Docket #: S19-323

Simultaneous Measurements of Gradients in Optical Networks

Stanford researchers have an efficient method to measure gradients simultaneously and in parallel, as related to an optical network. These optical networks based on integrated waveguide meshes are utilized in artificial neural networks or machine learning as they can perform matrix multiplications at zero marginal energy cost. A common difficulty with current electrical approaches is getting the network to learn to solve a problem. This technology overcomes that issue by utilizing a feedforward photonic network of tunable beamsplitter nodes to simultaneously nullify nodes in parallel. For a given network with L device columns and N input nodes, this parallel nullification strategy is up to (N/2) times faster than existing component-wise calibration approaches. Overall, this would allow optical neural networks to implement fast and low power learning.

Related Technology: "S19-093 Efficient, scalable training of artificial neural networks directly on optical devices"

Stage of Research

- Proof of concept, can be made with currently available technology

Applications

- **Optical neural networks and machine learning**
- Optical communications systems
- Self-training sensing systems

Advantages

- **Reduced time spent optimizing arbitrary optical networks**
- Faster matrix multiplication (zero marginal energy cost) vs electronic systems

Publications

- Pai et al. IEEE Journal of Selected Topics in Quantum Electronics (2020) "Parallel Programming of an Arbitrary Feedback Photonic Network"

Patents

- Published Application: WO2021050526
- Published Application: 20220327369
- Issued: 12,705,475 (USA)

Innovators

- Shanhui Fan
- Tyler Hughes
- David Miller
- Sunil Pai
- Olav Solgaard
- Ian Williamson

Licensing Contact

David Mallin

Licensing Manager, Physical Sciences

Email