

Chapter 40

Machine Learning for Smart Tourism and Retail

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ABSTRACT

The unprecedented growth in the amount and variety of data we can store about the behaviour of customers has been parallel to the popularization and development of machine learning algorithms. This confluence of factors has created the opportunity of understanding customer behaviour and preferences in ways that were undreamt of in the past. In this chapter, the authors study the possibilities of different state-of-the-art machine learning algorithms for retail and smart tourism applications, which are domains that share common characteristics, such as contextual dependence and the kind of data that can be used to understand customers. They explore how supervised, unsupervised, and recommender systems can be used to profile, segment, and create value for customers.

INTRODUCTION

The growth in the amount and diversity of data that can be obtained from people's behaviour has seen an unprecedented growth in recent years. This growth is parallel to the popularization and development of machine learning algorithms that can detect patterns in vast amounts of data. Personal electronic devices, such as smartphones, tablets or wearables are becoming ubiquitous, and the amount and variety

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of sensors that those devices possess are raising quickly. The combination of those factors creates the opportunity of finding patterns that explain consumers' behaviours, preferences or tastes.

In this chapter, we will explore the possibility of applying artificial intelligence algorithms into smart retail and tourism problems. We will explain what are the main challenges that we need to face when creating solutions for those two fields that can learn from the past preferences and behaviours of users, as well as what are the possibilities that machine learning methods can provide for companies, both in increasing customer value and improving decision-making.

First, we will explore the use of supervised learning methods for those tasks. The use of different learning algorithms (deep neural networks, random forest, decision trees, boosting, etc.) will be motivated and compared, so that we can have a better idea on what algorithms are more suited for each task that is involved in the process of creating smart tourism applications. We will study problems such as class imbalances, overfitting, missing values or dimensionality reduction, and different ways of tackling those problems correctly. Machine learning frameworks for different programming languages will also be compared.

The use of unsupervised learning methods is of interest for this problem. Most notably, automatically detecting groups of users that behave similarly can be of great value for retail and smart tourism companies, as, from those groups, they will be able to understand better their own customers. Clustering algorithms, including Self-organised maps (SOM), Expectation-maximization (E-M), K-means or density-based methods like DBSCAN, will be compared and reviewed, as in the supervised learning part of the chapter.

The ultimate goal of using machine learning for smart retail and tourism solutions is to offer customers products and services that maximize their value. A way to do so is through recommender systems, which learn from the characteristics of products that each user has liked in the past, as well as from preferences from similar users, in order to provide a recommendation that maximizes the chance of that users buying that particular product or service. Smartphones and wearables are equipped with several sensors that can provide information about what the user is doing (is it moving, driving, running, etc.) and what are its surroundings (weather, geolocalization, etc.). This is known as contextual information, and it can provide valuable information to recommender systems. Context-aware recommender systems are algorithms that learn from past preferences of users over product taking into account the context in which they interacted with the application (e.g., e-commerce) in the past. The way in which this contextual information should be integrated into recommender systems is, nevertheless, not obvious, and there is no clear consensus in the scientific literature on to which method is preferable. In this final part of our chapter, we will analyse and compare different context-aware recommender systems, as well as different ways of representing contextual information.

In sum, the main goal of this chapters is to explore the use of three different areas of machine learning in the setting of retail and smart tourism applications: Unsupervised and supervised learning, and recommender systems. Those three areas provide algorithms that are indubitably useful for retail and touristic companies and their customers, as they can provide insights that were undreamt of in the past. Different methods will be reviewed and compared with a critical point of view and with the final goal of helping whoever is interested in creating data-driven retail and smart tourism solutions.

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