Image and video processing

Image Compression
- Problem: images take up a lot of space —> huge size of the data files
- Definition: reduce image file size
- Benefits: reduce storage needed, reduce transmission cost/latency/bandwidth

Image Inpainting — reconstruct corrupted/destroyed parts of an image

Applications

Medical research
Environmental control
Scientific photography and videography
- Image systems: to gather quantitative information about physical systems and processes

False color images
- Image with grey levels representing original image
- Use a suitable filter/false colors to highlight edges/important areas (e.g. blood flow levels)
e.g. PET scan, MRI scan

Forensics & law enforcement
Video production

Histograms: the distribution of pixels in an image
作用: improve the contrast of images

Exploiting photo and video collections
Intelligent browsing
- Content based image retrieval
- Metadata based image retrieval

Content based image retrieval: images can be grouped based on the features of the image itself (color, texture, shape)

Metadata based image retrieval: images are grouped based on descriptions of image or the data associated with the image

Semantic image analysis technique: detect high-level semantic contents
Computer vision: trains computer to interpret and understand the visual world

High Dynamic Range (HDR) images
- HDR image: very bright and very dark parts in a single image

Problem: Dynamic range in photographed scene may exceed number of available bits to represent pixels

Solution: capture multiple images at different exposure, combine them using image processing

Panoramic
Panoramic mosaics:
Takes multiple shots and combine them together for a wide view
Panoramic distortion:
Straight lines in the scene appear bent in the image
—> no 'distortion free'

Refocusing and **light** field rendering
Light field rendering: change the focus of an image that has been taken

Extended **depth of field**
Depth of field: the portion of a scene that appears acceptably sharp in the image

Practice

c) This question is about **image processing applications**.

[5 marks]

i) What are the differences between the *content* based and *meta-data* based image-retrieval?

(2 marks)

ii) What do you mean by a panoramic distortion? Is there any way to create a full panorama with distortion?

(2 marks)

iii) A false colour image is obtained by systematically mapping the intensities of a greyscale image to a fixed series of colours. Give two applications in which false colour images could be used.

(1 mark)

(1) content-based image retrieval means to retrieve image by the features of the image such as the color, texture, shape and etc. meta-based image retrieval means to retrieve image by the descriptions of the image or the data associated with the image.

(2) Panoramic distortion means that the straight lines appear to be bent in a panoramic image. Take multiple shots and combine them together to create a wide view.

(3) PET scan, MRI scan (medical scenarios).

b) This question is about **image processing applications**.

[5 marks]

i) Write two major tasks of digital image processing.

(2 marks)

ii) What do you mean by High Dynamic Range (HDR) in an image? How can you create an HDR image?

(3 marks)

(1) 1. Image compression: reduce the size of image to reduce the storage need and the transmission latency/bandwidth/cost. 2. Image inpainting: recover the image that is partially destroyed.

(2) HDR: it means that the very bright and very dark parts appear in the same image. First, create multiple images under different exposure, then, combine them together using digital image processing techniques.