Image processing
"Introduction to digital image processing"

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Lecture available at http://mathieu.delalandre.free.fr/teachings/image.html

Introduction to image processing

1. Definitions
2. The origins of digital image processing
3. Some applications
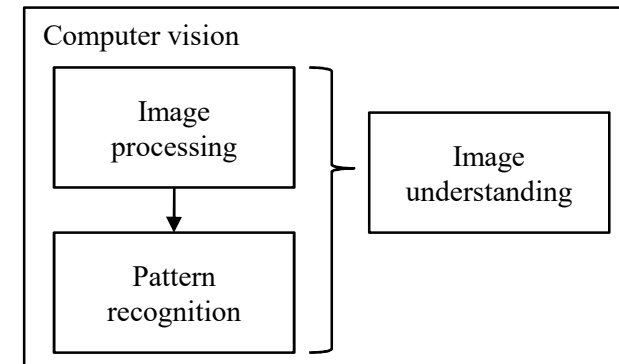4. Computer vision and ubiquitous computing

Definitions

Image processing in electrical engineering and computer science, is any form of signal processing for which the input is an image, such as photographs or frames of video; the output can be either an image or either a set of characteristics or parameters related to the image.

Pattern recognition is the assignment of some sort of output value (or label) to a given input value (or instance), according to some specific algorithm. An example of pattern recognition is classification, which attempts to assign each input value to one of a given set of classes (e.g. to determine whether a given email is "spam" or "no-spam").

Image understanding is the process that integrates explicit models of a visual problem domain with one or more methods for extracting features from images and one or more methods for matching features with models using a control structure.

Computer vision is the science and technology of machines that see, where see in this case means that the machine is able to extract information from an image that is necessary to solve some task. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images.

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The origins of digital image processing (1)

Bartlane cable picture transmission system: one of the first application of digital image was in the newspaper industry. Digital pictures were sent by submarine cable between London and New York, in less than 3 hours.

- 1921, this system was capable of coding image in 5 distinct levels of gray (top)

- 1928 coding capability was increased to 15 levels (bottom)

The origins of digital image processing (2)

US Spacecraft Ranger 7: the first computer powerful enough to carry out meaningful image processing task appear in the early 1960's. In 1964, at the Jet Propulsion Laboratory, pictures of the moon transmitted by the spacecraft Ranger 7 were processed by a computer to correct various type of distortion inherent in the on-board television camera.

On the left, the first image of the moon taken by Ranger 7 on July 31, 1964 at 9:09 A.M. Eastern Daylight Time (EDT), about 17 minutes before impacting the lunar surface.

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Some applications (1)

Image enhancement

Image rendering

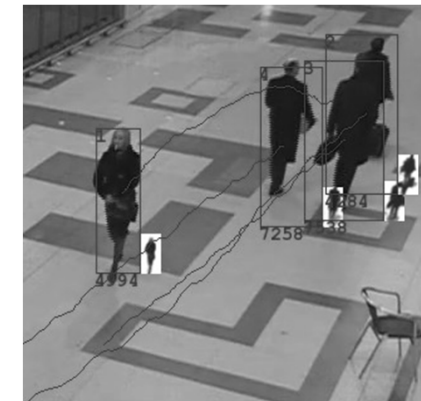Augmented reality

Some applications (2)

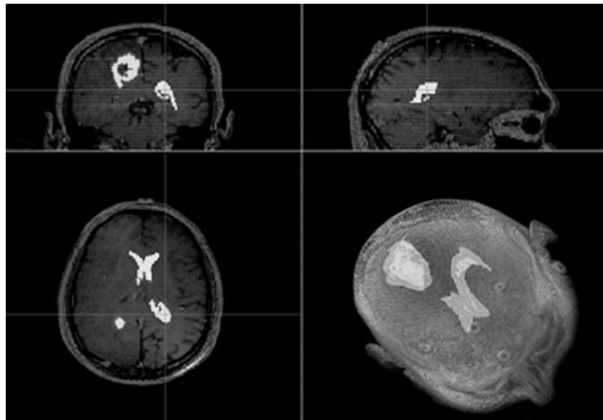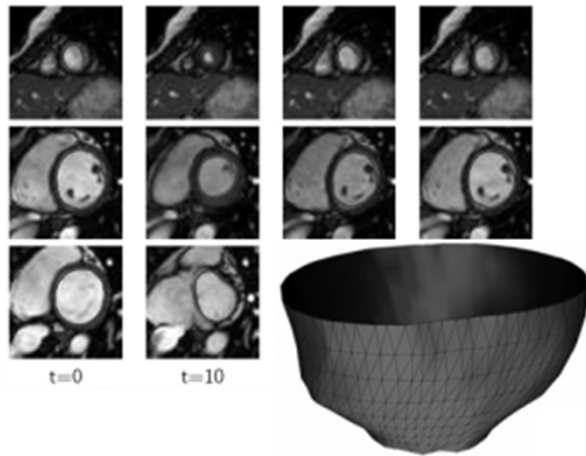Face tracking and recognition   Road tracking   People tracking

Some applications (3)

Medical imaging

Satellite image processing

Some applications (4)

Optical Character Recognition

Watermarking

Finger Print Recognition

Captcha

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Computer vision and ubiquitous computing

Ubiquitous computing is a post-desktop model of human-computer interaction in which information processing has been thoroughly integrated into everyday objects and activities. More formally Ubiquitous computing is defined as "machines" that fit the human environment instead of forcing humans to enter theirs.

Mobile and ubiquitous computing will constitute the support to design distributed and computer vision based systems in a near future. Next generation of mobile systems will be the wearable computers with eye-tapes, where computer vision will play a major role within the system interaction.