

Coding & STEM 4 Schools

2019 AI Workshop

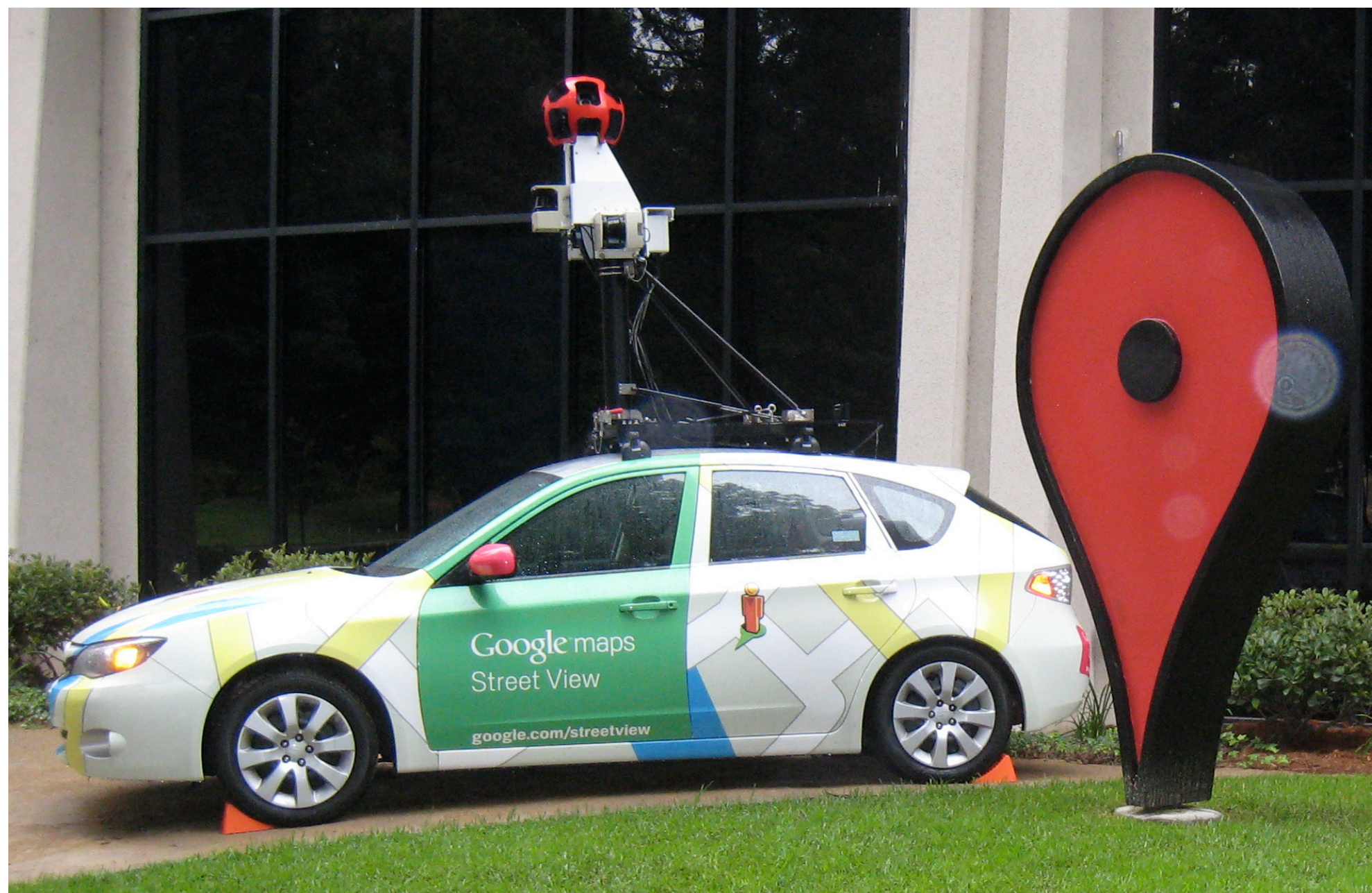
Computer Vision

Presented by Mr Daniel Hickmott on 12th November 2019

What is Computer Vision?

