06.10.2020

- Discriminator doesn't learn with too few layers. With two layers it was not able to distinguish between fixed real and fixed fake state. It is able to do so with 5 layers.

08.10.2020

- It seems that the label introduced by single rotation along X axis is not enough to bring desired state information.
- The training regime should pick R or G at random, not first batch of R, then batch of G etc.
- How purity (or lack of it) of real input influence training? (Remember that $tr[p] = sum(\lambda) = 1$ and $tr[p^2] = sum(\lambda^2) \leq 1$). How eigenvalues of real and generated state influence training.

UNSUPERVISED AND SEMI-SUPERVISED LEARNING WITH CATEGORICAL GENERATIVE ADVERSARIAL NETWORKS

Discriminator

- We model the class information using Shannon entropy H - expected value of the information carried by a sample from a given distribution. If we want $p(y|x, D)$ to be highly peaked (e.g. Gaussian bell with very low variance), which means low entropy. This is because, if x belongs to class k, then all the elements drawn from conditional distribution should be similar.
- On the other hand, for $p(y|G(z), D)$ we want the entropy to be maximized. This will cause discriminator to be *uncertain* of class generated by the generator.

General objective

- Discriminator wants to maximize mutual information about data distribution and predicted class while minimizing information it encodes about $G(z)$.
- Generator wants to maximize mutual information between generated sample and predicted class distribution

12.10.2020

Circuit-centric quantum classifiers

- It seems that strong (complete) entanglement is crucial for shallow circuit predictive power.
- Interesting view is to see a unitary (or a circuit moment) as a connection between two NN layers (p. 8).
- Interesting evaluation on how noise in the quantum device influence the classification results (p. 12).

- Possible takeaways that can be included in my research are:
  - Gradient calculation
  - Regularization (after the gradient base is extracted from quantum device)
  - Dropout
- Possible ways to reduce/translate circuit layout:
  - It is possible to decompose any gate G to $Q^T DQ$, where Q is another single qubit unitary and D is diagonal.
  - With controlled G - $C(G)$ - we can replace the "controlled part" by two phase gates for upper and lower qubit and decompose G as above.

Quantum machine learning in feature Hilbert spaces

This paper is exploring a link between SVM kernel methods and QML. The idea is that both of those techniques are leveraging high dimensional (infinite) Hilbert spaces to perform classification.

In the quantum case, the kernel trick corresponds to changing the data encoding strategy