AKPIK 4: Postersession AKPIK

Zeit: Mittwoch 18:00–18:30 Raum: C.A.R.L. Foyer EG

AKPIK 4.1 Mi 18:00 C.A.R.L. Foyer EG

Towards Realizing Machine Learning Using Spin Qubits based on GaAs — •Zheng Zeng[1], Yulin Hu[2], Beata Kardynał[1], and Anke Schmeink[2] — [1]Peter Grünberg Institute (PGI-9), Forschungszentrum Jülich, D-52425 Jülich, Germany — [2]Theoretische Informationstechnik, RWTH Aachen University, D-52056 Aachen, Germany

Machine learning (ML) has been a powerful tool for executing advanced inference tasks. Recently, implementing ML on a powerful quantum computer becomes an attractive research filed as it has been shown that quantum computers exhibit square-root and even exponential speedups over classical computers in some machine learning methods based on quantum algorithms. Different from classical computers, quantum computers are able to process information using effects like quantum coherence and entanglement. Therefore, as a basic unit of quantum computation, a qubit has a high information capacity, i.e., it could carry much more information than a classical bit. In this work, we are motivated to investigate a possibility to improve the performance of ML programs by utilizing the high information capacity characteristic of qubits. In particular, we provide a case study to realize a neural network via a set of a few spin qubits. We propose a protocol to encode the training set of the neural network by manipulating the spin qubits on the Bloch sphere using radio frequency (RF) pulses, and finally evaluate the performance of the neural network.

AKPIK 4.2 Mi 18:00 C.A.R.L. Foyer EG

The Influence of Labeling Statistics on Supervised Learning — •Christian Haase-Schuetz — Institute of Radio Frequency Engineering and Electronics, Karlsruhe Institute of Technology

Recent progress in Deep Learning is based on Supervised Learning. Deep Neural Networks (DNNs) used as powerful function approximators learn a mapping from inputs x to labels y, i.e. $\mathrm{DNN}(x) = \hat{y}$. Training progress is based on the suitably measured distance of the predicted label $\hat{y}$ to the reference label y. The distance is measured using a cost function $C(y, \hat{y})$. While these algorithms have proven to be useful in a large number of applications for some of them it is tedious and expensive to generate the reference labels y. Often human annotators are involved in creating the reference labels y. There is a non-zero probability of human annotators creating reference labels that are incomplete or flawed.

Let y^* be the perfect label, for each sample i we assume $y_i = y_i^* \pm \Delta y_i$ where $\Delta y_i \sim N(0, \sigma)$ is called labeling noise and follows a normal distribution. Varying σ enables to study the performance of the network a function of the labeling noise i.e. $\min_{\text{training}} C(y^*, \hat{y})[\sigma]$. We do so for a classification and a regression setting.

AKPIK 4.3 Mi 18:00 C.A.R.L. Foyer EG

Study of direct CP-violation in B $\to$ K π with Belle II - Overview and Prospects — •Benedikt Wach for the Belle 2-Collaboration — Max-Planck-Institut fuer Physik, Muenchen, Deutschland

Although the Standard Model (SM) is an established and well-tested theory, mysteries such as the matter-antimatter-asymmetry call for new physics lying beyond. The Belle II experiment will help to test theoretical predictions, provide necessary experimental input and look for non-SM phenomena.

With an expected integrated luminosity 50 times that of its precursor Belle, the Belle II experiment will allow to measure the flavor dynamics of B-meson decays with unprecedented precision.

Charmless B meson decays to K-π final states represent a powerful tool to better understand B decay mechanisms and further provide excellent sensitivity for new physics, in particular, phenomena related to CPV.

An overview of the basic concepts of charge-parity violation (CPV) in the B meson sector is given, focusing on neutral and charged B $\to$ K π decay channels. Furthermore, a prospect for Belle II is provided, taking into account the expected increase in integrated luminosity.