PRODUCT INFORMATION

Free your time with Nikon Artificial Intelligence

Nikon
artificial intelligence

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Shedding New Light On **MICROSCOPY**

Nikon *artificial intelligence*

Expanding the NIS-Elements platform by incorporating tailor-made solutions for acquisition, visualization and analysis

Artificial Intelligence (AI) and deep learning methods are making seemingly impossible tasks now possible. Recovering contrast, improving signal-to-noise ratio, managing challenging acquisition parameters or segmentation were previously difficult to achieve, but now can be automated thanks to AI.

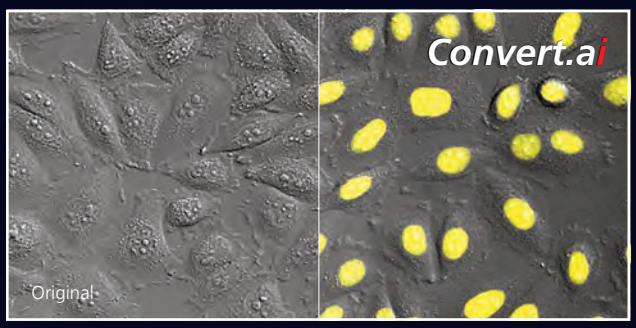
User-trainable AI

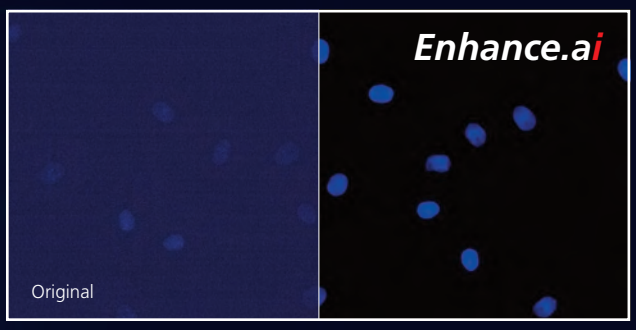
Create your own N³ (Nikon Neural Network)

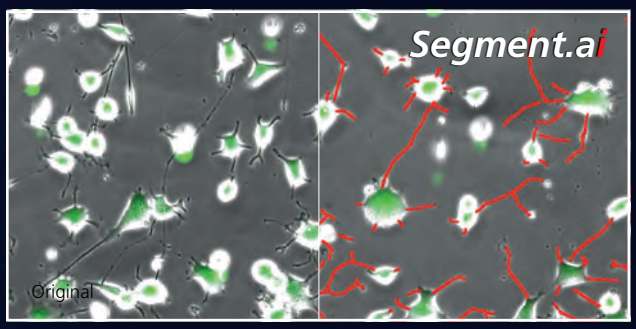
The **NIS.ai processing and analysis module** consists of tools dedicated to improving and enhancing efficiency in data acquisition and simplifying previously complex analysis routines.

The software modules of NIS.ai suite enable, for example:

- Label-free imaging without near-UV excitation
- Segmentation of complicated objects
- Analysis of under-exposed images of light-sensitive samples







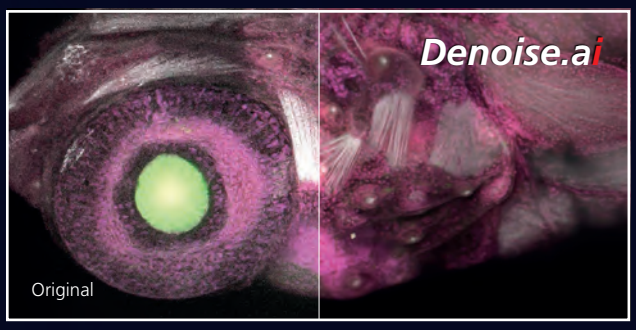
Pre-trained AI

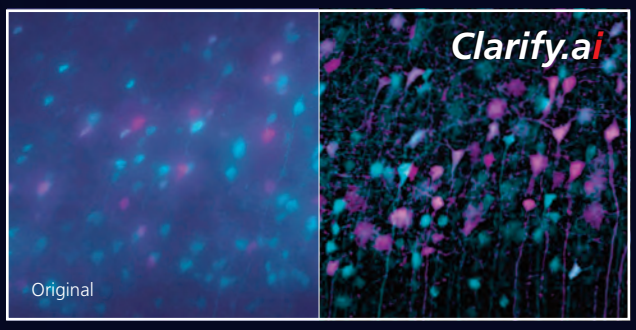
One click for crystal clear images

Further expanding the NIS-Elements platform, our pre-trained N³ require no additional settings or parameters in order to improve images.

