Photonic chips application in Autonomous Vehicle

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I. Abstract

Today, photonic chips have been widely used in machine learning tasks due to their high performance. In integrated photonic circuits, the created optical neural network can compute complex computation in a short time. Since signals can transmit faster in optical than in electrical, photonic chips have become more competitive compared to the traditional electrical chips in the integrated circuits for machine learning and communication areas. In this article, we will introduce the photonic chips on applications in the machine learning area and imaging recognition in an autonomous vehicle.

II. Introduction

Photonic chips are also known as integrated optical circuits, which utilize multiple techniques to fabricated more compacted integrated circuits. Unlike electrical chips, which are manipulated by electrical signals, photonic chips are manipulated by light. Due to the wider optical spectrum, the photons with different wavelengths can modulate or transmit in different routes at the same time without interrupts. With this wider bandwidth, the photonic chips are able to transmit the information faster. Also, the passive optical networking (in unpowered conditions) has the advantage of low consumption and phase modulation, and the light signals can be easily detected and modulated over a certain frequency.

Therefore, photonic chips are mostly used in fiber-optic communications, but they are also useful in various applications in which light has an important role, such as chemical, biological or spectroscopic sensors, metrology, and classical and quantum information processing [1].

III. Application

The integrated photonic chip is a technical improvement that would solve many bottlenecked problems and will bring us? to the new era of many attractive applications associated with machine learning, such as autonomous vehicles, supercomputers, biosensors, and etc.

The autonomous vehicle requires to detect the surrounding environment and analyze those images at the same time. The vehicle will be capable to follow the instructions from the central processors. All these massive workloads require the computer to compute in a short time and give feedback to the vehicle immediately, which means the high performance of the chips is significant.

In the paper of Xu et. al, the authors demonstrate the optical neural networks-based photonic convolution accelerator, which could dramatically accelerate computing speed [2]. This optical vector convolutional accelerator operating at more than ten trillion (1012) of operations per second, or tera-ops per second (TOPS), which generating convolutions of images with 250,000 pixels—sufficiently large for facial image recognition [2].

Thus, compared to the traditional electrical silicon chips, photonics chips would help with the autonomous vehicle.

IV. Conclusion

Based on the research and experiments, integrated photonic technology has a great potential in artificial intelligence applications that require a large amount of data processing, including smartphones, computers, vehicles, and etc.

REFERENCES

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