Commercial CAS programming environments: a brief comparison
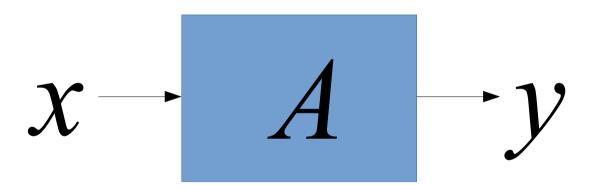
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Image restoration

- Signal-processing model of imaging device:

$$x \longrightarrow \boxed{A} \longrightarrow y$$

- Problem: given measurement y, retrieve underlying signal x

- Typically linear model (A is a matrix)

Algorithm research: discussion

- Creativity

- Reproducibility

- Interoperability

- Productivity

$\Rightarrow$ Best platform?

CAS comparison

- Application example: implement and document toy algorithm for image restoration

- Demo of 4 CASs:
  - Matlab
  - Mathematica
  - Maple
  - Jupyter (non-commercial)

Matlab Live Editor

- Introduced recently (R2016a)

- Basic functionality, easy to learn

- Matlab language targeted towards linear algebra

Mathematica Notebook

- Mathematica 11 just released

- For large software projects, the Mathematica documentation recommends using the Wolfram Workbench (based on Eclipse)

Maple Document/Worksheet

- Maplesoft advertises two possibilities for advanced coding:
  - Code Editor
  - Maple IDE (based on Eclipse)

Jupyter Notebook

- Web server for browser-based edition of documents that interleave code and explanatory text

- Support for Python and 40+ other languages

Summary

- Dominant CASs seem to be converging towards interactive documents

- Mathematica and Maple: head-to-head race
    - Very similar feature set
    - Image-processing libraries have some limitations

- Historically Matlab has been very popular among signal-processing engineers; over the past few years, Python has gained popularity thanks to its extensive libraries