These pre-trained AI modules enable, for example:

- Removal of noise from images
- Removal of out-of-focus blur from widefield fluorescence images





NIS.ai

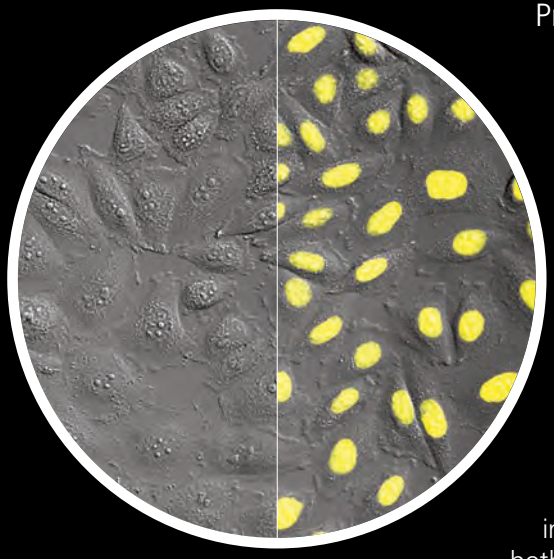
Processing module

User-trainable pattern recognition

Enhance.ai, Convert.ai and **Segment.ai** together form the NIS.ai module. It employs convolutional neural networks learning from ground truth data based on a small subsets of representative samples. The software interface makes it easy to apply deep learning to ground truth, eliminating the need to design a complex neural network and apply training data to it.

Automated tools take this training data and apply it to the neural network to recognize patterns. The N³ can then be applied repeatedly and reliably to similar samples to process or to analyse huge volumes of data at significantly faster speeds than traditional techniques, without the need for AI training or programming knowledge. This ensures that there is no user bias and even allows for revision of complete data sets.

Convert.ai



▲

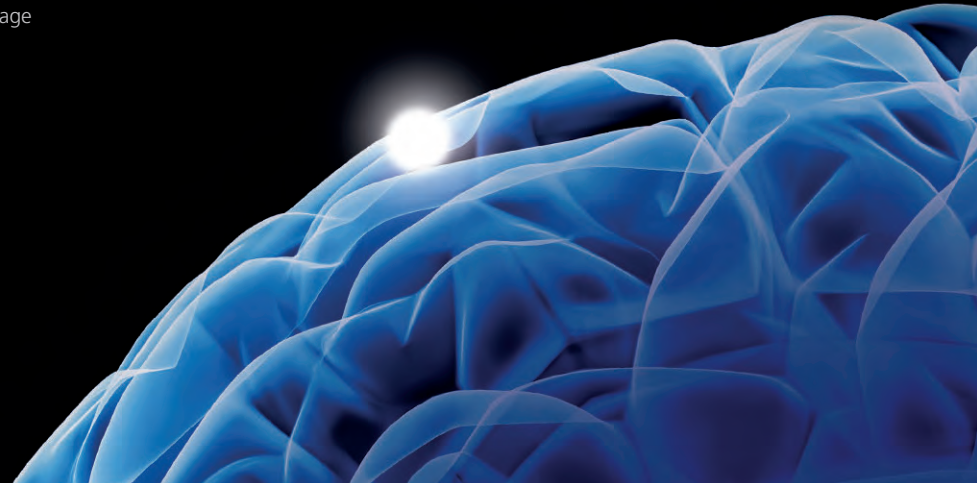
Brightfield imaging is the most gentle way to see your cells (right side). Cells can be followed over long periods of time without side effects. Segmentation of these images can be impaired e.g. by cell density. Convert.ai provides the information about the position of the nucleus and allows for cell segmentation from this brightfield image without any further image acquisition (right side).

