Bayesian model choice via mixture estimation model : Poisson versus Geometric regression models

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1. Introduction
2. Overview of bayesian methods for model selection
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Problem of model selection in the bayesian framework

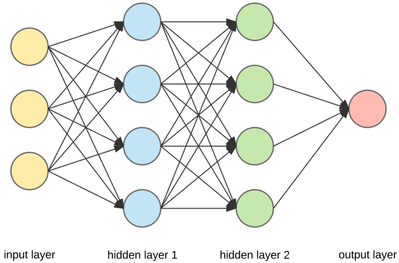


Figure 1 – A shallow neural network

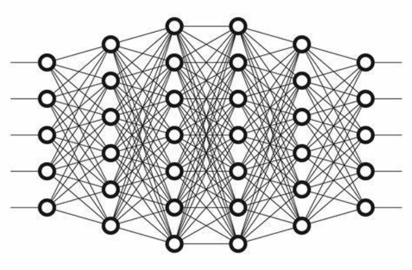


Figure 2 – A deeper neural network

Question of the activation function :

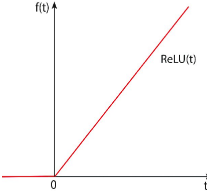


Figure 3 – ReLU function

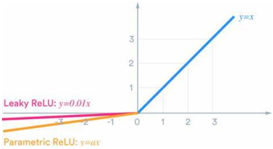


Figure 4 – Leaky ReLU function

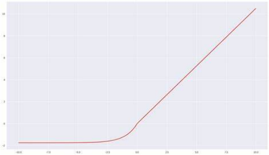
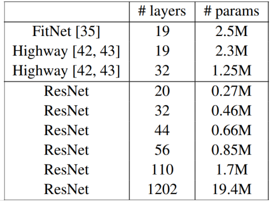


Figure 5 – SeLU function

Very high number of parameters (without regularisation)

Example of resnet : [?]



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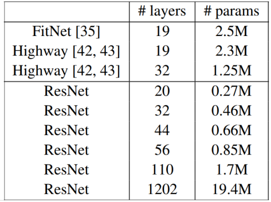
FitNet [35]	19	2.5M
Highway [42, 43]	19	2.3M
Highway [42, 43]	32	1.25M
ResNet	20	0.27M
ResNet	32	0.46M
ResNet	44	0.66M
ResNet	56	0.85M
ResNet	110	1.7M
ResNet	1202	19.4M

Figure 6 – Number of parameters for different neural networks

Very high number of parameters (without regularisation)

Example of resnet : [**?**]



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$$\mathrm{AIC} = 2(\mathrm{Card}(\mathrm{param}) - \log(\hat{L})) \tag{1}$$

VC dimension : maximal number of point such that there exists a generally positioned data point set of that can be shattered by the model

Need for Bayesian methods

- Go further than a simple balance to strike between accuracy on the training data set and over-fitting
- More interpretability
- More understanding of our uncertainty

Bayes Factor

$$B_{01} = \frac{\frac{P(H_0|x)}{P(H_1|x)}}{\frac{P(H_0)}{P(H_1)}} = \frac{P(H_0|x)P(H_1)}{P(H_1|x)P(H_0)} \tag{2}$$

Advantage :

- Allows to clearly see the dependency on initial hypothesis (or to "eliminate" it partially...)
- Shows the importance of new data

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Disadvantages :

- Just a description of the "evolution" of the probability
- No penalization nor finegrained description of uncertainty

Directly giving (hierarchical) probabilities to hypothesis

Kaniav Kamary, Kerrie Mengersen, Christian P. Robert, and Judith Rousseau. Testing hypotheses via a mixture estimation model, 2018.