

Discriminative Clustering for Market Segmentation

Peter Haider^{*}
Dep. of Computer Science
Univ. of Potsdam, Germany
haider@cs.uni-
potsdam.de

Luca Chiarandini[†]
Web Research Group
Universitat Pompeu Fabra
Barcelona, Spain
chiarluc@yahoo-inc.com

Ulf Brefeld
University of Bonn
Bonn, Germany
brefeld@uni-bonn.de

ABSTRACT

We study discriminative clustering for market segmentation tasks. The underlying problem setting resembles discriminative clustering, however, existing approaches focus on the prediction of univariate cluster labels. By contrast, market segments encode complex (future) behavior of the individuals which cannot be represented by a single variable. In this paper, we generalize discriminative clustering to structured and complex output variables that can be represented as graphical models. We devise two novel methods to jointly learn the classifier and the clustering using alternating optimization and collapsed inference, respectively. The two approaches jointly learn a discriminative segmentation model for each segment. We evaluate our methods on segmenting user navigation sequences from Yahoo! News. The proposed collapsed algorithm is observed to outperform baseline approaches such as mixture of experts. We showcase exemplary projections of the resulting segments to display the interpretability of the solutions.

Categories and Subject Descriptors

I.5.3 [Clustering]: Algorithms

General Terms

Algorithms, Experimentation

Keywords

Discriminative Clustering, User Understanding, Market Segmentation

1. INTRODUCTION

^{*}This work was performed during an internship at Yahoo! Research, Barcelona, Spain.

[†]Also Yahoo! Research, Barcelona, Spain.

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Market segmentation reveals divisions in a given market, where a market refers to a population of interest such as people, customers, or organizations. A market segment is a subset of a market that is characterized by similar demands and/or needs based on qualities of a given product such as price or function.

Every segment is required to meet the following criteria. (i) It is homogeneous within the segment, so that individuals within the same segment exhibit common needs and can be targeted jointly with the same marketing strategy. (ii) It is easily distinguishable from other segments to guarantee that different segments have different demands and (iii) serves as a blueprint for distinct targeting strategies. The requirements are often summarized as *homogeneity*, *identifiability*, and *interpretability* (19).

Besides frequently deployed self-organizing maps (SOMs) (13; 7), market segmentation matches the problem setting of model-based clustering approaches. Clustering techniques either minimize the within-cluster similarity (1; 14), maximize the between-cluster similarity (7), or optimize a combination of both (18), and thus aim to produce homogeneous and identifiable solutions. Once segments have been computed, new customers need to be assigned to one of the subgroups to advertise the product accordingly.

Unfortunately, mapping new instances to an existing clustering is often difficult in practice. Intuitively, the new customer should be grouped to the closest segment with respect to some similarity measure. Closeness can for instance be computed as the distance in feature space to the median or the nearest member of a segment (11; 4). However, often at the time of classifying a new instance, not all features are known. Even using the similarity measure that is used by the clustering method itself on all features is frequently observed to perform surprisingly inaccurate, see e.g., (20) and Section 4. Other difficulties are for instance distribution-based clusterings, such as Expectation Maximization (6), which assign probabilities for cluster-memberships. By doing so, customers are probabilistically related to every segment. Converting this soft assignment into a hard assignment by taking a maximum a posteriori or winner-takes-all decision is often suboptimal if the memberships deviate from a point distribution, in which case more than one segments are likely candidates (14).

Optimally, the segmentation is therefore learned together with a classifier that discriminatively maps new instances to clusters; a problem setting which is also known as discriminative clustering (5; 20; 24; 8). The idea is to have the clustering provide the labels for the classifier which is

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**Anders Fjellstedt, Ling Wang, Jon
Weissbard, Victor Yip**



Discriminative Clustering For Market Segmentation:

Reinventing Manufacturing and Business Processes Through Artificial Intelligence Geeta Rana,Alex Khang,Ravindra Sharma,Alok Kumar Goel,Ashok Kumar Dubey,2021-12-14 This edited book describes how newly emerging Artificial Intelligence AI technologies will provide unprecedented opportunities to penetrate technology and automation into everything we do and at the same time provide a huge playing field for businesses to develop newer models to capture market share It establishes a milestone in understanding global transformational changes occurring in the manufacturing and corporate world due to AI and tries to find powerful and sophisticated solutions that will improve and streamline operations Reinventing Manufacturing and Business Processes Through Artificial Intelligence will be of interest to students researchers and professionals of the AI community as well as interdisciplinary researchers

