Fiji Spectrometer Low Noise



Overview

This report proposes a new development of the birefringent wedge-based FT spectrometer and evaluates its application in low-light detection in analyzing analytes using Raman spectroscopy.

Key Takeaways

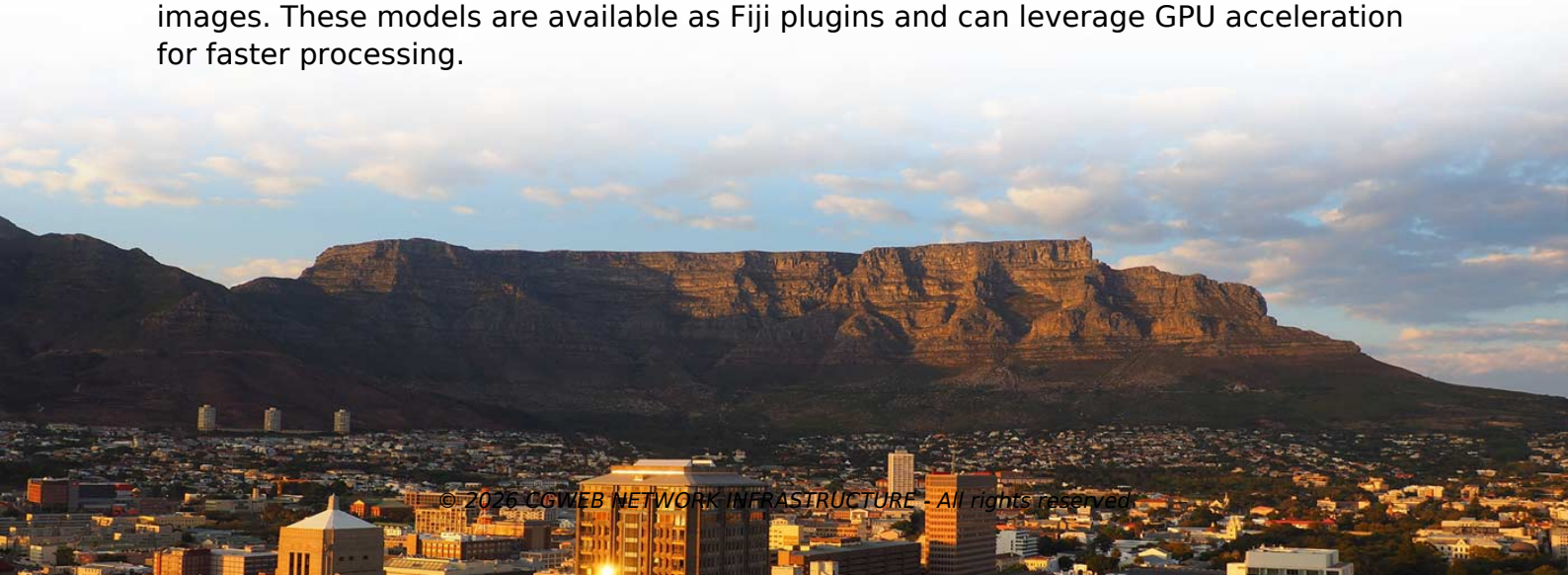
Fiji can achieve low-noise spectral and microscopy imaging using built-in plugins, denoising algorithms, and careful SNR optimization.

Noise Reduction in Fiji

Fiji, a "batteries-included" distribution of ImageJ, provides numerous plugins for image processing and noise reduction, including tools for spectral imaging and particle analysis. For low-noise spectrometer or microscopy data, you can use: Gaussian or median filters to reduce background noise while preserving signal features. Rolling ball background subtraction for uneven illumination or autofluorescence, which helps isolate weak signals.

Noise2

Noise and DnCNN ML models for advanced denoising of 2D and 3D microscopy images. These models are available as Fiji plugins and can leverage GPU acceleration for faster processing.



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Spectral Imaging and Signal Isolation

For spectral imaging, Fiji supports workflows that include importing hyperstacks, adjusting contrast, and performing linear unmixing to separate overlapping spectral signals. This is particularly useful for detecting weak signals below autofluorescence levels or for multi-dye experiments.

Signal-to-

Noise Ratio (SNR) OptimizationTo quantify and improve SNR in Fiji: Adjust brightness and contrast to visualize the full signal range without altering raw data. Measure background intensity in regions without signal and compare to peak signal intensity to estimate SNR. Use local maxima detection (Process → Find Maxima) with appropriate prominence settings to identify true signal points while minimizing false positives.

