- around time 1960s

- analysing digital images

1 image

sequence of images

multiple views of a scene

multi-dimensional data

↳ 3D scanner

↳ medical imaging

system: CT, MRI

- interdisciplinary field



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# What is Computer Vision?

Extracting information from images

Methods for: acquiring, processing, analyzing and interpreting digital images.

Can we come up with algorithms that mimic the function of the human visual cortex?

Areas of interest: object/pattern recognition, segmentation, tracking, motion estimation, ...

“Machine vision” – giving “machines” the power to make decisions based on information from images



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# What problems is Computer Vision trying to solve?

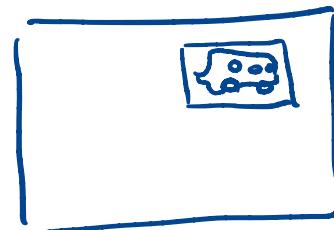
1. Recognition
2. Tracking / segmentation
3. Motion estimation / analysis
4. Pose estimation
5. Scene reconstruction , 3D scene modeling 
6. Visual servoing
7. Image restoration



# 1. Recognition

Does the image contain a certain object/ feature/ activity?

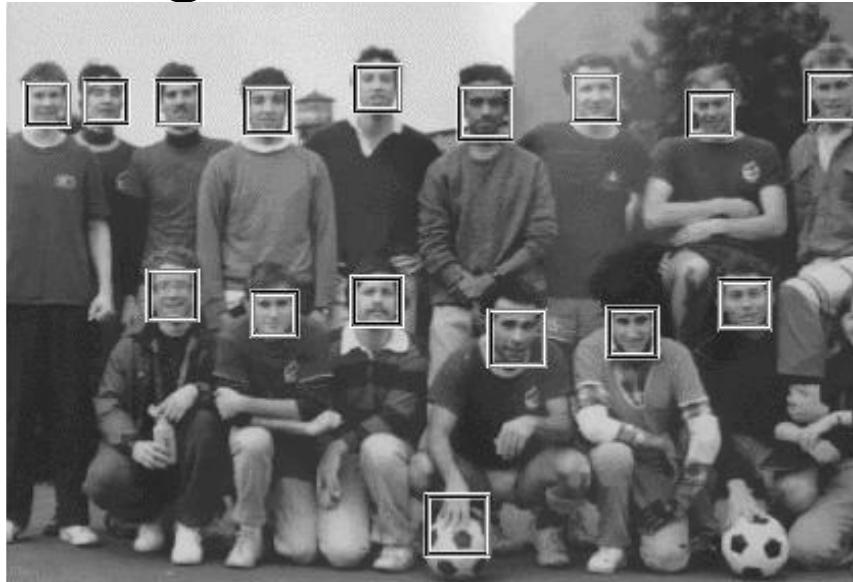
- **Recognize and classify** a certain given object or object class
- **Identify and localize**
- **Detect** a certain specific condition, object



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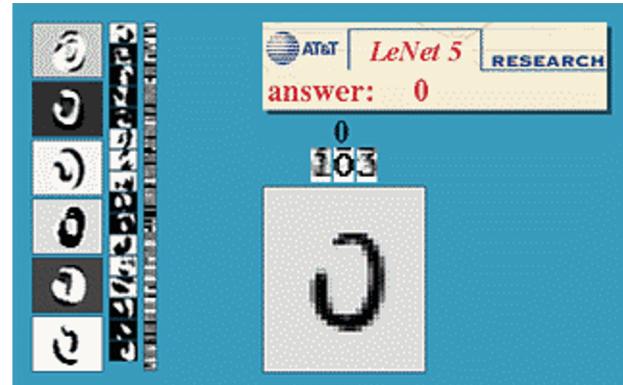
# 1. Recognition

