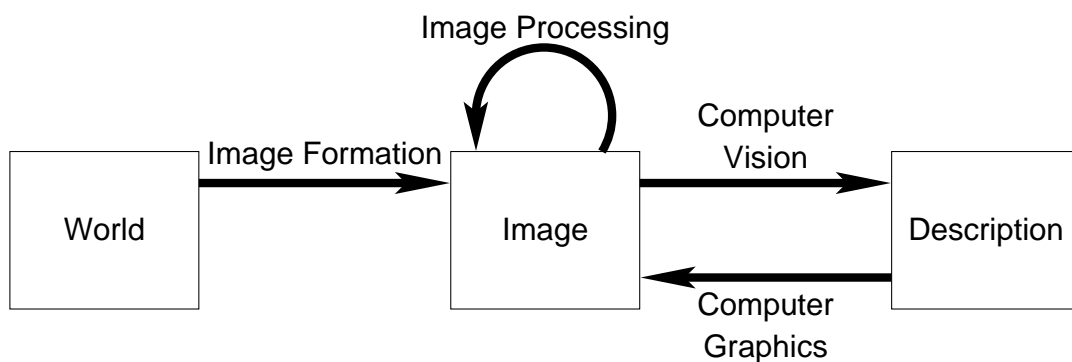
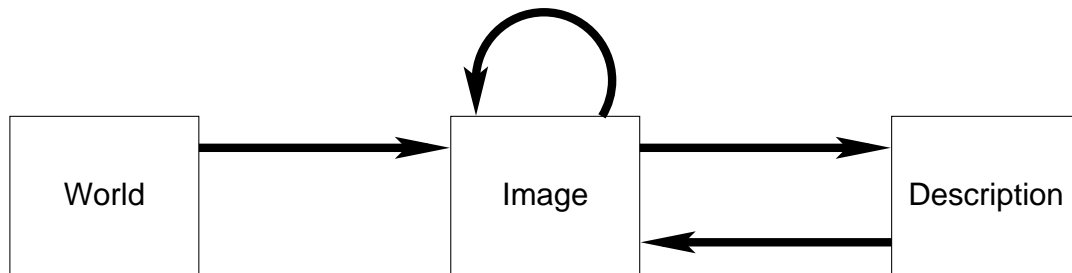


Introduction

1. Give a definition of “Computer Vision”.

Extracting information about the world from images.

2. The diagram below shows different representations of the same information, and possible transitions between them. Label each of the arrows with the name of the field of study or process that deals with the transition illustrated.



3. What type of information is extracted in each of the following applications:

- **optical character recognition**

category of each letter

- **face tracking web-cam**

location of face in image

- **face recognition software / biometrics**

identity of individual

- **content based image retrieval**

category of each item in image (description of relationships between items)

- **driver assistance**

categorisation (e.g. pedestrians, road edge) and 3D location

- **3D modelling**

the 3D locations of all image points

4. Vision is often described as an “ill-posed, inverse problem”. Briefly describe what is meant by the terms “ill-posed” and “inverse problem” and their opposites “well-posed” and “forward problems”.

A forward problem is one where we know the causes and want to predict or model to outcomes (e.g. we know the forces acting on an object and want to calculate its acceleration).

An inverse problem is one where we know the outcomes and want to infer the causes (e.g. we know where an object currently is and want to know how it got there).

A well-posed problem is one which has one, unique, solution.

An ill-posed problem has multiple solutions (or no solution).

Vision is an inverse problem as we know the pixel intensities (the outcomes) and want to infer the causes (i.e. the objects in the scene, etc.). It is ill-posed as there are usually multiple solutions (i.e. multiple causes that could give rise to the same outcomes).

5. What is a “prior” and how does it help solve the ill-posed, inverse problem of vision? Give examples of priors.

A prior is an additional source of information that can help reduce the number of possible solutions, and hence, help infer the correct causes that gave rise to an image. Examples, include knowledge of the world and the image formation process, expectations and prior exposure, contextual information from elsewhere in the image or from another sense.