AI MICROSCOPY: DEEP LEARNING MINIMIZES THE IMPACT OF FUNDAMENTAL MICROSCOPY LIMITATIONS.

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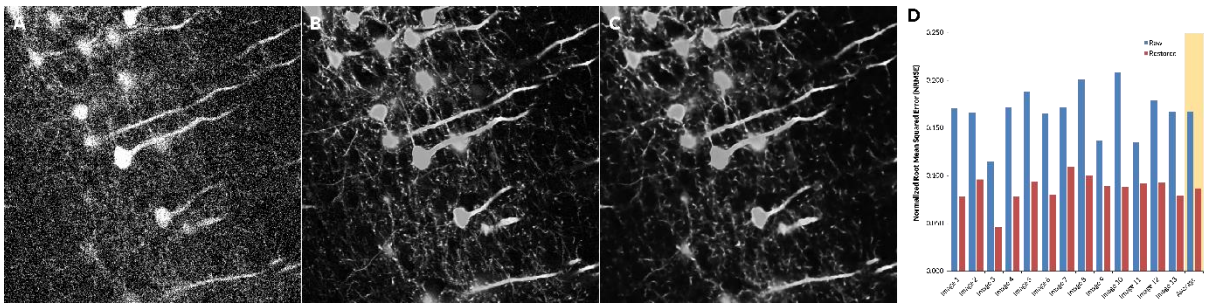
Fluorescence microscopy has contributed to numerous major discoveries in life sciences. This is despite the limitations all imaging systems have. Typically, light microscopes excel at just one of the three core factors that modulate image quality and/or sample viability: spatial resolution, temporal resolution and light exposure. To minimize the impact of the mentioned handicaps, deep learning (DL) enabled microscopy image restoration is starting to be adopted (Content Aware Image Restoration (CARE)(1) and our own work (2)). Here we illustrate how a customized Residual Channel Attention Network (RCAN)(3) can be used for microscopy image restoration.

Using the hybrid cloud-desktop platform, Aivia / Aivia Cloud, we demonstrate how deep learning can help mitigate the limitations of light microscopy. Specifically, we show how the amount of light a sample is exposed to can be dramatically reduced, allowing for long term live cell iSIM imaging (figure does not fit abstract format). Also, our DL approach can markedly reduce the time needed to image samples on a point-scanning confocal system with resonant scanner (image below). In both instances, the restored images benefit from major spatial resolution improvements vs the input data. Finally, we explore how DL can be used to enhance the spatial resolution of standard confocal images to that close to STED microscopy (figure does not fit abstract format). We continue to work on validation, error quantification and quality optimization in order to minimize DL related artifacts.



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