Smart on-chip Fourier-transform spectrometers harnessing machine learning algorithms

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Miniaturized silicon photonics spectrometers have great potential for mass market applications like medicine and hazard detection. However, the performance of state-of-the-art silicon spectrometers is limited by fabrication imperfections and temperature variations. In this work, we present a fundamentally new strategy that combines machine learning algorithms and on-chip spatial heterodyne Fourier-transform spectroscopy to identify specific absorption features operated under a wide range of temperatures in the presence of fabrication imperfections. We experimentally show differentiation of four different input spectra with unknown temperature variations as large as 10 °C. This is about 100x increase in operational range, compared to state-of-the-art retrieval techniques.

Keywords: silicon, spectrometers, machine learning

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