

# Chapter 1

## iOS App and Architecture of Convolutional Neural Networks

### ABSTRACT

*Deep convolutional neural networks (CNN) have attracted many attentions of researchers in the field of artificial intelligence. Based on several well-known architectures, more researchers and designers have joined the field of applying deep learning and devising a large number of CNNs for processing datasets of interesting. Equipped with modern audio, video, screen-touching components, and other sensors for online pattern recognition, the iOS mobile devices provide developers and users friendly testing and powerful computing environments. This chapter introduces the trend of developing pattern recognition CNN Apps on iOS devices and the neural organization of convolutional neural networks. Deep learning in Matlab and executing CNN models on iOS devices are introduced following the motivation of combining mathematical modelling and computation with neural architectures for developing pattern recognition iOS apps. This chapter also gives contexts of discussing typical hidden layers in the CNN architecture.*

### CNN-BASED PATTERN RECOGNITION IOS APPS

Nowadays, artificial intelligence (AI) is a world-wide hot issue. Researchers make efforts for AI development, in order to let the AI system deal with some single job for humans, make life more convenient and reduce labour expenditure. The field of machine learning has been the focus of AI development. Machine

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learning analyses large-scale datasets, constructing structured mathematical models for approximation, prediction, classification or visualization. In the past decade, deep learning of convolutional neural networks (CNNs) has a major breakthrough (LeCun, Bengio, & Hinton, 2015) and has been extensively applied for computer vision (Krizhevsky, Sutskever, & Hinton, 2012), image recognition (Simonyan & Zisserman, 2014), speech recognition (LeCun & Bengio, 1995), natural language (Kim, 2014), etc. Nowadays, the “data-driven” deep learning of CNNs directly extracts filters of convolutions for realizing classifiers or approximation formula subject to large-scaled training data, making use of advanced parallel and distributed processes in a way significantly different from constructing traditional expert systems. It no longer needs to define axioms and rules for resolving the problem of constructing classifiers or approximating formula. The designer can extract information or filters from the training dataset directly and classify patterns through convolutional neural networks derived by deep learning methods. Like human brain learning, deep learning adapts interconnections of neural networks subject to constraints proposed by labelled training patterns so that the neural network can correctly classify testing patterns properly to correspondent categories. The neural architecture for deep learning includes feed-forward multilayer neural network (Charalambous, 1992), deep feed-forward neural networks (Hagan & Menhaj, 1994), convolutional neural networks (LeCun, et al., 1989), and deep convolutional neural networks (LeCun, Bottou, Bengio, & Haffner, 1998), etc. Neural organization of deep feed-forward neural networks and deep convolutional neural networks will be discussed in this book.

In the era of the global village, the emergence of Internets, computers and smart phones has brought people closer together, and the App Store of the smart phones has also brought developers and users closer. In addition to developing software, developers can also hit the product to the shelves of App Store for sale or provide users for free, and users can instantly give feedback to developers. Finally, the products can be patched and updated based on the feedback of user.

Using Xcode environment to create app software, packaging the software into the product and finally hitting the App Store shelves, such a development process can be completed by a developer or a team of developers. The Xcode for developing apps is equipped with a good environment of designing user interface (UI) based on the latest Swift programming language. In addition, learning and writing of the Swift programming are friendly in the Xcode.

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