Consumer Behaviour in Retail: Next Logical Purchase using Deep Neural Network

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Abstract

Modelling consumer behaviour is one of the most challenging problems for large retail firms, given the operational scale both in terms of consumer and inventory. Retailers spend a lot of money and resources to ensure a very smooth and delightful consumer shopping experience by recommending and maintaining right inventory at right time. Accuractely determining the products consumer would purchase in the near future not only enriches the consumer shopping experience but also plays a pivotal role in managing inventory by reducing the chances of Out of stock as well as Excess Inventory. This problem has been there since a long time and has been adrressed by ML researchers in conventional manner through recommender systems and varying ML approaches. But, to my knowledge none of the models have generalized well in predicting the items consumer is likely to purchase at given time point due to immense non-linearity existing in the consumer purchase pattern. In order to address this problem I present my study of consumer purchase behaviour using e-commerce retail data. Considering each consumer-product as an individual time series, I then build generalised models to predict the propensity of an item to be purchased by a consumer for a given time frame. I demonstrate the robust performance by experimenting with different neural architectures including Multi-Layered Perceptron (MLP), Long Short Term Memeory (LSTM), Convolution Neural Networks (CNN), CNN-LSTM and their combined performance as meta models.

Introduction

When a shopper goes shopping in a retail store or surfs on app for purchasing merchandises, he/she generally has merchandise list either in the form of notes or on top of his mind. In general the merchandise list of the regular shoppers happens to be huge and has hidden pattern. The problem on hand uses customer and his/her transaction data over time and attempts to predict the next basket of the customer leveraging his/her past purchased merchandises.This will provide very smooth and delightful shopping experience for the shoppers. It is meant to acheive three major objectives: - Revenue Enablement: A SmartList that predicts what merchandise a customer is likely to purchase during his next visit Relevance: The SmartList prediction is expected to achieve a satisfactory accuracy level so that the customer finds the SmartList relevant User Experience: The size of a SmartList should be manageable so as not to overwhelm the customers with too many merchandises. Build a framework to predict the next basket for each customer. When a shopper goes shopping in a retail store or surfs on app for purchasing merchandises, he/she generally has merchandise list either in the form of notes or on top of his mind. In general the merchandise list of the regular shoppers happens to be huge and has hidden pattern. The problem on hand uses customer and his/her transaction data over time and attempts to predict the next basket of the customer leveraging his/her past purchased merchandises.This will provide very smooth and delightful shopping experience for the shoppers. It is meant to acheive three major objectives: - Revenue Enablement: A SmartList that predicts what merchandise a customer is likely to purchase during his next visit Relevance: The SmartList prediction is expected to achieve a satisfactory accuracy level so that the customer finds the SmartList relevant User Experience: The size of a SmartList should be manageable so as not to overwhelm the customers with too many merchandises. Build a framework to predict the next basket for each customer. When a shopper goes shopping in a retail store or surfs on app for purchasing merchandises, he/she generally has merchandise list either in the form of notes or on top of his mind.

Methodology

Feature Engineering

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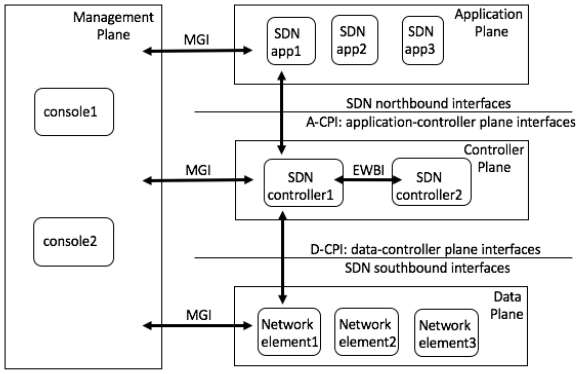