## Faces



Face recognition, MIT+CMU test set  
Reading: Viola and Jones 2001 Paper

## Optical Character Recognition (OCR)



Digit recognition, AT&T labs  
<http://www.research.att.com/~yann/>

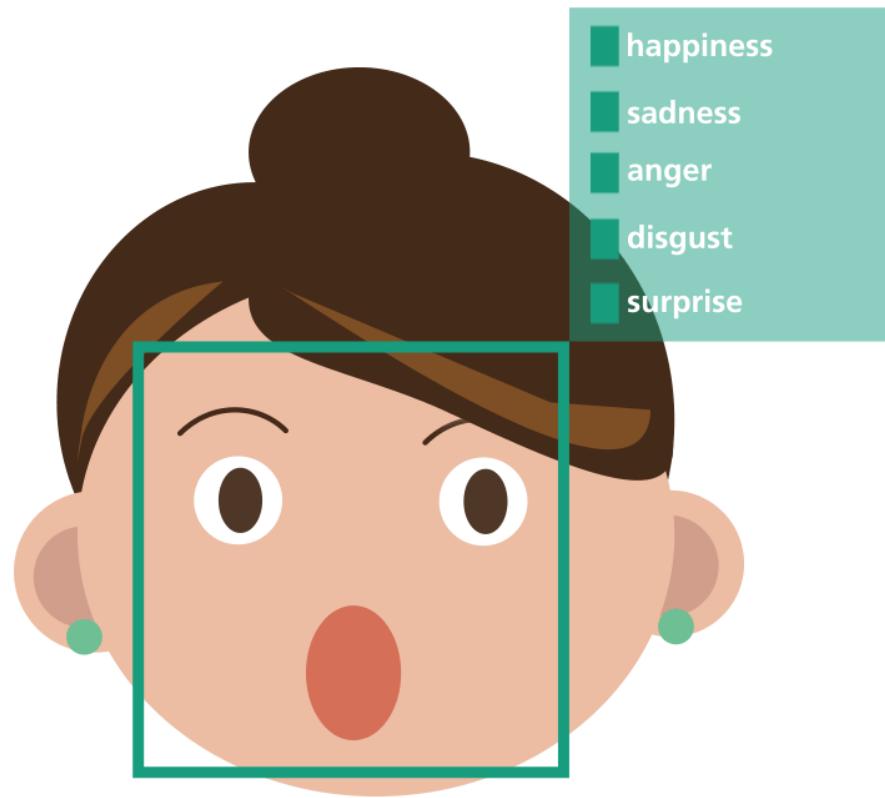


License plate readers  
[http://en.wikipedia.org/wiki/Automatic\\_number\\_plate\\_recognition](http://en.wikipedia.org/wiki/Automatic_number_plate_recognition)



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# Smile detection?



- photo selection
- analysing user experience
- patient monitoring

Reading: Can artificial intelligence recognize facial human emotions?



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# Object recognition (in supermarkets)

## Amazon Go: Cashier-less stores

In 2016, Amazon introduced Go, a store where you could walk in, pick up items you wanted to buy, and walk out. There was no need for cashiers.

"As customers move about the store, cameras equipped with advanced computer vision algorithms monitor their behavior and keep track of the items they pick up or return to shelves. When they leave the store, their shopping cart is automatically charged to their Amazon account. Three years after the announcement, Amazon has opened 18 Go stores and it's still a work in progress."

