

Solving intractable problems with coherent Ising machine

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We introduce the recent progress of coherent Ising machine (CIM), which finds solutions to complex combinatorial optimization problems using a network of degenerate optical parametric oscillators (DOPO). We describe our effort to generate time-multiplexed DOPOs using long-distance fiber cavities including telecom-band phase sensitive amplifiers [1-4]. We then present our experiments where we found solutions to complex combinatorial optimization problems using a CIM with measurement-feedback scheme [5]. Finally, a future perspective of the CIM project will briefly described.

References

- [1] H. Takesue, T. Inagaki, K. Inoue, and Y. Yamamoto, “Coherence Property of >2500-pulse Multiplexed Degenerate OPO,” The 61st JSAP (Japan Society of Applied Physics) Spring Meeting, 17p-PA1-1, Sagamihara, Kanagawa, Japan, Mar. 2014 (in Japanese).
- [2] H. Takesue, T. Inagaki, T. Umeki, O. Tadanaga, and H. Takenouchi, “Large-scale Time-division Multiplexed OPOs Using PPLN Waveguide,” The 62nd JSAP Spring Meeting, 12a-P6-1, Shonan, Kanagawa, Mar. 2015 (in Japanese).
- [3] T. Inagaki, K. Inaba, R. Hamerly, K. Inoue, Y. Yamamoto, and H. Takesue, “Large-scale Ising Spin Network Based on Degenerate Optical Parametric Oscillators,” Nat. Photonics, Vol. 10, pp. 415–419, 2016.
- [4] H. Takesue and T. Inagaki, “10 GHz Clock Time-multiplexed Degenerate Optical Parametric Oscillators for a Photonic Ising Spin Network,” Opt. Lett., Vol. 41, No. 18, pp. 4273–4276, 2016.
- [5] T. Inagaki, Y. Haribara, K. Igarashi, T. Sonobe, S. Tamate, T. Honjo, A. Marandi, P. L. McMahon, T. Umeki, K. Enbutsu, O. Tadanaga, H. Takenouchi, K. Aihara, K. Kawarabayashi, K. Inoue, S. Utsunomiya, and H. Takesue, “A coherent Ising Machine for 2000-node Optimization Problems,” Science, Vol. 354, No. 6312, pp. 603–606, 2016.