Research Abstract

Designing and Evaluating Physical Unconventional Computers

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Physical computing, or *in materio* computing, directly exploits the physical dynamics of materials to perform computational operations in an unconventional manner. In this talk, I will describe a methodology based on Abstraction/Representation theory [1] for designing such systems, including consideration of appropriate physical substrates, corresponding computational models, and issues to do with input, output, and validation. I will further describe an evaluation approach, based on the CHARC framework [2], to quantify the computational capacity of the resulting system. I will use examples drawn from physical reservoir computing, but the approach is more general.

[1] D. Horsman, S. Stepney, R.C. Wagner, V. Kendon. When does a physical system compute? *Proc. Roy. Soc. A*, **470**(2169) 20140182 2014. doi:10.1098/rspa.2014.0182

[2] M. Dale, J.F. Miller, S. Stepney, M. Trefzer. A Substrate-Independent Framework to Characterise Reservoir Computers. *Proc. Roy. Soc. A*, **475**(2226), 2019. doi: 10.1098/rspa.2018.0723