Accelerated AFM characterization of DNA origami shape and properties via deep-learning-based image super-resolution

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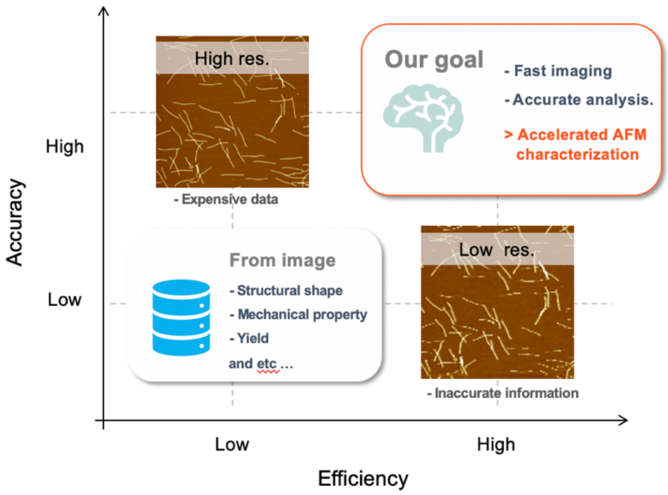
To characterize the shape and properties of DNA origami nanostructures, atomic force microscopy (AFM) has been widely used. Unfortunately, it generally suffers from a low scanning yield due to its method of raster scanning as a sufficiently high resolution for imaging is required. In this presentation, we introduce a systematic method of data acquisition and preparation combined with a deep-learning-based image super-resolution that enables rapid AFM characterization with accuracy for a broad range of DNA origami nanostructures [1]. DNA origami samples are first imaged at a low resolution, and then deep-learning-model generates the corresponding higher-resolution images from which the geometrical and mechanical properties of DNA origami nanostructures are measured. Around a tenfold reduction in AFM imaging time can be achieved without significant loss of accuracy. In addition, the trained model can be efficiently customized for a specific target sample on demand through a transfer learning strategy. This hybrid experimental and computational characterization method is expected to be useful in advancing the computational models for structured DNA assemblies as one can obtain a much larger dataset.



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References

1. Young-Joo Kim, Jaekyung Lim, and Do-Nyun Kim, "Accelerated AFM characterization via deep-learning-based image super-resolution", *Small*, 18: 2103779 (2021)