

Construction of super-resolution DNA AFM images with VR DNA molecular models

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An Atomic Force Microscope (AFM) is a high-resolution instrument that can detect various materials and samples in the atmosphere and liquid environment. It has become a basic tool in molecular robot research especially for DNA nano-structural design such as DNA origami technology. However, due to the limitation of AFM imaging resolution, it is difficult to observe the details of double-helix DNA structure, such as major groove and minor groove. In order to solve the difficulty to obtain high-resolution DNA pictures directly, this research first tries to establish a VR molecular model approach to obtain super resolution AFM images in atomic levels. Then, we use a virtual AFM probes in various scales to scan the DNA molecular models and to obtain DNA AFM images of different resolutions by simulating the AFM imaging process. Finally, the deep learning method is applied to build a super-resolution network to obtain high-resolution AFM images with different resolution DNA images as training sets.

[1] Gregory Gutmann, Ryuzo Azuma, Akihiko Konagaya: A Virtual Reality Computational Platform Dedicated for the Emergence of Global Dynamics in a Massive Swarm of Objects, *J. of the Imaging Society of Japan*, **2018**, 57(6), 647-653.