Using a non-destructive readout camera to image in low light conditions.

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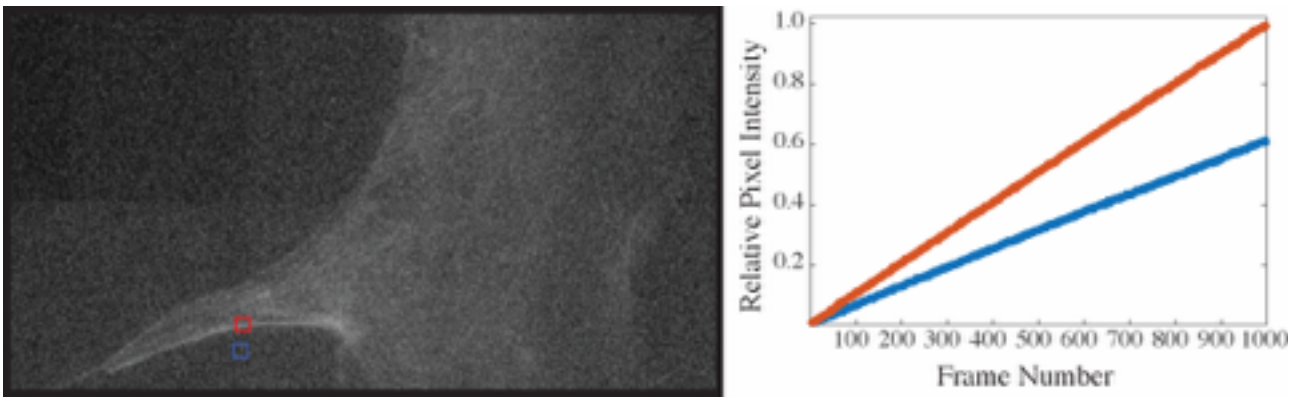
Abstract

Non-destructive readout (NDR) cameras allow for the interrogation of the camera sensor during exposure. This allows a typical camera frame to be subsampled in time and as such allows the user to alter the effective frame rate in post-processing. We have previous applied NDR technology to localisation microcopy [1]. In this work we apply the technology to low light imaging.

NDR has two advantages when imaging under low light conditions. Firstly, as mentioned above, it allows for a variable frame rate in post processing. This allows to user to image under low light conditions and trade off temporal resolution for increased signal to noise after the measurement has been taken. Secondly, the correlated nature of the NDR measurement allows for a wide variety of statistical measurements to be applied to the data in order to increase the signal to noise of the image.

We present data which demonstrates the two advantages of NDR outlined above. We show how a post-processing variable frame rate can be used to increase the signal to noise ratio of an image at the cost of temporal resolution. We also present several simple statistical techniques which can be used on NDR data to improve the quality of the image.



The image shows a BPAE cells with Alexa Fluor 488 Phalloidin labelling from a Thermo Fisher Fluo Cells Prepared Slide taken under very low light conditions. The graph shows the signal increase on the NDR chip for a dark region and for a region containing sample. The differences in the gradient can be used to extract more data under low light conditions.

1. Barnett, S.F.H., M. Snape, C.N. Hunter, M.A. Juárez, and A.J. Cadby. 2017. A Novel Application of Non-Destructive Readout Technology to Localisation Microscopy. Sci Rep. 7: 42313.