题　　目：　深度学习中的正则化

摘　要

在深度学习中，正则化的应用十分普遍，旨在减小泛化误差的同时不过度产生偏差。限于作者水平，我将主要介绍参数惩罚正则化，即通过添加惩罚项的方式对模型进行约束。本文介绍了几种常用的范数，并且给出了 L2 参数惩罚和 L1 参数惩罚的推导过程。在最后还将用岭回归来处理具体问题，即回归分析与神经网络之间的关系。

我所使用的数据处理软件是 Matlab2016b。先行对多维数据集红酒质量的影响因素进行了线性回归和岭回归，其结果岭回归的预测能力与线性回归相差无几甚至略有不如。而后又对“Challenger USA Space Shuttle O-Ring”数据进行了线性回归以及惩罚系数多次递增的岭回归，结果表明岭回归以训练集的偏差为代价获得了更好地测试集准确率。可以得出结论：L2 正则化确实可以以减少泛化误差（尽管增大了训练误差）!

通过对这两组数据的处理，使我获益匪浅，不但对正则化有了更加全面的认识，而且对 matlab 操作的有了更好的理解。经过此次论文撰写的洗礼，在以后的工作和学习中，我定会更加脚踏实地，积极进取！

关键词：正则化；过拟合；岭回归；回归分析；

Abstract

In deep learning, the application of regularization is very common, aiming to reduce the generalization error without excessively generating bias. Limited to the author level, I will mainly introduce the regularization of the parameter penalty, that is, to constrain the model by adding penalty items. This paper introduces several commonly used norms, and gives the derivation process of L2 parameter penalty and L1 parameter penalty. In the end, ridge regression will be used to deal with specific problems, namely the relationship between regression analysis and neural networks.

The data processing software I use is Matlab2016b. First, linear regression and ridge regression were performed on the influencing factors of red wine quality in the multi-dimensional data set. As a result, the prediction ability of ridge regression was almost the same as that of linear regression. Then, linear regression and ridge regression with multiple increments of the penalty coefficient were performed on the "Challenger USA Space Shuttle O-Ring" data. The results show that ridge regression obtains better test set accuracy at the cost of the deviation of the training set. It can be concluded that

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