

# Machine Learning Engineer-Nanodegree

## Capstone Proposal

### Starbucks-Analyze the Coffee Innovation

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#### Proposal

##### ➤ Domain of research-

Starbucks opened the doors to its first store in Seattle, Washington in 1971. While successful, this first shop originally only sold prepackaged coffee beans with no opportunity for customers to sit and enjoy a cup of coffee in a public setting.

Its first store outside North America opened in Japan in 1996, and the company quickly moved into dozens of other countries and expanded to over 16,000 locations over the next decade and a half (Starbucks Coffee Company, 2011). Starbucks currently professes to have 28,218 stores as of 2019.

Imagine pulling into a Starbucks drive-thru and seeing not just your drink order but your name on the screen and to your smartwatch —are serving suggestions generated by artificial intelligence of what foods you might like with your drink, automatically generated by the weather, your buying history, and the choices that others with similar preferences have made.



It's all part of the coffee giant's plan to use AI and the cloud to drive sales and growth.

➤ **Problem Statement-**

- The first of Starbucks' challenges is figuring out how the chain will continue to stay relevant to their customers. With 27,000 locations across over 70 countries, it's a large undertaking that involves all parts of the organization and requires creative thinking.
- Secondly, the incredible success of Starbucks' mobile ordering has led to a large amount of orders, creating a need to make the Baristas' job simpler.

Our approach is to incorporate [AI technology](#) to make the Baristas' production more seamless. By helping their employees do their jobs more efficiently, Starbucks improves the customer experience.

➤ **Datasets and Inputs-**

Using consumer data, the coffee chain designed its new line of products to complement the habits it gleaned from its own stores. Basically, the company says it talked to its baristas about how customers ordered coffee, lattes and tea while in Starbucks locations and culled several industry reports about at-home consumption. It used that data to create K-Cups and bottled beverages to sell in grocery stores. While others are setting up mobile payments and struggling to start a loyalty program, Starbucks is seeing 11 percent of its sales from mobile order and pay, and 14.2 million Starbucks Rewards members accounting for 37 percent of U.S. company-operated sales.

- **Solution Statement-** The solution to the above problem can be solved using Reinforcement Learning. Starbucks as a coffee retailer knows every nuance of its customer's coffee habits through its in-house Artificial Intelligence technology.

**Starbucks Barista**, the face of Starbucks backed by AI, leverages voice-recognition technology to allow its users to speak to the app to place an order. The Starbucks mobile app has more than 17 million and the Starbucks reward has 13 million active users who create an overwhelming amount of data about their location, preferences and buying habits. With a core focus on Customer centricity, Starbucks sends a customized email to any customer who hasn't visited Starbucks recently with offers drawn from the customer's previous history. For Starbucks, AI will be going through the mounds of data it already has in areas like scheduling, inventory, and restaurant traffic. Scheduling and inventory are necessary tasks, but monotonous and uncreative, innovation is the name of the game, and today, there is more pressure than ever for companies to bring new products to market.

- **Benchmark Model-** For this project, Starbucks-Analyze the Coffee Innovation, the benchmark model would be the reinforcement learning algorithm. I will try to strike it's performance with the LSTM and other statistical models like K-means and PCA-learning algorithm.
- **Evaluation Matrix-** The reinforcement model can be evaluated based on various measures. The agent interacts with environment in repeating sequences of time  $t$ , observing the environment state  $s_1$ , taking action  $a_1$ , receiving rewards  $r_1$ .
  - **State** At time  $t$ , the reinforcement learning agent observes the state of the environment  $S_t$ . The agent's behavior and ability to learn is greatly influenced by the state and it's definition.
  - **Action-** After observing state  $s_1$ , the agent chooses an action  $a_1$ , it also has the effect of putting more weight on large errors.
  - **Reward-** After observing state  $s_1$ , and taking action  $a_1$ , the agent receives a scalar reward  $r_1$ , from the environment. The reward is the feedback for how 'good' the action  $a_1$ , was in state  $s_1$ . Many rewards have been proposed for reinforcement learning.
  - **Agent-** The agent here is the entity, through repeated interaction with the environment that implements and improves the policy.
- **Project Design-** The workflow for the project would go by this:
  - a) Extracting data
  - b) Data cleaning and pre-processing-
    - i. Removing unwanted features.
    - ii. Renaming and merging features as per the requirement.
    - iii. Indexing dataframe.
  - c) Visualizing data of different customers on hourly, monthly and yearly rewards.

- d) Defining necessary helper functions for Reinforcement Learning.
- e) Fitting and evaluating models.
- f) Predictions based on best model.

➤ **References-**

- 1) <https://medium.com/@jeffrisandy/investigating-starbucks-customers-segmentation-using-unsupervised-machine-learning-10b2ac0cfd3b>
- 2) <https://www.cognizantsoftvision.com/blog/starbucks-solving-greatest-challenges-today/>
- 3) [https://www.researchgate.net/publication/324735733\\_Evaluating\\_reinforcement\\_learning\\_state\\_representations\\_for\\_adaptive\\_traffic\\_signal\\_control](https://www.researchgate.net/publication/324735733_Evaluating_reinforcement_learning_state_representations_for_adaptive_traffic_signal_control)