Two-bit input binary task with reservoir computing using nanomagnet array

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Neural network has made great achievements in recent years, e.g. AlphaGo⁰ from Google DeepMind. However, a general neural network implemented on a CPU/GPU has a problem of power consumption. To reduce the power consumption, reservoir computing⁰ which use physical phenomenon for numerical calculation has been reported⁴. Recently we demonstrated reservoir computing with nanomagnet array reservoir shown in Fig.1⁶. In this reservoir computing, static magnetization of the nanomagnets in the reservoir are used as node state. Each node state are connected via dipole field of the nanomagnets. The node state are updated by changing each anisotropy of the nanomagnets. This reservoir can perform single-bit input binary tasks. However, more complex tasks such as image recognition require not a single-bit input but a multi-bit input.

Here, we demonstrate reservoir computing with two-bit binary task using a nanomagnet array as a reservoir. Fig. 2 shows schematic top view of reservoir with nanomagnets array for two-bit input binary task. With this reservoir, we performed macro-spin simulations. As a results, an output matrix of this reservoir can be trained to perform two-bit binary input tasks with delay up to one.

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