- "A scientific field about how computers can be made to emulate human vision; in areas like face recognition and spatial awareness."¹
- Recent advances allow for a lot of opportunities:
 - The ease of taking many photos or video, e.g. drones with cameras
 - Increased processing power, e.g. Snapchat filters on phones

¹ CS Field Guide: Computer Vision

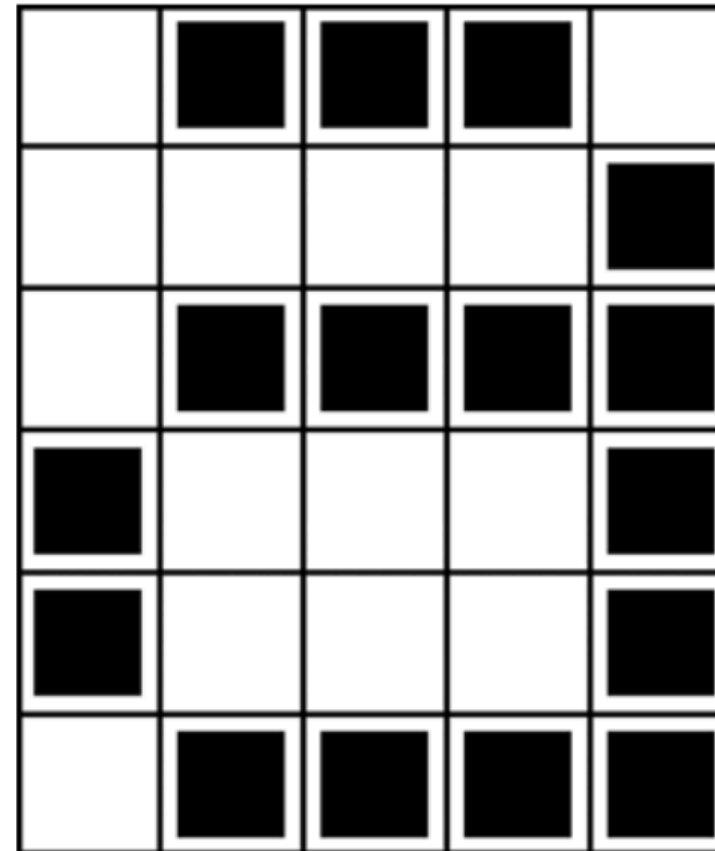


Google Street View cars

How Do Computers See?

- Need to have some way of 'seeing' e.g. video, photo or scanned document
- Usually images are represented as a list of individual colour values (for each pixel in the the image)

Image Representation



1, 3, 1

4, 1

1, 4

0, 1, 3, 1

0, 1, 3, 1

1, 4

Computer Science Unplugged: Image Representation



[(195, 187, 185), (192, 184, 182),
(189, 181, 179), (196, 188, 186),
(203, 198, 195), (202, 197, 194),
(194, 189, 186), (191, 186, 183),
(186, 181, 178), (177, 172, 169), (199,
191, 188), (195, 187, 184), (192, 184,
182), (195, 187, 185), (200, 195,
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188), (194, 189, 186), (189, 184,
181), (184, 179, 176), (203, 195,
192), (199, 191, 188), (193, 185,
182)...]

CS Field Guide's Pixel Viewer

Applications of Computer Vision

- Computers can process many images very quickly and repetitively
- Used for surveillance at events with large numbers of attendees, e.g. Superbowl
- Optical Character Recognition (OCR), e.g. Google Translate
- Combined with drones for automating processes livestock management

Recognising Faces

- A common application of Computer Vision is **facial recognition**
- Used a lot for identification (e.g. airports)
- The Viola-Jones algorithm is used, good high-level explanation here
- Algorithms can identify **attributes** of faces which we can then use in Machine Learning models, can you think of some examples of these **attributes**?

Attributes of Faces

- Human face has appropriately 80 **nodal points**², including:
 - Distance between eyes
 - Width of the nose
 - Depth of the eye sockets
 - The shape of the cheekbones
 - The length of the jaw line

² How Facial Recognition Systems Work

Challenges and Techniques

- The Computer Vision chapter from the CS Field Guide is a great resource for Computer Vision if you would like to know more:
 - Noise and Filtering
 - Edge Detection: splitting images up to detect different objects in the image, e.g. Facebook tags

Snap!

- Next, we will work through the [Snap!](#) activity from the worksheets available from the [Machine Learning for Kids website](#)
- In this activity we will teach a computer to recognise photos of hand-made cards as the correct suit (spades, clubs, hearts and diamonds)