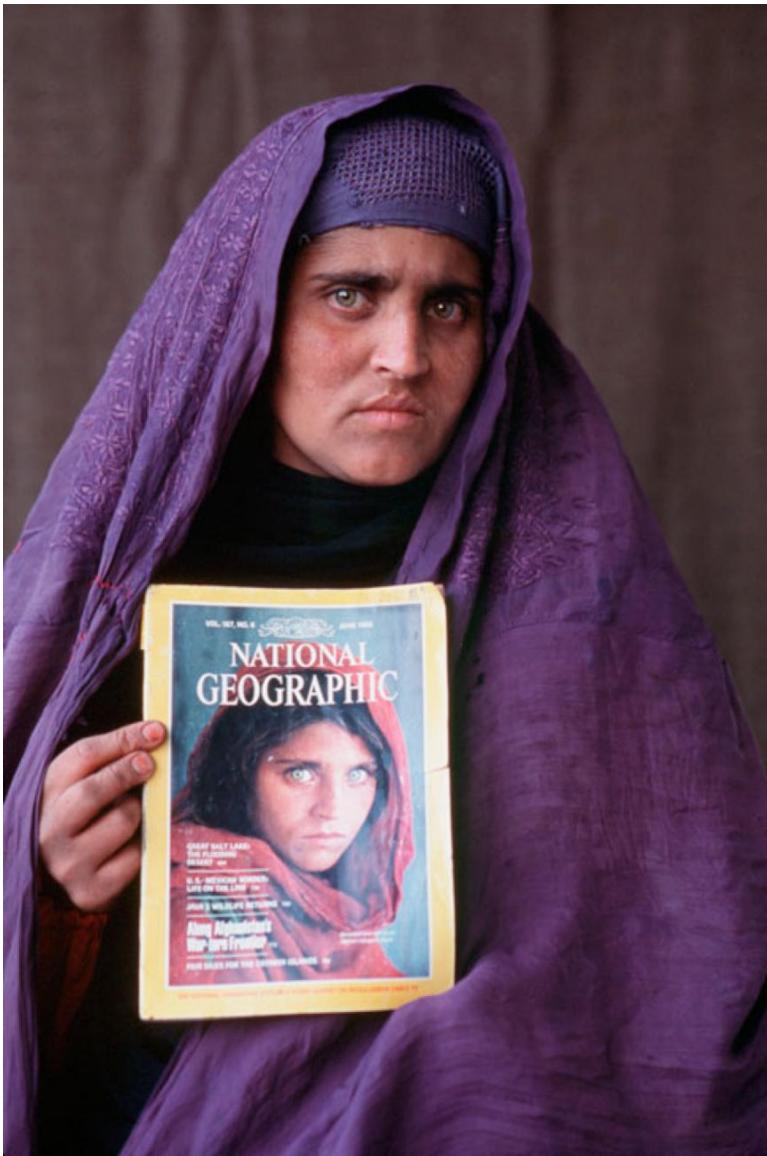
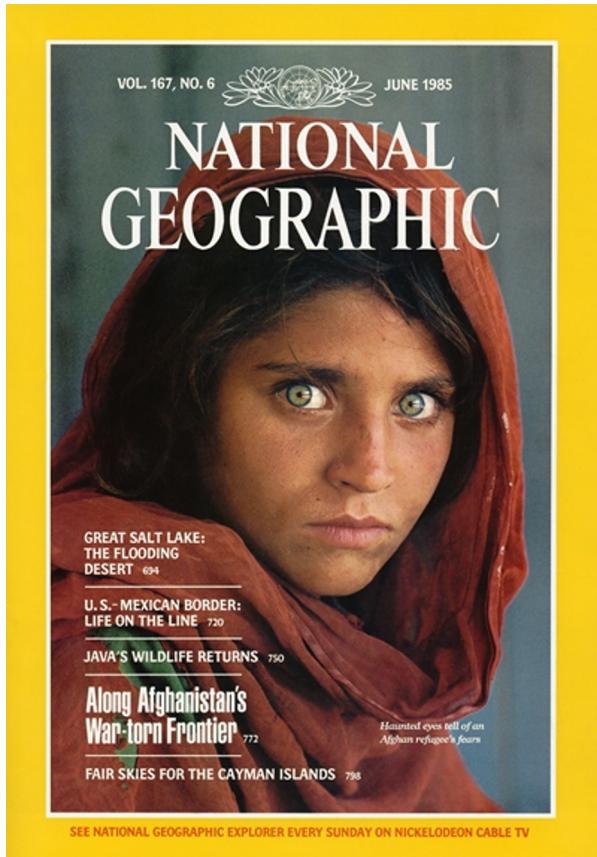
Computer vision applications: The power and limits of deep learning <https://bdtechtalks.com/2019/12/30/computer-vision-applications-deep-learning/>



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# Who is she?