Green Internet of Things and Machine Learning Roshani Raut,Sandeep Kautish,Zdzislaw Polkowski,Anil Kumar,Chuan-Ming Liu,2022-01-10 Health Economics and Financing Encapsulates different case studies where green IOT and machine learning can be used for making significant progress towards improvising the quality of life and sustainable environment The Internet of Things IoT is an evolving idea which is responsible for connecting billions of devices that acquire perceive and communicate data from their surroundings Because this transmission of data uses significant energy improving energy efficiency in IOT devices is a significant topic for research The green internet of things G IoT makes it possible for IoT devices to use less energy since intelligent processing and analysis are fundamental to constructing smart IOT applications with large data sets Machine learning ML algorithms that can predict sustainable energy consumption can be used to prepare guidelines to make IoT device implementation easier Green Internet of Things and Machine Learning lays the foundation of in depth analysis of principles of Green Internet of Things G IoT using machine learning It outlines various green ICT technologies explores the potential towards diverse real time areas as well as highlighting various challenges and obstacles towards the implementation of G IoT in the real world Also this book provides insights on how the machine learning and green IOT will impact various applications It covers the Green IOT and ML based smart computing ML techniques for reducing energy consumption in IOT devices case studies of G IOT and ML in the agricultural field smart farming smart transportation banking industry and healthcare Audience The book will be helpful for research scholars and researchers in the fields of computer science and engineering information technology electronics and electrical engineering Industry experts particularly in R D divisions can use this book as their problem solving guide

Computational Biology in Drug Discovery and Repurposing Rajani Sharma,A. V. Senthil Kumar,Kunal Kumar,2024-08-16 This new book takes an in depth look at the emerging and prospective field of computational biology and bioinformatics which possesses the ability to analyze large accumulated biological data collected from sequence analysis of proteins and genes and cell population with an aim to make new predictions pertaining to drug discovery and new biology The book explains the basic methodology associated with

a bioinformatics and computational approach in drug designing It then goes on to cover the implementation of computational programming bioinformatics pharmacophore modeling biotechnological techniques and pharmaceutical chemistry in designing drugs The major advantage of intervention of computer language or programming is to cut down the number of steps and costs in the field of drug designing reducing the repeating steps and saving time in screening the potent component for drug or vaccine designing The book describes algorithms used for drug designing and the use of machine learning and AI in drug delivery and disease diagnosis which are valuable in clinical decision making The implementation of robotics in different diseases like stroke cancer COVID 19 etc is also addressed Topics include machine learning AI databases in drug design molecular docking bioinformatics tools target based drug design and immunoinformatics chemoinformatics and nanoinformatics in drug design Drug repurposing in drug design in general as well as for specific diseases including cancer Alzheimer s disease tuberculosis COVID 19 etc is also addressed in depth Integration of IoT with Cloud

Computing for Smart Applications Rohit Anand,Sapna Juneja,Abhinav Juneja,Vishal Jain,Ramani Kannan,2023-07-25

Integration of IoT with Cloud Computing for Smart Applications provides an integrative overview of the Internet of Things IoT and cloud computing to be used for the various futuristic and intelligent applications The aim of this book is to integrate IoT and cloud computing to translate ordinary resources into smart things Discussions in this book include a broad and integrated perspective on the collaboration security growth of cloud infrastructure and real time data monitoring Features Presents an integrated approach to solve the problems related to security reliability and energy consumption Explains a unique approach to discuss the research challenges and opportunities in the field of IoT and cloud computing Discusses a novel approach for smart agriculture smart healthcare systems smart cities and many other modern systems based on machine learning artificial intelligence and big data etc Information presented in a simplified way for students researchers academicians and scientists business innovators and entrepreneurs management professionals and practitioners This book can be great reference for graduate and postgraduate students researchers and academicians working in the field of computer science cloud computing artificial intelligence etc *Marketing Decisions for New and Mature Products* Robert D.

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