Machine Learning and Coffee: *A Smart Way to Get to Know your Morning Brew*

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For centuries, coffee production has been a rudimentary task involving a huge consumption of energy along with a significant environmental impact. For instance, after selecting and milling, green coffee beans are then heated up in a gas-fired roaster for a given time, resulting in different flavors and characteristics for the consumer.

However, such roasting emissions are known to be a big issue for the environment, where toxins in the smoke such as allergens, volatile organic compounds and greenhouse gases are released into the atmosphere. Since coffee consumption per day is quite significant - according to a study by the International Coffee Organization, just in the United States there are consumed 400 millions cups of coffee per day - it has become rather important to develop new technologies to improve efficiency and sustainability in the large production chain of making a cup of coffee.

In 2013, The Roastaire, an innovation in roasting technology, has made a stand on decreasing levels of carbon footprints related to the number one morning brew: *coffee*.

According to this patented, The Roastaire is 20 times more energy efficient as well as 85 per cent emission free than a traditional roaster, without losing quality nor flavor of coffee. This outstanding invention is a clear example of improving the coffee production chain by means of innovation and technology. However, one might wonder if technology could also allows us to predict the quality of artisan coffee and, if so, how such prediction could help to improve and ensure a five-star cup of coffee.

Figure 1: *The demand for coffee is growing. Image taken from UnleashedSoftware*

By collecting large amounts of data associated with quality factors such as altitude, processing method, roasting profile and so on, data scientists and researchers are applying Machine Learning (ML) techniques to answer such questions.

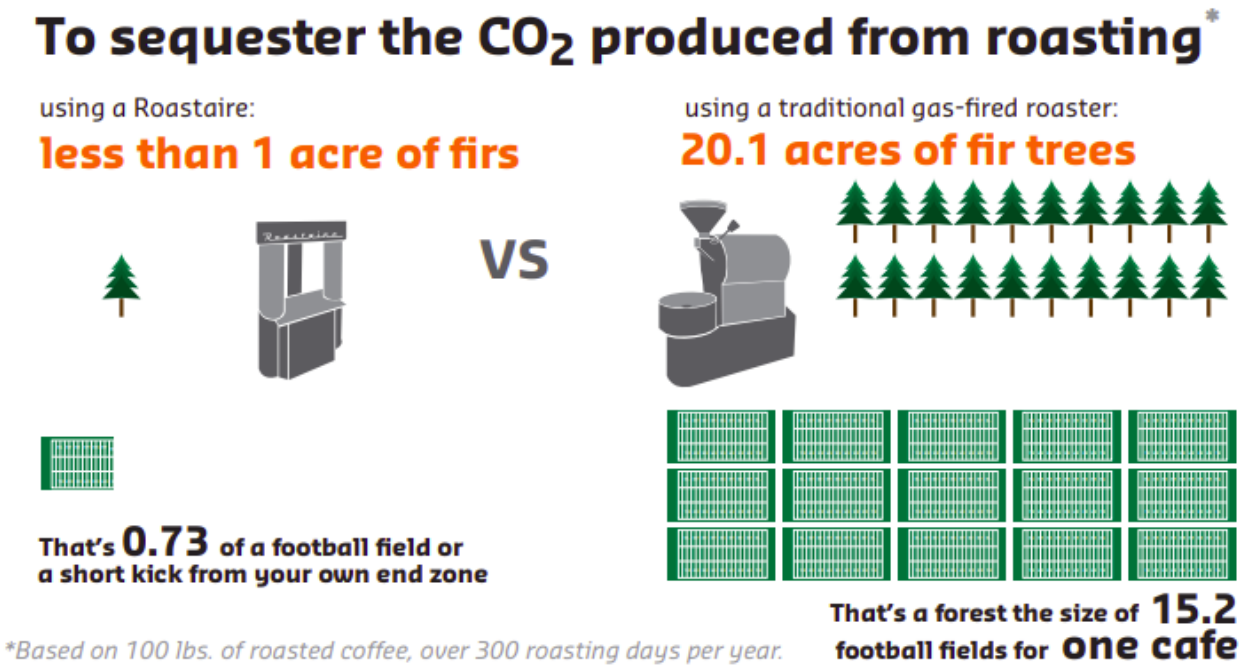

Figure 2: *Emissions CO_2 using The Roastaire and a traditional roaster. Image taken from The Roastaire*

In plain english, ML is a way to learn from data, in order to spot any pattern that allow to predict better outcomes. More specifically, ML is an application of Artificial Intelligence (AI) that applies a variety of algorithms to a given database, in order to iteratively describe, improve and spot patterns by means of statistical techniques. Bearing that in mind, from previous experiences with different type of coffees beans, roasting methods and many other features, ML techniques could extract for us how good it will taste our hot brew.

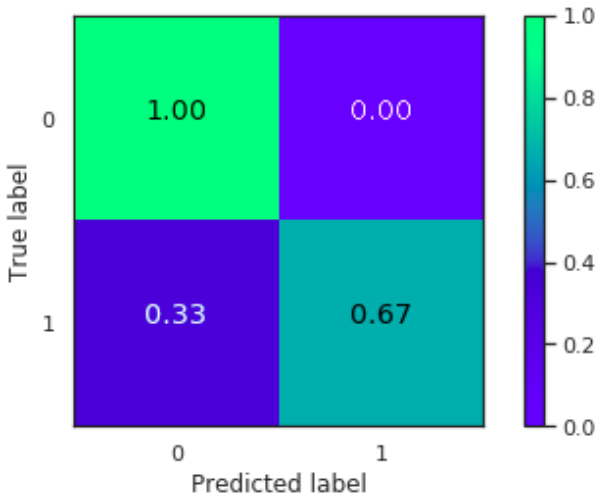

Figure 3: *Neural Network, confusion matrix results. Image taken from Researchgate*

Rooting for answers, two colombian researchers performed a recent study for coffee quality prediction from green and roasted coffee beans features, by applying different ML algorithms. The collection of data used for the study was obtained with the support of Almacafé, which is part of the National Federation of Coffee Growers of Colombia (FNC) and it was found that using the ML algorithm called Neural Network (NN), the quality of a cup of coffee can be predicted with an accuracy of 81 per cent as being of high or low quality from the green beans features.

Additionally, not merely ML can given us a hand with the quality prediction but also with the prediction of coffee grading and disease identification as a new research by PhD. Serawork Wallelign has shown. Thus, ML is helping us to improve our daily experience with coffee and it could provide an useful tool for enhancing the production chain.