Predicts label locations based on unstained images

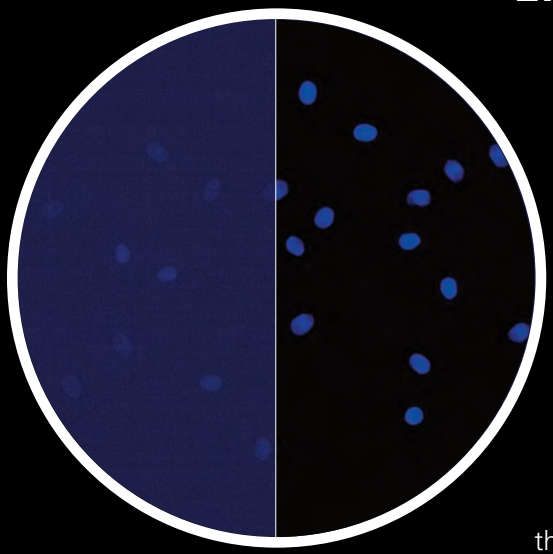
Do you have too few colours available?

By recognizing patterns present in two different imaging channels, Convert.ai can be trained to predict what the second channel would look like even when presented with only the first channel.

This can be used as a segmentation tool for label-free approaches. For example, nuclear staining is a common method for cell segmentation and counting. Convert.ai can be trained to predict where the nuclear label would be based on unstained DIC or phase-contrast images. This later enables users to perform nuclei-based image analysis without labelling the nucleus for live-cell imaging. The spare fluorophore can be used as additional marker for a protein of interest. Throughput of acquisition as well as specimen viability both increase as a result.



Enhance.ai



Images of the nucleus are taken under mildest imaging conditions (low laser power, short exposure) resulting in under-exposed imaging (left side), which provide longer survival of the cells. Enhance.ai is used to restore the signal-to-noise ratio to normally exposed nuclear staining, for easy segmentation and counting.

Restores details in seemingly under-exposed images

Are your imaging conditions too harsh for long term imaging?

Some fluorescent samples express a very low signal and it is difficult to visualize or extract details for segmentation, typically resulting in compromised image quality with poor signal-to-noise ratio. In addition, many of these samples are sensitive to light or photobleach very quickly and need to be imaged as fast as possible.

Enhance.ai learns what a high signal-to-noise image looks like by comparing under-exposed and optimally-exposed images. Enhance.ai then restores details in under-exposed or dim fluorescent images, enabling researchers to gain more insights from their low signal imaging applications.

