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# Image Processing

SUMMARY:

- Introduction
- Subfields in imaging science
- Methodology



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# Definition

Digital Image Processing

is the science that extracts useful information about the world by carrying out computations on images by digital computer.



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# Origins

Produced in 1921 from coded tape by telegraph printer.



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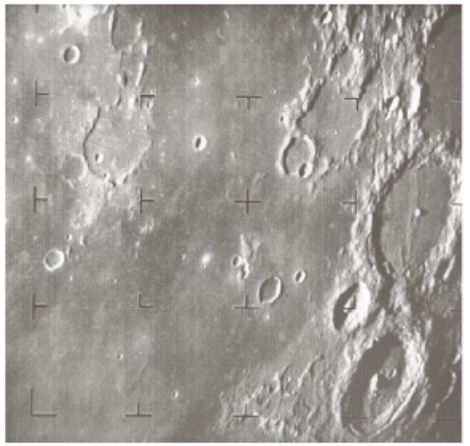
# Origins



First picture of the moon by US spacecraft (July 31, 1964).

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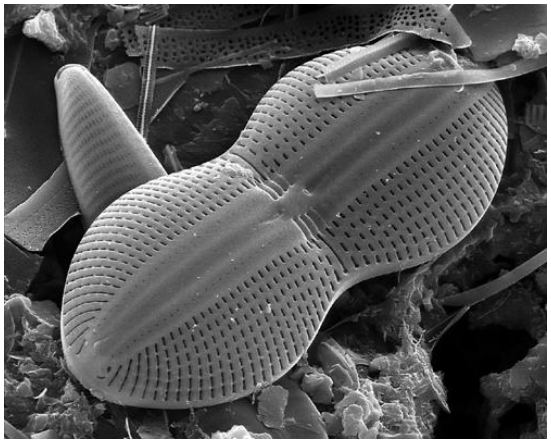
## Scanning electron microscopy



Diatom (Diploneis heemskerkiana).



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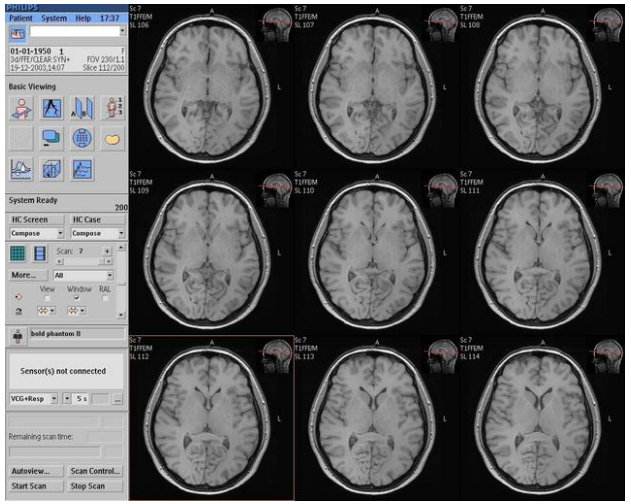
## Magnetic Resonance Imaging




Slices of an MRI head scan.



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## Classification

IMAGING SCIENCE (Beeldinformatica)

- COMPUTER GRAPHICS - Image Synthesis
- IMAGE PROCESSING - Image analysis
- COMPUTER VISION - 3D scene Analysis
- SCIENTIFIC VISUALIZATION



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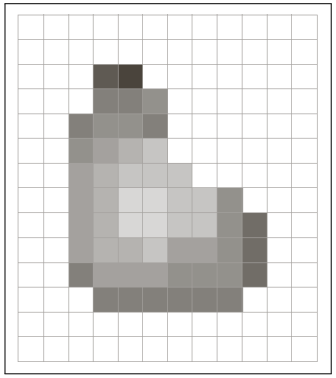
## Digital image



Discrete domain, discrete range.

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## Image representation

- An image is a spatial representation of an object or a two- or three-dimensional scene.
- Usually the images we use are represented as a function $(x, y) \rightarrow f(x, y)$, where the domain of $(x, y)$-values is a 2D set, which can be continuous or discrete.
- The points $(x, y)$ are called pixels, the values $f(x, y)$ are called grey levels: for 8-bit images these grey levels range from 0 to 255.
- grey levels can have different interpretations: intensity, range, symbolic.



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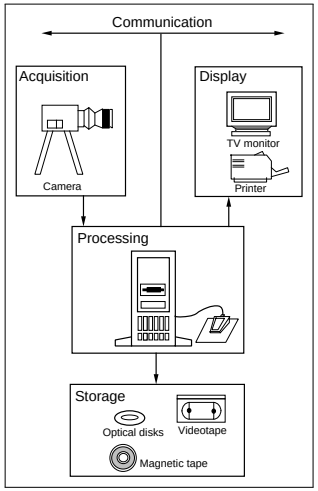
## Digital image processing system



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## Methodology

1. image formation
2. conditioning (enhancement, noise suppression)
3. labeling (spatial structures: edges, corners)
4. grouping: linking similar pixels into pixel sets (segmentation, edge linking)
5. extraction of features: area, center of gravity, number of holes, curvature, relation to other groups
6. interpretation (matching): find meaning in terms of real 3D world



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## Levels in image analysis