

# Project Part 2

Group 6: Janette Rounds, David Rice, Mitch Vander Linden

September 29, 2015

## 1 Introduction

## 2 Bayesian Classifier Learning Algorithm

In the field of Machine Learning, there are many models based off of Bayes Theorem:

$$P(x|y) = \frac{P(y|x)P(x)}{P(y)}$$

where  $x$  and  $y$  are events, and  $P(x)$  is the probability of  $x$  [1]. In short, Bayes Theorem states that the probability of an event  $x$ , given that we know event  $y$  happened, is proportional to the probability of event  $y$  given event  $x$  times the probability of  $x$ . Bayes Theorem allows us to use prior information about a domain or a model in order to assess what can be thought of as a "degree of belief".

There are two Bayesian methods that we are concerned with in [2, Liu 2013], Bayesian Optimization and Naive Bayes Classification (NB). NB is a powerful Machine Learning method that allows us to assign a category (or a label) to an observation based on a training data set [1]. NB is a powerful model, but it also has some very strong assumptions, primarily that all attributes (variables that help us figure out which label to assign) are independent of one another. There are countless domains and problems where this assumption does not hold.

Our other Bayesian method of interest is Bayesian Optimization (BO). BO involves approximating functions, especially functions that are computationally expensive, where derivatives do not exist or are unknown, or where there are only a few observations available [3]. In [2, Liu 2013], the authors show that, through an algorithm that converts the BO model into a classifier, we can create a Bayesian Classifier without the strong independence assumption of Naive Bayes Classifiers.

## 3 Tree Counting Algorithm

[4, Santoro 2013]

## 4 Automated Scheduling Algorithm

[5, Casadesus 2012]

## References

- [1] D. Koller and N. Friedman, *Probabilistic graphical models: principles and techniques*, ch. 3, The Bayesian Network Representation, pp. 45–102. MIT press, 2009.
- [2] S. Liu, M. Zhu, and Y. Yang, "A bayesian classifier learning algorithm based on optimization model," *Mathematical Problems in Engineering*, vol. 2013, 2013.

- [3] E. Brochu, V. M. Cora, and N. De Freitas, “A tutorial on bayesian optimization of expensive cost functions, with application to active user modeling and hierarchical reinforcement learning,” *arXiv preprint arXiv:1012.2599*, 2010.
- [4] F. Santoro, E. Tarantino, B. Figorito, S. Gualano, and A. M. D’Onghia, “A tree counting algorithm for precision agriculture tasks,” *International Journal of Digital Earth*, vol. 6, no. 1, pp. 94–102, 2013.
- [5] J. Casadesús, M. Mata, J. Marsal, and J. Girona, “A general algorithm for automated scheduling of drip irrigation in tree crops,” *Computers and electronics in agriculture*, vol. 83, pp. 11–20, 2012.