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Research implications of social network analysis on psychology from 2019 to 2021: a systematic review

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ABSTRACT

This paper aims to give a systematic review on how Social Network Analysis (SNA) Applied in the psychology field of study. Research questions are used to analyse the dataset of journal articles and conference papers collected from IEEE Xplore. 50 papers gathered after applying the advance search of "Social Network Analysis" AND "Psychology" OR "Behaviour prediction" OR "Emotion prediction" OR "Depression" OR "Self-harm" OR "Happiness" ranging from the year 2019 to 2021. Of the 50 journals and papers collected, one journal is the most cited, namely the journal Armstrong R, Hall BJ, Doyle J, and Waters E in 2011. "Cochrane Update. 'Scoping the scope' of a Cochrane Review". The Journal of Public Health. We found that the discussion and uses of SNA in psychology can be divided as to propose a model of early prediction, to propose a model on how to handle and process the data, also analysing psychological factors and problems using the SNA and social computing itself.

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Introduction

The notion of psychology as an important discussion in any academic or practical field is not a matter of debate anymore. It is even no less than before in a modern society nowadays when changes in how human see themself and its society are ever changing in a pace beyond what has been imagined. The growth of technology creates a world with no boundaries in any aspect of life - communication, education, business, and others. Psychology as a field of study is an embodiment of human mind and behaviour (LD, 2008). Often as a psychologist, they need to be able to understand thoughts and feelings - not only for individual, but also their groups (Hockenbury & Hockenbury, 2010).

Looking into how the behaviour of a human behaves themself as a social being, social network analysis can be used as a process of figuring out how the social structures shapes human behaviour as a group using networks and graph study (Otte, n.d.). As social network analysis dwells in the study of networks, meaning that it will look at how a structure of a network are built of individual matter that we can call nodes (Grandjean, 2016). These nodes could be ranging from individual being (human) or groups (society), including any other nodes that we could think of forming a network (Hagen et al., 2018). Finding out and analysing the relationship of each nodes need to be done to understand the social network itself to find insights based on the interaction of each node (Brennecke & Rank, 2017).

Bridging the two academic worlds together into a discussion is the job of social computing here - where the meeting point is visible on how computational system in an SNA (Social Network Analysis) crosses its path with the study of social behaviour that psychology have. Social computing itself can be defined as a system that will help the process of understanding and obtained insights from different information that can be gathered throughout social collectives anonymously - some of the examples are communities, particular culture, markets, even media and others (Computing, n.d.-b). Others said that recent studies embark its ways to refrain from the anonymous and focus on the pervasive distribution of social computing - in other words, social computing is the use of any computational device to provide and facilitate social interaction and also evaluate it in order to gain knowledge (Computing, n.d.-a).

In this paper we will take a look at recent studies and figuring out how SNA (Social Network Analysis) with a perspective in social computing is implemented in the field of Psychology studies. Flowchart on the arrangement of the paper can be seen on Figure 1.

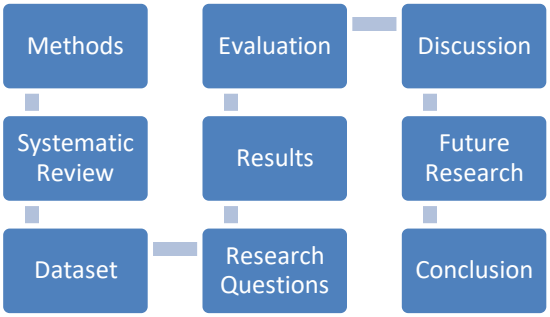

Figure 1. Flowchart on the arrangement of the paper.

