Improving under-sampled imaging data quality in live tissue imaging.

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Long-term imaging suffers from fluorescence fading, damages to samples, and large data size. Especially, detailed analysis with three-dimensional live imaging requires techniques for using photon budgets in optimal conditions without deteriorating the quality of information gain obtained per scan. Such requirements are largely hampered by the performance limits of microscopes at present.
Recent progress in signal processing via optimization problems has provided revolutionary measurement with compressed sensing [1-2]. Extracting essential information from fewer observations than the standard level using compressed sensing has led to successful results in various fields [3]. In this study, we propose a technique to realize interpolation and noise reduction suitable for three-dimensional fluorescence microscopic images of tissues and organs; this is achieved based on compressed sensing and by solving one optimization problem. We employ interpolation of insufficiently acquired images by incorporating the concept of compressed sensing using L_1-norm minimization to efficiently reduce the cost of microscopic measurements of biological specimens. We performed visualization of morphological details of fluorescence-labelled skeletal muscle cells images in living mice for the evaluation of this technique.

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