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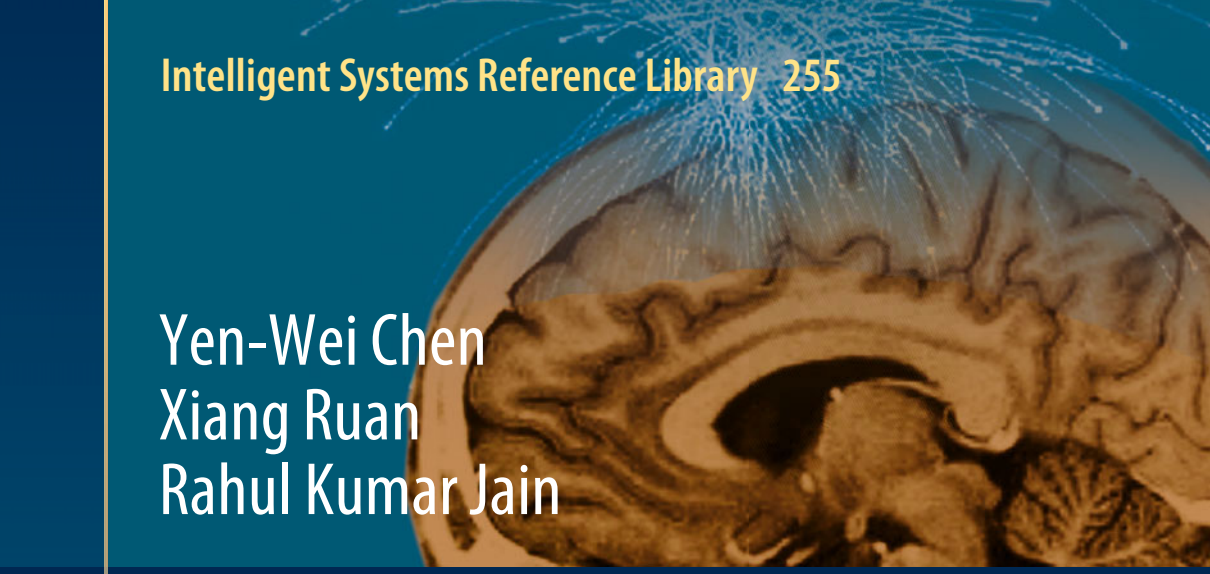

Yen-Wei Chen
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Recent Advances in Logo Detection Using Machine Learning Paradigms

Theory and Practice

Springer

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Preface

In recent years, there has been a notable transition from rule-based Artificial Intelligence (AI) to Machine-Learning-based AI, with an increasing focus on Deep Learning. Currently, deep learning frameworks are at the forefront of AI technology, marking significant advancements in academic and industrial fields. The evolution of deep convolutional neural networks (CNNs) has positioned deep learning as the method of choice for computer vision tasks, including image classification, segmentation, object detection, and human keypoint detection. This surge in deep learning has sparked interest in applying Convolutional Neural Networks (CNNs) across various domains, including the task of logo detection.

A logo is a unique symbol which identifies the product and services of any company. Logos serve as the quintessential elements for brand identity in today's market, symbolizing a company's products and services while setting them apart from competitors. Consequently, automatic logo detection in real-world images has emerged as a critical challenge with substantial implications across numerous applications, such as brand management, copyright protection, advertisement, and market analysis. To date, various logo recognition methods have been proposed, but most of them require huge annotated datasets for training, posing significant challenges due to domain discrepancies between training (source domain) and testing (target domain) datasets. These discrepancies often result in suboptimum detection accuracy. In this book, we aim to document recent advancements and explore future directions for deep learning in logo recognition. This book introduces:

(1) A weakly supervised logo detection approach leveraging attention mechanisms, which emphasizes key features and identifies logo positions without need of detailed object-level annotations.
(2) A robust logo detection framework, incorporating a feature extraction network enhanced with spatial and channel attention modules, coupled with an anchor-free detection head for precise and efficient logo identification.
(3) Strategies to address the domain shift problem between training and testing data by integrating domain adaptation methods into detection frameworks, improving accuracy across different logo datasets.

(4) An innovative domain adaptation technique based on entropy minimization to bridge the domain gap between synthetic (simulated) and real logo images, facilitating unsupervised logo detection suitable for practical application.

This book also provides valuable insights into feature learning and the application of various deep learning frameworks in logo recognition through detailed experiments and analyses, offering readers a comprehensive understanding of deep learning and logo detection.

Ibaraki, Japan/Hangzhou, China — Prof. Yen-Wei Chen
Kusatsu, Japan — Dr. Xiang Ruan
Ibaraki, Japan — Rahul Kumar Jain
December 2023

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