This paper already opened with a brief introduction and will be continued with the methods of the research followed by the results after that. In the methods we will explain how we gather the data and how to analyse it. The results will be divided by multiple parts depending on the psychology factors that we found in each of the data. Conclusion to summarize the findings of this paper will be presented last

Method

Systematic Review

Along in this paper we are going to do a systematic review on the literatures that we collected as the dataset. In a systematic review we will synthesize different findings on the paper with a formulated research question to get the insights needed (Armstrong et al., 2011). It is also a method to provide an extensive summary of the evidence which is relevant because of the research question (Ader HJ, Mellenbergh GJ, 2008).

Dataset

The dataset are journal articles and conference paper taken from Institute of Electrical and Electronics Engineers and Institution of Engineering and Technology (IEEE) Xplore Digital Library. It is a database to discover research paper related to electrical engineering, electronics, computer science, and similar fields (Wilde, 2016)

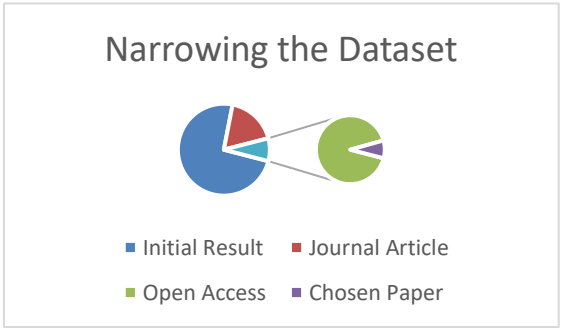

Figure 2. Dataset gathered.

Seen in Figure 2, the dataset is gathered using the advance search feature with the keywords of "Social Network Analysis" AND "Psychology" OR "Behaviour prediction" OR "Emotion prediction" OR "Depression" OR "Self-harm" OR "Happiness" ranging from the year 2019 to 2021. 5,535 results were found with the

mentioned keywords, we narrow the numbers to 1,340 by selecting journals article and conference paper only. Further narrowing the number, we only choose papers with characteristics of open access only - which narrows the number down to 550. From there we randomly picked 50 literature pieces as the sample of the database and also the object of our research.

Research Question

From there on we build our research questions as the means on getting the information from the dataset. Understanding that research questions is the set of questions that will be answered and will give us the necessary answers is important (Mattick et al., 2018). That is why we built 6 different questions with social network analysis, psychology, and social computing in mind. The research questions that need to be answered are as follows: what is the objective of the paper, what are the findings that need to be taken into consideration, what kinds of algorithms and approaches are employed in the paper, and as well as how the benefits or qualities of the data set are mentioned in the article, and how the psychological elements are addressed in the paper., and how the aims of the research are achieved via the use of algorithms and procedures.

Result and Discussion

After analysing the papers with the research questions, we are classifying the dataset into three main discussions which can be seen on Figure 3 below. 16 papers were found having a main discussion of developing a model to create an early recognition system based on psychology factors. Another 14 papers discussed on how to analyse the data itself. The rest of the paper mainly discussed on analysing psychological aspects.

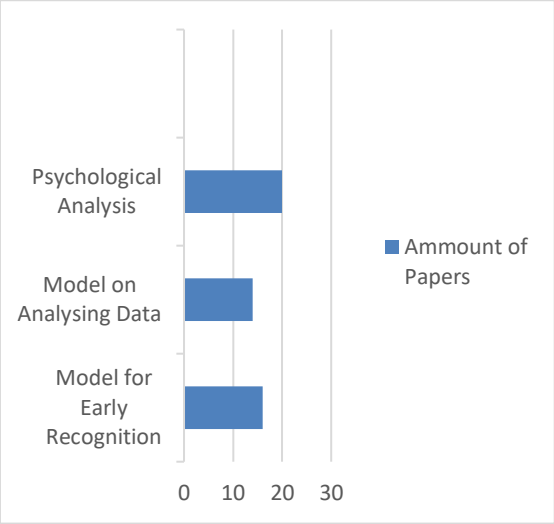

Figure 3. Classification of the dataset based on the discussion.

