Chapter 4
Artificial Neural Network Research in Online Social Networks

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ABSTRACT

Artificial neural networks are a machine learning method ideal for solving classification and prediction problems using Big Data. Online social networks and virtual communities provide a plethora of data. Artificial neural networks have been used to determine the emotional meaning of virtual community posts, determine age and sex of users, classify types of messages, and make recommendations for additional content. This article reviews and examines the utilization of artificial neural networks in online social network and virtual community research. An artificial neural network to predict the maintenance of online social network "friends" is developed to demonstrate the applicability of artificial neural networks for virtual community research.

INTRODUCTION

The origins of computer-based (online) social networking go back to the 1970's when communities of users interested in a specific topic would gather on a Bulletin Board System (BBS) (Rafaeli, 1984), but these systems were limited by the ability to access computer systems at that time. Modern electronic social network sites began in 1997 and generated numerous specialized as well as general communities (boyd & Ellison, 2008). Social networking sites continued to gain in popularity and expanded rapidly in the early 21st century (Thelwall, 2009).

Online social networks have become the new norm for communication between individuals and also between individuals and organizations (Cheung et al., 2011; Culnan et al., 2010; Dijkmans et al., 2015; Loader et al., 2014). Gen Z and millennials prefer to perform research online and communicate through online social networks (Hampton & Keys, 2016; Riordan et al., 2018). Prior research has found that in

2011, 70% of teens used social media at least once per day and 25% of these did it at least 10 times daily (Ali & Senan, 2016). Not only do millennials prefer to perform research through online social networks, but they are more engaged as participants and more likely to respond to research survey requests when approached via Twitter (Guillory et al., 2016) or other online social networks.

It is estimated that over one third of the world's population will be social network users, with a projected 2.62 billion users, by the end of 2018, and a growth rate of 6.5-7.9% annually (Statista.com, 2018). Online social networking applications produce enormous quantities of data. Mayer-Schönberger and Cukier (2013) claim that Facebook, LinkedIn, Twitter, and other online social network applications have datafied our experiences as humans, including both personal and business information. As an example, Facebook generates over 3 billion pieces of data content every day (Chen & Zhang, 2014). These big data resources from online social networks provide a vast resource for performing research, which includes: academic, customer relationship management, marketing, medical, and political research, to name a few.

Machine learning provides a solution for performing research with big data (Landset et al., 2015; Wu et al., 2014), including data generated from online social networks. Artificial neural networks (ANNs) is a subfield of machine learning, sometimes referred to as soft computing methods that also includes genetic algorithms. ANNs are a popular solution method in numerous domains including: business (Tkáč & Verner, 2016; Wong et al., 2000), engineering (Ali et al., 2015; Bansal, 2006), and medicine (Reggia, 1993; Yardimci, 2009). Research and development with ANNs continues to be highly productive with the quantity of articles published in this subfield increasing annually (Walczak, 2017). ANNs are already being applied in online social network research.

Using the compound search query of the term "neural network" combined with one of the following social network terms: "facebook" or "twitter" or "snapchat" or "instagram" or "youtube", on a university article database to search for academic articles produced 134,000 hits. The actual number is somewhat smaller than this, since authors' Facebook or Twitter accounts (if published in the contact information for an article) would cause the search engine to accept that for the second part of the combined search terms. The term "social network" was excluded from the original query terms to eliminate the large number of false positives associated with the use of the research methodology social network analysis in combination with ANNs but not focused on an online social network or virtual community topic or problem. However, at a reviewer's recommendation, a search was also performed on Google Scholar for the phrases "artificial neural network" and "social network" both appearing in the title of an article, which produced 13 new articles, though only 7 of these actually had the term "social network" in the title and only 4 (31%) utilized both online social network data and ANNs in their research methodology.

The purpose of this article is three-fold. Familiarizing online social network and virtual community researchers with the capabilities of ANNs and how to develop ANNs for performing online social network research is the first goal. Next, will be a brief review of current research in online social networks that already utilizes ANNs, utilizing the search terms given previously. These first two goals may be interpreted as a review of previous research. The research question for the review analysis is: what are the types of research for which an ANN methodology has either been used with online social network data or to analyze online social networks and virtual communities. Finally, the efficacy of utilizing ANNs for performing online social network research is demonstrated by developing an ANN to predict the maintaining, unfollowing, or unfriending of friends on Facebook.

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