Scroll through image stacks to determine the lowest SNR frame where the signal is still detectable, which helps optimize acquisition parameters and denoising workflows.

Practical Tips

Always verify pixel size and metadata to ensure accurate measurements. For large or sparse images, combine filtering with ROI-based analysis to reduce noise impact on segmentation and quantification. Consider machine learning-based denoising for datasets with very low SNR, such as short-exposure fluorescence images or lattice light-sheet microscopy data.

By combining these Fiji tools and workflows, you can significantly reduce noise in spectrometer and microscopy images, improving the reliability of quantitative analysis and spectral measurements.

Article Content

Raman spectroscopy by a detector-noise-limited ...

This report proposes a new development of the birefringent wedge-based FT spectrometer and evaluates its application in low-light detection in analyzing analytes using Raman spectroscopy.

Denoising method for Raman spectra with low signal-to-noise ratio

Using the method proposed in this paper, the Raman signal of biological samples such as rice leaves were extracted from the raw spectrum, and information on the spectral peak position,

Data visualisation with ImageJ and FIJI

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FIJI copes with 16 bit and other TIFF image types very well. The beamline has a number of parameters we can control to optimise the quality of the 2-D images we collect.

fiji_noise2noise/README.md at master

Details: Input: 2D single channel image from ACsN dataset of HeLa cell microtubules at different exposure time (5ms, 10ms) noisy and denoised results.

Stowers ImageJ Plugins

Here I will describe a number of tools we have created at Stowers for exploration and analysis of spectral imaging data in Fiji/ImageJ. Our typical workflow proceeds from interactive data exploration

Download imagej (operation is the same in Fiji)

Download imagej (operation is the same in Fiji) imagej: imagej.nih.gov/ij/download.html Fiji: imagej /software/fiji/downloads

SQUID Noise in a 176-Pixel FDM Demonstrator for the SAFARI

We are developing the frequency-domain multiplexing (FDM) readout for the SAFARI far-infrared spectrometer on board the SPICA space observatory. Each readout channel comprises a set

Low-frequency ambient noise measurements in the South Fiji Basin

The effect of wind speed on low-frequency ambient noise has been measured in an experiment carried out in the South Fiji Basin. This site provides an ideal location for studying sea

Very low contrast thresholding?

Hi all! I''m a newbie to ImageJ/Fiji I was trying find a better way to threshold this image- manual thresholding introduces some background noise just when I have a decent amount of the

THE WAVELET-BASED DENOISING OF IMAGES IN FIJI, WITH

The resulting plugin demonstrates main possibili-ties of applying DWT in Fiji to images: Decomposition of an input picture to DWT using various wavelet filters and levels of details with ...

Fiji Training Manual

This site contains the complete version of the Fiji Training Manual that is written and maintained by Cameron Nowell of the Monash Institue of Pharmaceutical Science. This manual is provided under

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Low-frequency ambient-noise measurements in the South Fiji basin

The effect of wind speed on ambient noise has been measured in an experiment carried out in the South Fiji basin. The noise data in the band 15-250 Hz are well correlated with the variations in the local

ImageJ/Fiji Jython Plugin: Noise Subtraction

ImageJ/Fiji Jython Plugin: Noise Subtraction This is a Python plugin for ImageJ/Fiji which implements an algorithm developed by Patrick Doyle''s group at MIT. It performs a two-stage background removal on

The Wavelet-Based Denoising Of Images in Fiji, With Example ...

The Wavelet_Denoise plugin enhances image filtration using discrete wavelet transform (DWT) in Fiji software. DWT preserves image resolution while effectively removing noise and artifacts in super

Noise2Void for Fiji

Hi all, there''s a new Jug-Lab Fiji plugin of Noise2Void available now (originally implemented in python). Any volunteers for testing an early version? It''s a deep learning method for

Common Causes of Noise in Spectrophotometry and How to Fix Them

Understanding the common causes of noise and implementing strategies to minimize them is crucial for accurate and reliable data. Instrumental Noise Instrumental noise is one of the

Free Noise Reduction with Siril and Fiji for astronomical images

In this video I show how I reduce the noise in my images. It will use the wavelets function to splitt the regular high frequency noise from the rest of the i...

FIJI/ImageJ User Manual

FIJI/ImageJ User Manual Manual refers specifically to FIJI unless otherwise stated OPENING IMAGES (BIO-FORMATS) ADJUSTING THE IMAGE WINDOW SIZE AND MAGNIFICATION SELECTING A

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