Proposing Model for Early Recognition

One of the main uses of SNA and social computing on psychology can be found in 14 papers that we analyse. It is to develop a model to create a system of early detection on some psychological factors, such as a Teen Trust Model (TTM) which is used to evaluate stranger's trustworthiness depending on teen's psychological and social needs (Samreen, A., Ahmad, A., Zeshan, F., Ahmad, F., Ahmed, S., & Khan, n.d.). The findings on this paper shown that 81.77% of teens who does the testing were overall satisfied by the proposed model. Another paper that develops a model on prediction can be found creating a system to measure the issues on ethics when engaging with social media (Al-Rahmi et al., 2018). Another one was to build lexicon for Weibo-based emotion with sentiment analysis (Xu et al., 2020). Furthermore, there is a paper that the objective of the research was to be able to create a learning framework to predict adolescents (Wadekar, 2020). The finding of these paper also ranging from the completion of the system to create an early detection from pre-processes method specifically in South Korea (Baek & Chung, 2020). Details on the purposes of the papers falls in this discussion category can be seen in the Table 1.

Table 1. Purposes of the papers in Model Proposing discussion category.

Evaluating the trustworthiness of a stranger.	[13]
Measuring ethics issues related to engagement with social media.	[14]
Building a Weibo-based emotion lexicon for sentiment analysis.	[15]
Constructing an ensemble learning framework to predict adolescent at risk for substance use disorder (SUD).	[16]
Creating deep learning framework to model customer interaction.	[17]
Improving prediction analysis by better data extracting.	[18]
Proposing DNN Model to predict depression with multiple-regression.	[19]
Level of stress detection using social media posts.	[20]
System of recognising depression by domain-invariant subspace.	[21]
Predicting mental disorders with the uses of networking sites.	[22]
Early recognition system for depression to prevent self-harm.	[23]
Predicting depression symptoms in in Arabic forum.	[24]
Recognition of retweet behaviour in social media during public emergencies.	[25]
Self-reported personality classification prediction.	[26]
Predicting political orientation during Italian political debate.	[27]
Stress detection on social media.	[28]

The algorithm and techniques used to be able to achieve the goal above also varied in each paper. FullConnected Long Short-term Networks (FC-LSTM), nonlinear sequence, and cumulative effect was used in modelling customers behaviour (Ling et al., 2019). Classification is also widely used, one of the examples was to deduce the correlation from multiple social aspects (Maryame et al., 2019). Convolutional Neural Networks (CNN) and Recurrent Neural Network (RNN) were used to create a detection system on the stress level of a students (Mounika et al., 2019). A latDADR, a system created from a model to be able to discover invariant subspace through the domain and recognising depression was also found (Tao & Xu, 2019). As for the algorithms and techniques that is mostly used in the papers falls on this category can be seen in Table 2.

Table 2. Algorithms and techniques used in Early Recognition category.

FullConnected Long Short-term Networks (FC-LSTM)	[18]
PLS algorithm with SmartPLS	[13], [14]
Convolutional Neural Network (CNN)	[20], [21], [16], [17]
Recurrent Neural Network (RNN)	[22], [23]
Classification using SVM	[19], [15]

Multiple factors on psychology field were found all of the paper. Mental disorder was discussed a lot in one of the papers that create a system of detection of it (Lavhare & Kulkarni, 2021). Other than mental disorder, depression was also found in the detection of depression using deep leaning and social media dataset (Rao et al., 2020)]. Natural language processing (NLP) algorithm was also found in one specific paper trying to create a system of predicting depression symptoms in Arabic forum (Alghamdi et al., 2020). Human behaviour on handling critical moments such as disaster and also their behaviour in handling rumour, especially by retweeting it can be found in some of the papers ((Tian et al., 2020), (Wang et al., 2021)). Another stress detection and social behaviour on election moment also become a discussion on the papers ((Cardaioli et al., 2020),(Jadhav et al., 2019)

Proposing Model on Analysing Data.