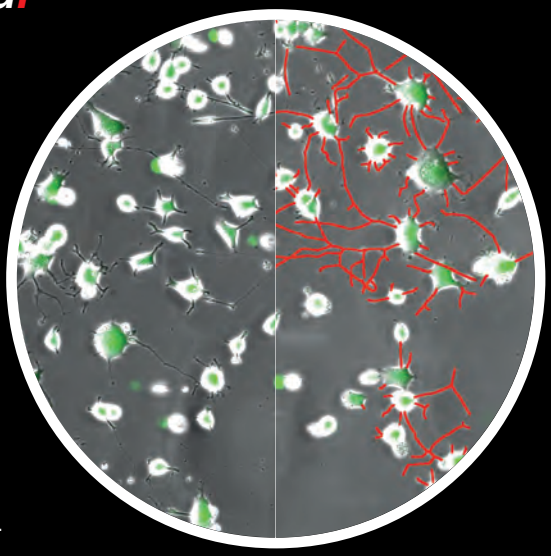
Segment.ai

Segments structures that cannot be identified by traditional thresholding

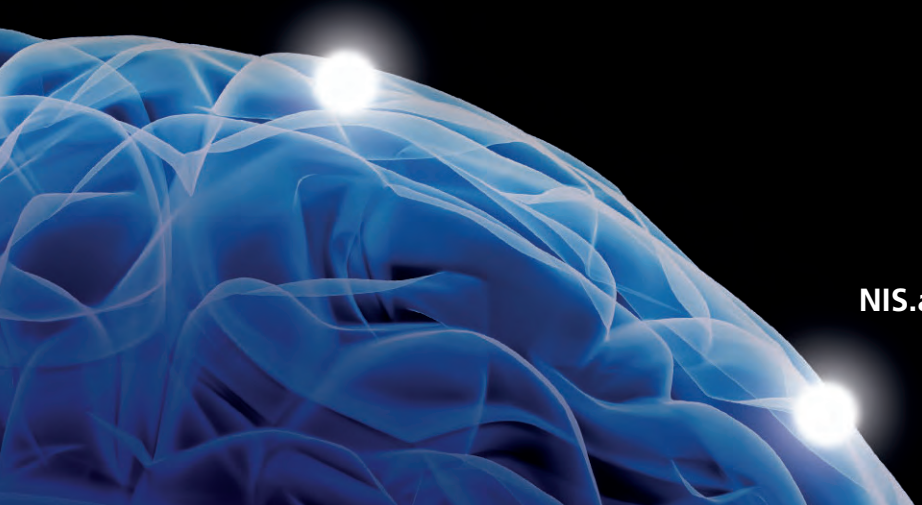
Can't segment your images?

Segment.ai enables complex structures to be easily identified and segmented. Some images in phase-contrast are nearly impossible to segment by traditional intensity thresholding methods. Segment.ai can be trained on a small set of hand-traced images to automatically detect and segment features of interest from thousands of untraced datasets.

By tracing features of interest and training these compared to the underlying image, the neural network can learn and apply segmentation to similar images, recognizing features previously only identifiable by painstaking manual tracing approaches.



Neurites in phase-contrast were not possible to define accurately by traditional thresholding. Segment.ai was trained on hand-traced neurites (human recognized) and learned how to trace neurites in subsequent images.



NIS.ai

NIS.ai processing and analysis module

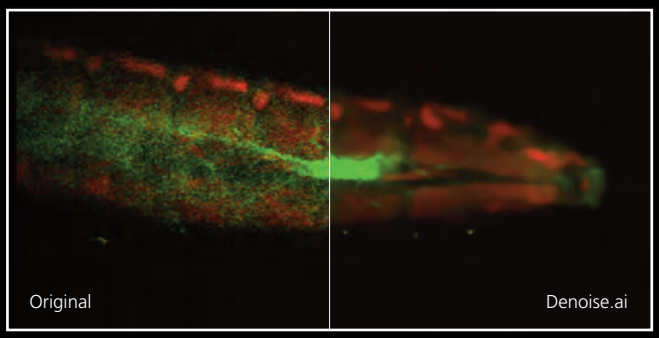
Denoise.ai

Removes noise from fluorescent images

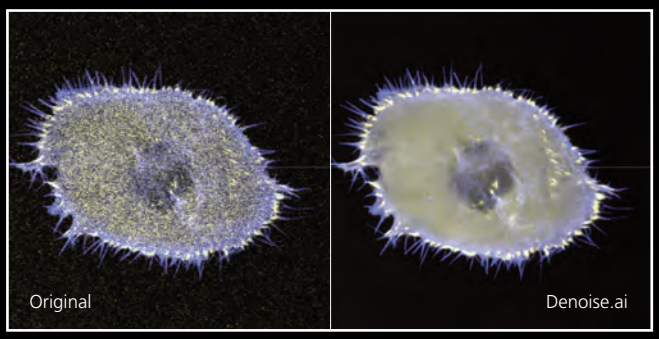
Are you tired of the noise in your images?

High-speed resonant confocal microscopy is a gentle imaging technique for living samples allowing the use of shorter exposure times and less laser power. However, resonant confocal images contain significant amounts of shot noise.

Denoise.ai is a N³ that filters shot noise in both fixed and live images. This N3 is pre-trained, can be applied live and enables fast processing of huge amounts of data. With new fluorescent techniques pushing intensities lower and acquisition speeds higher, Denoise.ai can recognize and remove the shot noise component, greatly improving signal-to-noise ratios and increasing clarity for images captured with such settings.

