Image input with a scanner

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IMAGE INPUT

with a scanner

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Samples, pixels and halftone dots

- When an image is scanned, a number of sample points are analysed. The number of samples per inch or cm is the scanning resolution. Each **sample** is given a grey level corresponding to its darkness.
- When an image is presented on a computer display, it is built up by picture elements. **Pixels** have a position, and numerical values expressing "grey level" for each colour component.
- A halftone dot is the **elementary printing cell**. Different values of grey are obtained by varying the size of the dot (AM screening), or by more or less filling the cell in a random way (FM screening).

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Adapt input to output ...

- Our output is the printed newspaper delivered to readers. Our (final) output resolution is the line screen.
- Line screen defines the distance, in the horizontal and vertical axis, between the halftone cells used for printed reproduction. Newspapers commonly print at 85 lines per inch.
- The computer needs to know how to fill each halftone cell. Obviously, each halftone cell should reproduce the grey level of the corresponding sample in the original document (or this grey level corrected for quality improvement).

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One sample = one printing cell ?

- Certainly, it is the minimal scanning resolution. If the printed image is 'n' times the size of the original document, then we must take 'n' times more samples. Thus the minimal scanning resolution is, in any case:
  Line screen x Magnification rate
- To make provision for interpolation and picture improvement, most scanner drivers propose a default scanning resolution, which is : Line screen x Magnification rate x 2.
  This gives 4 samples per printing cell.
- Optimal scanning resolution?

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"Scanner" - what do you mean?

- The traditional colour scanner needs originals wrapped around a drum, analyses them with RGB filters, detects light with photomultipliers, enhances and corrects documents according to scanner settings, finally delivers CMYK output on film. No operator intervention except for settings.
- Some B & W scanners also do input & output.
- In both cases : high price, high quality, high picture productivity, but no pagination.
- Those traditional scanners which digitize originals can be connected to an external computer.
- Here we will restrict the word "scanner" to image input.

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Drum scanners

- Input unit of traditional scanner or scanner built as input only
- Several documents on a drum (reflective or transparencies)
- Photomultipliers as light detectors
- Always "single pass"
- Repro functionalities
- CMYK digital output
- Limited list of scanners built as input only :
  Itek 350 / ScanMate Plus (Scanview) / Colorgetter (Optronics) /
  DTS-1030 (Dainippon Screen) / Scanmaster D4000 (Howtek)

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Flat-bed scanners

- CCD as light detectors
- Get RGB components in one pass or three pass
- A4 size office scanners (built to detect reflected light) U-max / HP ScanJet IIcx / Arcus Plus (Agfa)
- Quality and large size scanners for the printing industry: Leafscan / Scitex / Horizon (Agfa) / Eskoscan (Eskofot) Topaz (Linotype)
- A few deliver CMYK

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35 mm transparency scanners

- Equipment built to scan 35 mm only, positive or negative film, one document at a time.
- Small, lightweight, sometimes integrated with a portable computer
- CCD light detection
- A row of CCD's moves across the document, detecting RGB either in three pass (Nikon) or in a single pass (Polaroid)
- Row of CCD's might be replaced by a CCD matrix: no movement necessary (Kodak RFS 2035).

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High-definition digital camera

- Digitizing bench composed of
  -> a CCD camera fixed on a pedestal and looking downward to the document
  -> a digitizing board
- Could scan books or thick objects

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Scanner selection criteria

- Resolution
- Scanning speed
- Density range (dynamic range)
- 8-bit, 12-bit or 16-bit per colour sample

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