EC601 A1: Product Design in Electrical and Computer Engineering

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Project 1: Photonics chips for machine learning

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**Problem Statement**

Machine learning is a concept created about 70 years ago by Arthur Samuel, becoming popular in recent years[1]. It had wide application in big data, artificial intelligence, and deep learning, neural networks, etc. Compared to the development in software, things do not look as positive in hardware. General VLSI design, precisely transistor design, have almost hit microphysical limits as the process development did not have a really impressive leap in recent 10 years. Intel had been criticized for not updating the transistor process of their most popular customer CPU series for more than 5 years, compared to the rapid development in the beginning of 2010s[2]. Evolution of machine learning cannot only depend on the software as the hardware is the basic and the essential part. One of the possible ways to keep the chips improving is the photonics integrated circuit, or the photonic chips.

**Applications**

The potential applications of the photonic chips in machine learning is the empowered data center by smaller photonic computers, .This means that the relevant industries can apply their latest technological developments, the algorithms and data structures, for example, on the server or the computer arrays running quantum computing with much faster processing speed and larger communication bandwidth, while the other enviornment like thermal power consumption management keeps the same compare to the traditional data centers or similar facilities.

This improvement will excel the level of applications of machine learning, the enforcement of artificial intelligence can help people manage the metropolitical areas even better, the improved data processing procedure will help all the mobile applications with a better customer experience.

**Reference**

[1]A. L. Samuel, "Some Studies in Machine Learning Using the Game of Checkers," in IBM Journal of Research and Development, vol. 3, no. 3, pp. 210-229, July 1959, doi: 10.1147/rd.33.0210.

[2]J. Walton, “Intel CPU Roadmap: All THE 'LAKES' from 14nm to 7nm,” pcgamer, 08-May-2019. [Online]. Available: https://www.pcgamer.com/intel-cpu-roadmap-all-the-lakes-from-14nm-to-7nm/. [Accessed: 18-Sep-2021].