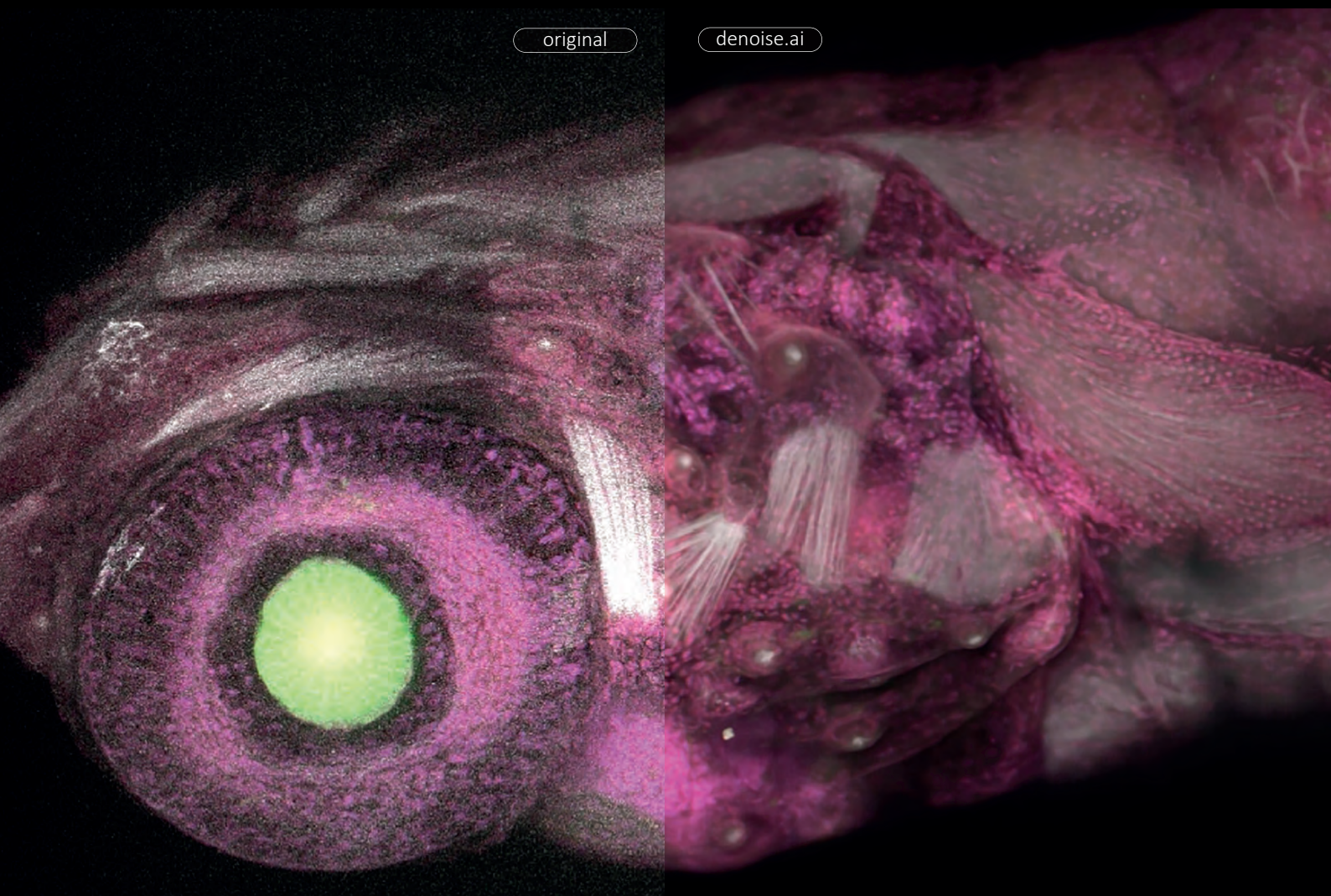


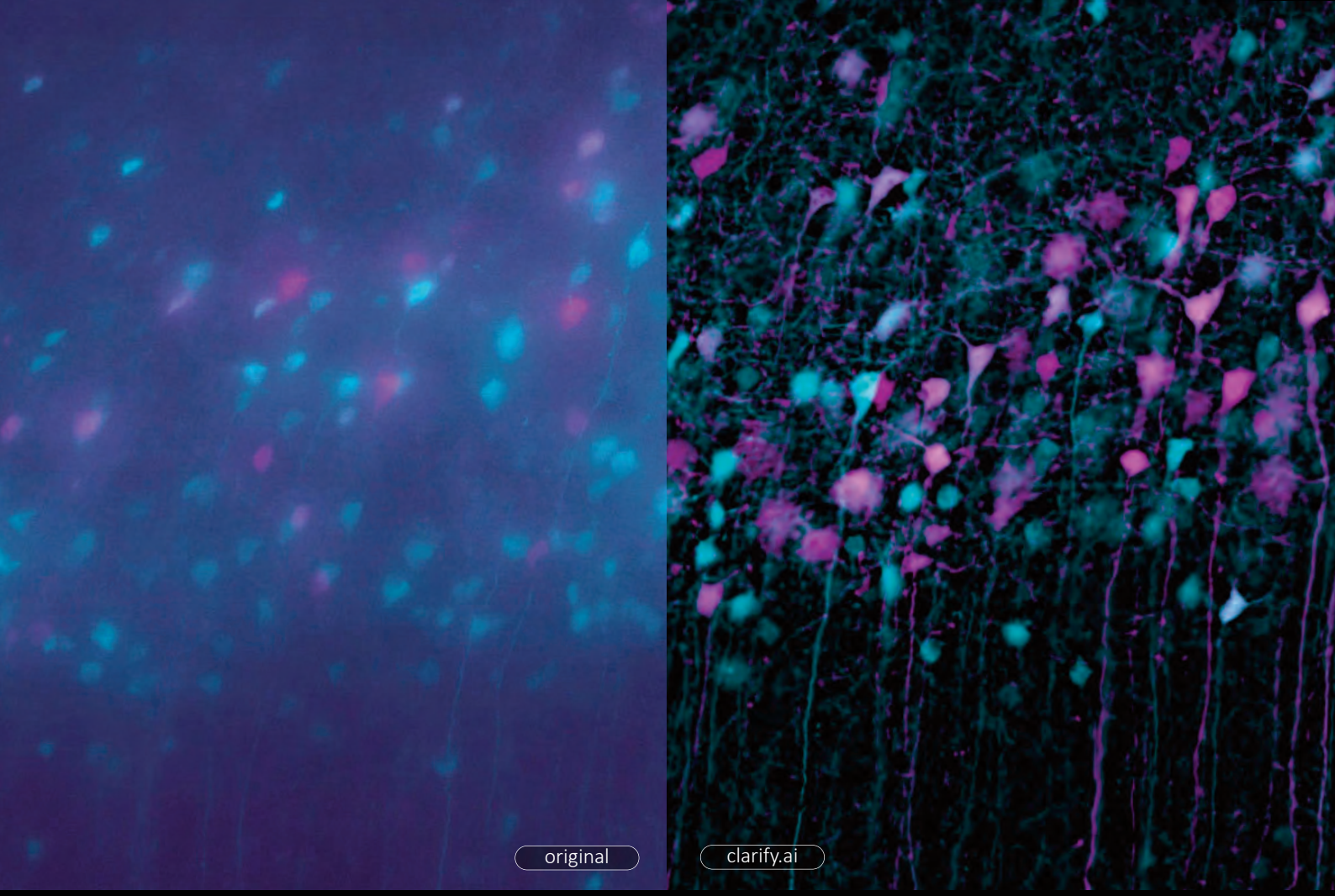
Drosophila sp. larvae provided by Amicia Elliot, PhD, NIH/NIMH, Bethesda MD, acquired at the Quantitative Fluorescence Microscopy Course



H1299 cells plated on fibronectin. Image courtesy of Pablo Hernandez-Varas, Karolinska Institute

▼ Max IP of multi-labeled Danio sp. prepared by Callen Wallace and Mike Calderon, Center for Biological Imaging, University of Pittsburgh for the Quantitative Fluorescence Microscopy Course