Figure 1: MLP Architecture

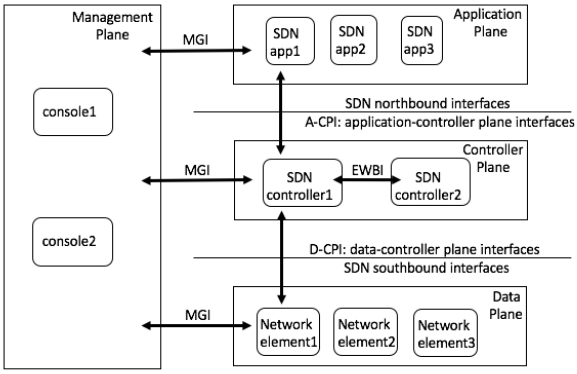

Figure 2: LSTM Architecture

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$$x^n + y^n = z^n$$

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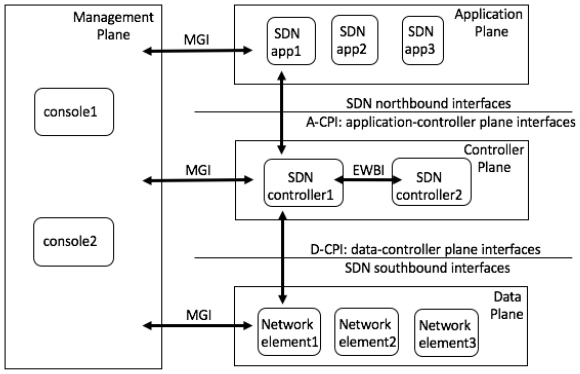

Figure 3: CONV1D Architecture

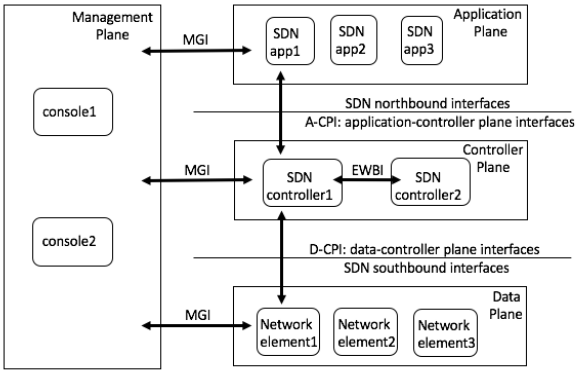

Figure 4: CONV1D-LSTM Architecture

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Experiments and Results

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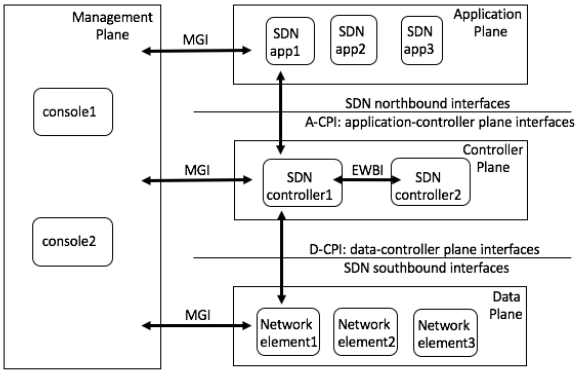

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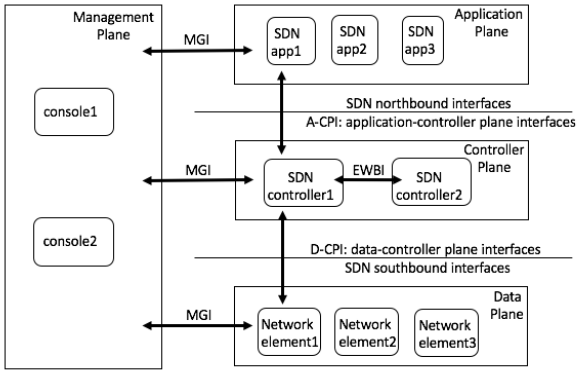

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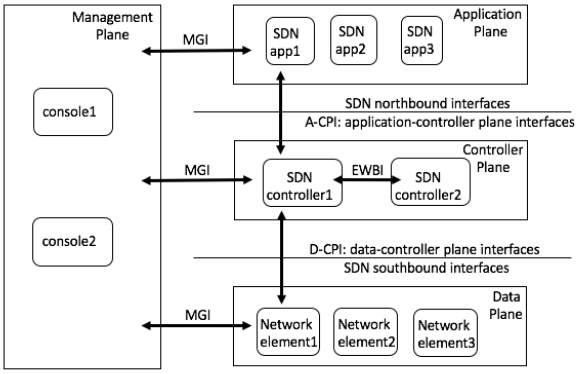

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