18 years



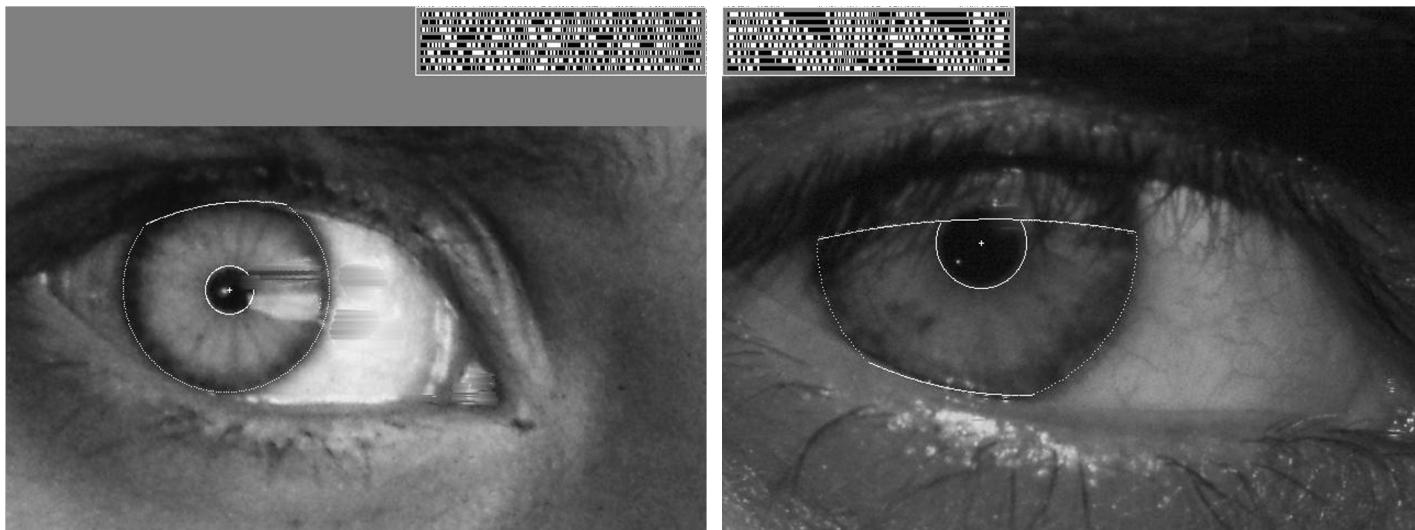
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# Vision-based biometrics

## Automatic Iris Recognition

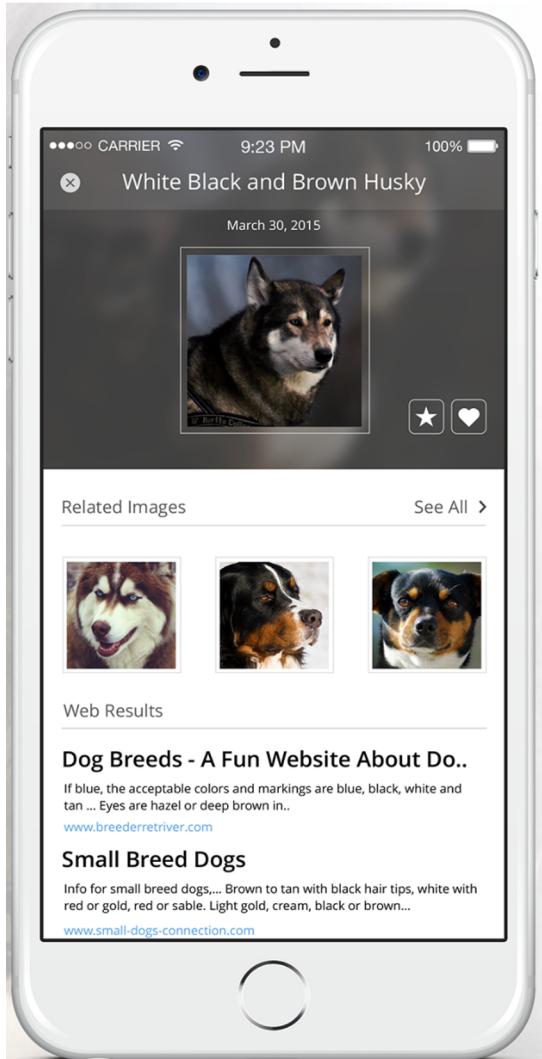
<http://www.cl.cam.ac.uk/~jgd1000/afghan.html>

John Daugman (University of Cambridge, England)



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# Object recognition in mobile apps



*Google Lens* app:

- *Text → translation*
- Identify plants and animals

Find out what plant is in your friend's apartment, or what kind of dog you saw in the park.



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