20x Multichannel 2D widefield image of a scattering tissue slice before and after application of Clarify.ai

Clarify.ai

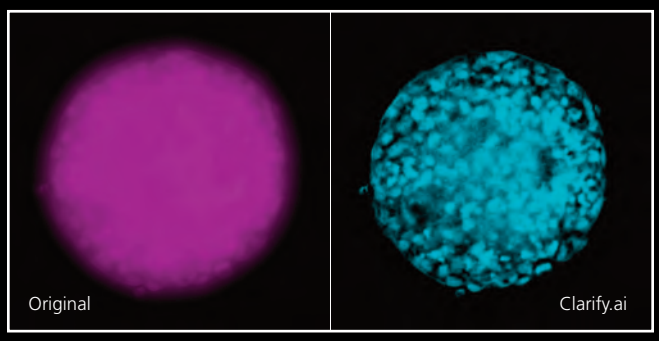
Remove out-of-focus blur from fluorescence images

Are you suffering from out of focus light?

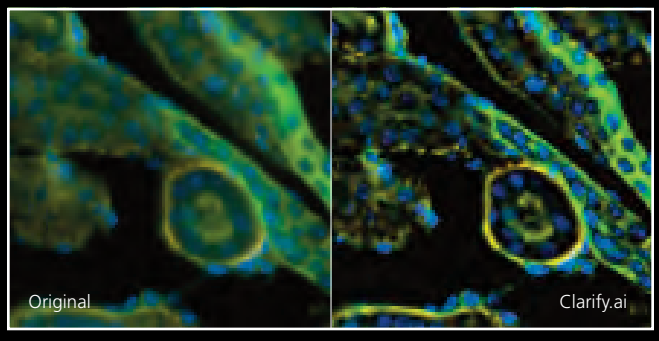
Clarify.ai is a pre-trained N³ that requires no additional settings or parameters to improve images. This enables huge volumes of data to be processed or analyzed at significantly faster speed than a traditional method such as deconvolution.

During widefield imaging, especially of thick 3D samples, image sharpness may be impaired by blurring caused by signals from sources other than the focal plane.

With Clarify.ai, the pre-trained N³ allows the user to remove the out-of-focus blur from the image. It enables fast and efficient acquisition of clear, haze-free images from deep within a sample without requiring traditional deconvolution, even when signals are weak, and greatly reduces phototoxicity.



Spheroid CX26, 40X Sil - DAPI raw image (left) and deconvolved (right)



Tissue section, 20x

Quantifiable Results

Artificial intelligence has become commonly accepted in diagnostic imaging and is an increasingly popular tool for a number of applications. Its appeal over traditional mathematical approaches is both its speed and incredible accuracy. However, it is important to be able to validate the results of AI computations, and to utilize these results appropriately for computational analysis.

NIS-Elements software provides feedback during training routines to indicate the confidence of the trained neural network to provide accurate results. In addition, several analysis tools and workflows validate the efficiency of the neural networks or allow easy comparison of AI data to ground truth data.

Summary of AI Modules

● included ○ option

	Denoise.ai	*Clarify.ai*	*Enhance.ai*	*Segment.ai*	*Convert.ai*
NIS C, Ar, Ar ML, Ar Passive	●	○	○	○	○
NIS.ai Module			●	●	●
Deconvolution Modules		●			
Batch Deconvolution		●			
Offline Batch Denoise Package	●				

Use NIS.ai for intelligent imaging

NIS.ai tools can be combined with all other features of the NIS-Elements platform to develop imaging protocols and targeted analysis from basic counting through rare event or selective phenotype detection and analysis.

This can be incorporated post-acquisition, or more impactfully, as an integral part of an experimental protocol. This enables NIS-Elements Intelligent Acquisition analysis results, obtained during the experiment run, to guide the experimental parameters in different directions.

Using the JOBS experiment wizard, customized experiments with embedded analysis tasks and branches based on analysis results can be created, allowing for higher throughput and more targeted acquisitions.

Request a demonstration and enhance your images with the power of Nikon artificial intelligence

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