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Conference Paper · November 2018

DOI: 10.5339/qproc.2019.imat3e2018.3

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Mathematical models of classification algorithm of Machine learning

Nabanita Dutta¹, Umashankar. Subramaniam^{2*}, Sanjeevikumar Padmanaban³

Abstract

Machine learning algorithm has brought the augmenting change in the field of artificial intelligence, which espoused human discerning power in a splendid manner. The algorithm has various categories among which classification is the most popular part. Support vector machine algorithm, logistic regression, naïve bays algorithm, decision tree, boosted tree, random forest and k nearest neighbor algorithm are all under classification of algorithms. Classification process needs some pre-defined method, which leads for choosing the train data from the sample data given by the user. Decision-making is the heart of any classification algorithm as supervised learning stands out on the decision of the users. Hence, a strong mathematical model based on conditional probability lies behind each algorithm. This paper is a study of those mathematical models and logic behind various classification algorithms, which help to create strong decision criteria for users to make the training dataset based on which machine can predict the proper output.

Keywords:

machine learning; algorithm; classification; mathematical mode; train data

Results and discussions

Mathematics behind the algorithms

Every classification algorithm is built up with strong mathematical models and logic. Though the decision tree is one of the classification algorithms every algorithm is bound to make one decision before starting of making the trained model [1][2]. The logic of the SVM is for finding out the optimal separating hyperplane that maximizes the margin of training data. There is a key challenge to find out the appropriate algorithm for each application in machine learning. The application depends on training time, prediction speed and accuracy, number of parameters, number of features, validation strategies, estimation of uncertainty condition, etc. Hence, in machine learning, the amount of math like probability, calculus, linear algebra, complex algorithm, etc. is used to justify the algorithm. The usage of algebra or linear algebra for Eigen value calculation, principal component analysis and probability is used for prediction and choice of the classes as this is a critical part in machine learning algorithm.

Markov chain model is a statistical and mathematical setup which has some hidden layers and can be represented as the simple Basyian network which is directly visible to the observer. This model has a remarkable contribution in the field of supervision, reinforcement of learning and for pattern recognition [3][4].

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[http://doi.org/10.5339/qproc.2019.
imat3e2018.3](http://doi.org/10.5339/qproc.2019.imat3e2018.3)

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Conclusion

This work presents the Markov chain model based on conditional probability which describes accurately the classification algorithms for prediction of faulty points in the system. The results present the importance of mathematical application in machine learning algorithm. In the heavy industry like oil and gas industry, petrochemical industry, household purposes and in agriculture, the pumping system is a very instigate part so the health of the pumping system is needed to be under proper vigilance. Machine learning algorithm has conveyed the bewildering elucidation where both incessant monitoring and ground level fault detection are conceivable.

References

- [1] Dutta, N., Umashankar, S., Shankar, A., Sanjeevikumar, P., Leonowicz, Z., Wheeler, P., "Centrifugal Pump Cavitation Detection Using Machine Learning Algorithm Technique" 18th International Conf. on Environmental and Electrical Engineering, IEEE-I&CPS/IEEE-EEEIC'18, Palermo, Italy.
- [2] Widodo, A., Yang, B. "Support vector machine in machine condition monitoring and fault diagnosis," Mechanical Systems and Signal Processing, vol. 21, pp. 2560–2574, 2007.
- [3] Alfayez, L., Mba, D., Dyson, D., "The application of acoustic emission for detecting incipient cavitation and the best efficiency point of a 60 kW centrifugal pump: Case study," NDT E Int., vol. 38, pp. 354–358, 2005
- [4] Guo, G., Wang, H., Bell, D., Bi, Y., Greer, K. "KNN Model-Based Approach in Classification", OTM Confederated International Conferences "On the Move to Meaningful Internet Systems, pp 986-996, 2003.

Acknowledgement

The committee of the International Meeting on Advanced Technologies in Energy and Electrical Engineering would like to thank Hamad Bin Khalifa University Press for publishing and hosting the accepted abstracts in QScience.com.