Technology Review

Flashing Lights (Fluorescence Imaging)

Background

- Fluorescence microscopy is a widely used imaging technique which can yield highly resolved spatial features within a system of interest.
  - Utilized heavily in biological research when imaging living cells and tissues

- Image stacks (videos) contain a bulk of relevant information, but can be difficult to present
  - Large file sizes slow down presentation times and can cause display software to crash
  - The durations of some videos are excessively long for the information they are intended to present

OpenCV

- Pros
  - Open source (Supports Windows/Mac)
  - Supports .jpeg/.tif/.mp4
  - Many Algorithms
- Cons
  - Infinite Loops
  - Limited Machine Learning Capabilities
  - Can have a steep learning curve

Sci-kit Image (skimage)

- Pros:
  - Open sourced and publicly available for download
  - Extremely powerful image editing tools (statistical adjustments, denoising, texture classification)
  - Machine learning capabilities
  - Well documented
- Cons:
  - Not designed for use with image stacks
    - Only .tiff files are supported, and they still need to be converted to an image array before analysis
  - Most tools are oriented towards image editing rather than processing

Pillow (compare with OpenCV)

- Easy choice, easily installable via pip install
- Both have image processing tools such as image filters (blur, sharpen, etc.), image transformation (flip, rotate, warp),conversion between image types, and other basic things you can do with image
- OpenCV also provides: tools to work with videos (Pillow + MoviePy),feature extraction methods for computer vision (SIFT, HOG, HAAR), machine learning (things like neural network, SVM, K-NN)
- Use Pillow if one wants to cut and resize images, and maybe do a bit of filtering, and one uses OpenCV when having more complex and vision-related tasks and one is building a package that is trying to "see" things

Conclusion

- Choosing to use **OpenCV**
  - **OpenCV** contains a variety of useful modules that can be directly used to process image stacks
    - Drawbacks: artifacts of **OpenCV** source code may be difficult to troubleshoot, machine learning capabilities are limited
  - **Sci-kit image** is extremely powerful, but limited by its ability to process image stacks; it may still be used to perform particular functions within our software package
  - **Pillow** is easy to start with but not powerful enough for complex tasks while OpenCV covers most of what Pillow offers and more.