Predicting Family Implementation of Complementary and Alternative Medicine in Autism Online Communities

Zhenni Ni[a, b,1] , Yuxing Qian[a], Hao Li[c] and Zhizhen Yao[a]

[a] *School of Information management, Wuhan University, China*
[b] *LIMICS (UMR_S 1142), Sorbonne Université, France*
[c] *Sch Med & Hlth Management, Huazhong Univ Sci & Technol, China*

Abstract. Complementary and alternative medicine (CAM) is widely adopted by families with autistic children. This study aims to predict family caregivers' CAM implementation in Autism online communities. Dietary interventions were reported as a case study. We extracted behavioral (degree and betweenness), environmental (positive feedback and social persuasion), and personal features (language style) of family caregivers in online communities. The results of the experiment showed that random forests performed well in predicting families' tendency to implement CAM (AUC=0.887). It is promising to use machine learning to predict and intervene in the CAM implementation by family caregivers.

Keywords. Autism spectrum disorder, Machine learning, Adoption behavior

1. Introduction

The use of complementary and alternative medicine (CAM) for children with Autism spectrum disorder (ASD) is common around the world [1]. Families are particularly susceptible to poorly evaluated fads and exaggerated claims about the effectiveness of so-called alternative treatments in social media [2]. Previous studies have revealed the prevalence, reasons and risk of CAM use in children with ASD [3]. Utilizing social media data to predict the implementation of CAM by families can help take steps to monitor the spread of these treatments. In this study, we report a case study of dietary interventions. Machine learning models are applied to predict CAM implementation of families with autistic children in Online Communities.

Table 1. Features and measurements for the prediction of family CAM implementation

Dimensions	Features	Measures
Behavior	Social interaction	Degree centrality [a]
		Betweenness centrality [a]
Environmental factors	Positive feedback	Number of posts that provide positive feedback
	Social persuasion	Number of replies from opinion leaders [b]
Personal factors	Language style	Percentage of words in TextMind [c]

[a] A weighted directed network was constructed based on the user's online interaction behavior.
[b] We calculated the PageRank score for each user. The top 1% of users were identified as opinion leaders.
[c] TextMind is a text analysis tool that can be used to reveal different emotions, thinking styles, social concerns, and parts of speech.

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[1] Corresponding Author: Zhenni Ni, E-mail: Jennie_n@whu.edu.cn.

2. Method and Results

Our dataset covered 136,763 records (60,479 posts and 76,284 comments) in the biggest Chinese autism community from January 2017 to May 2019. A preliminary selection was performed with keywords related to dietary interventions (10,583 records were obtained). Following that, we randomly chose 3000 records and manually labeled whether they were related to dietary interventions. The remaining records were automatically classified with BERT. Users were identified as family caregivers if any of their posts contained phrases such as "my daughter". Finally, we got 3279 records related to dietary interventions posted by unique 982 family caregivers. Inspired by previous studies [4], we extracted some features from three dimensions: behavior, environmental factors, and personal factors to predict family implementation (Table 1). We manually reviewed the posts of each family caregiver. Family caregivers who self-reported implementation or provided feedback were marked as implemented; others were marked as not implemented. FeatureSelector package in Python selected meaningful features from 102 features in TextMind. We applied four machine learning algorithms (Table 2), including Support Vector Machine (SVM), Random Forest (RF), Extreme Gradient Boosting (XGBoost), and Light Gradient Boosting Machine (LightGBM). AUC and Loss are chosen as evaluation metrics because they indicate how well the model can distinguish between classes. Random Forest has the best performance.

Table 2. Performance of algorithms

SVM		RF		LightGBM		XGBoost	
AUC	Loss	AUC	Loss	AUC	Loss	AUC	Loss
0.827	6.193	**0.887**	4.287	0.870	6.193	0.868	6.193

3. Discussion and Conclusions

The findings reveal that machine learning can predict the CAM implementation of family caregivers based on their online characteristics. Our study makes it possible to provide targeted online decision support to families implementing CAM. This could help families make informed decisions about the health of their children. For example, online interventions could be developed to improve access to evidence-based practices, increase caregiver education about evidence-based practices, and reduce the use of CAM that may be ineffective or harmful. In the future, further research will be necessary to eliminate possible biases. The designed therapies need to be in consensus in the expert domain and then recommended to the caregivers online.

References

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