# Spiking Neural Network Enhanced Gesture Recognition Using Low-Cost Single-Photon Avalanche Diode Array

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## Abstract

We present a compact spiking convolutional neural network (SCNN) to recognize gestures in completely dark environment, using a 9.6 USD single-photon avalanche diode (SPAD) array with 8×8 spatial resolution. Photon intensity data is leveraged to train and test the network. A Vanilla convolutional neural network (CNN) is also designed to compare the performance of the SCNN architecture with the same network topologies and training strategies. The SCNN is trained from scratch instead of being converted from CNN. The result indicates that SCNN achieve comparable result than CNN and exhibits much lower computational complexity. The code and dataset are available at.

## Introduction

## Prior Work Review

## Neural Network Details

The training datasets include 5,000 images of 10 kinds of gestures, where each kind of gestures have 500 images. With the same ratio, the test datasets have 1,000 images, with 100 images for each gesture. We used early stopping strategy with 20 epoch patients to avoid over-fitting. Adam is the optimizer. The learning rate is 10­-3. Cross-entropy is the loss function.

Two types of SNNs, spiking convolutional neural network (SCNN) and spiking multiplayer perceptron (SMLP) were constructed to investigate their differentiation in term of performance. We also designed a vanilla CNN to compare the performance versus the SNNs. The performance is discussed in the next section. The details of the SNNs are depicted in Fig.

## Performance Evaluation

As shown in the accuracy curve in Fig., vanilla CNN exhibits faster convergence than SNNs.

## Conclusion