Outline for the thesis

Abstract

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Introduction

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BBN

- Introduce neural netwrok frame work. And introduce probablistic model and bayesian neural network.
- Write about why we need bayesian neural network(overcome overfitting, reducing errors in area with less data, dertermine extents of overfitting automatically, better interpretability etc.) Use examples to illustrate(if time permitted)
- Write about difficulties in BBN and methods used before.

Difficulty	**Solution**
caculating closed form posterior distrubution function	conjugate prior
numerical difficulty of calculating posterior	use variational bayes to approximate posterior
difficulty to calculate gradient(often include expectation term) to variational parameter	sampling in posterior by MCMC and use it to to approximate

- then introduce the specific algorithm: Bayes by BackpropCharles Blundell et. al. 2015

DP part

- introduce basic DP definition, origin, post processing property, composition etc.

DP-SGLD part

- statistical property of MCMC estimator (consistency, assymptotic optimality etc.)
- Modifying SGLD to achieve DP: the algorithm
- proving its differential privay
- compare it theoretically with objective purtabation method etc.

Experiment part

I plan to extend the experiment of Bayes by Backprop method of classification of handwrittne digits on MNIST. (in Charles Blundell et. al. 2015) It has 2 layers. And I plan to use SGLD method and compare the performance with others.

- utility and error rate: compare with SGD etc. in a similar way as the paper Charles Blundell et. al. 2015
- privacy: compare it with previous empirical risk minimization method(mainly obj-purtabation?)