國立中正大學數學系
暨應用數學碩士班、統計科學碩士班
學　術　演　講

Discriminating Images with Randomly Located Patterns

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Abstract

Image discrimination is a pervasive task in the AI era, with convolutional neural networks (CNNs) often achieving high prediction accuracy. Influential patterns in images may appear in fixed regions or be randomly distributed. In literature, regression approaches effectively handle the former but leave the latter less addressed. To tackle the random case, we reveal that the parameter tensor of a tensor regression can be factorized into two matrices: one representing the CNN's convolutional unit to summarize local patterns, and the other representing the fully connected unit to identify influential pattern locations. However, the fully connected unit assumes fixed pattern locations, limiting its ability to detect randomly located patterns. To overcome this, we aim to preserve the strengths of the convolutional unit while relaxing the constraints due to adopting the fully connected unit. Specifically, we need a model that assigns a positive label if at least one sub-image contains a specific pattern and a negative label if none do. Multiple-instance logistic regression, a statistical model for multiple-instance learning, models the search with a very limited number of parameters. In contrast to CNNs regularly using massive parameters, we apply multiple-instance logistic regression to the MNIST, playing cards, and brain tumor datasets and thus demonstrate the trade-off between model explainability and prediction accuracy.

Keywords: Convolutional Neural Networks, Logistic Regression, Multiple-Instance Learning, Tensor Regression

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地　點：本校數學館 527 教室（嘉義縣民雄鄉大學路 168 號）

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