Other insights shown from this research was that various paper also discussed about the importance of handling and processing data better. These papers have the aims on creating a model to handle and process data better, and some of it to specific extensions. The purpose of this paper is to propose a concept of psychological pressure index and how to calculate it (Zhang et al., 2020). Found in a different paper is another analysing mechanism to calculate motivation of a personal using mathematical model (Matsumoto & Ishii, 2020). Approaches to how to construct an analysis of psychological factor is discussed in the context of social network (Ishukova et al., 2019). Another one is to help any depression recognition system by proposing a model of text mining from Twitter (Ma & Wang, 2019). One of the papers is also proposing a new model on identifying text using suicidal tendencies words (Shvetsova & Antropova, 2020). Table 3 below will be explaining the purposes of the papers in this Category.

Multiple techniques are also used in these papers, different algorithms can also be found. Deep Neural Network (DNN) and Natural Language Processing (NLP) can be seen in some papers ((Mourad et al., 2020), (Uddin et al., 2019)). A task-related common spatial pattern (TCSP) was also proposed in one of the papers to enhance an EEG-based classification (Jiang et al., 2021). Expectation-Maximization algorithm is used to identify emotional expression on the social media platform, Facebook (Giuntini et al., 2019). Slashdot,

Epinions, and Wiki-RfA used to demonstrate the effectiveness of prediction problem (Li et al., 2019). Details on the most used algorithm and techniques in the dataset can be seen in the Tabel 3.

Table 3. Purposes of the papers in model on data analysis discussion category.

Proposing a model on how to make a pressure index on public psychological factors.	[29]
To find a mechanism to analyse personal motivation with a mathematical model.	[30]
Proposing an approach to construct psychological analysis.	[31]
Figuring a way on how to extract depression symptoms from Twitter post to be able to process into a recognition system.	[32]
Proposing a model on identifying suicidal tendencies factors in a text.	[33]
Examining large-scale data from Twitter.	[34]
Introducing Gated RNN to analyse depression related posts.	[35]
Proposing a model on how to improve EEG-based classification to be used on spatial information.	[36]
Proposing a model to analyse data for emotional expression identification.	[37]
Integrating sign prediction and behaviour prediction.	[38]
To model and examine temporal behaviour by user interaction in social networks	[39]
Modelling a repeated rumour in social media	[40]
Proposing a model on how to analyse dataset related to COVID-19	[41]
Introducing a way of automating multi-label classification.	[42]

Table 4. Algorithms and techniques used in the Data Analysing discussion.

SVM for Classification Method	[29], [30], [31, [32]
Neural Network (CNN & RNN)	[35], [38], [39]
Natural Language Processing	[33], [40]
Expectation Maximization	[36], [37]
Multinomial Naïve Bayes	[34], [41], [42]

Psychological factors discussed in these papers can also be shows here. Human behaviour on depression while doing interaction on social networks (Giuntini, de Moraes, et al., 2021). The spreading of a rumour in social media (Han et al., 2021). Assessing human needs and behaviour during COVID-19 Pandemic in New York State was also discussed in one of the papers (Long et al., 2020). Studying psychological behaviour of a group in classifying their text similarity was also done in this paper (Oliseenko & Tulupyeva, 2021).

Analysing Psychological Factors.

Most of the paper were found purely discussing psychological factors using SNA and factors of social computing. Some of the purposes of the papers found will be discussed here. Analysis and the classification of how the younger generation behave communicatively in social media (Kotenko et al., 2020). In-depth analysis of psychology factors in human pursuing the most profitable performance in businesses (Bie, 2020). Pinduoduo users, a social network platform on China to stimulate the needs of the users (Alotaibi, 2019). Studying the effects of beliefs and attitude towards the norm, grabbing the attention on psychological factors on how Malaysian students behave with cyberbullying can be found on some papers ((Shaikh et al., 2021), (Jain et al., 2020)). Even understanding the gait of a person that is affected by their psychological aspects can be found on one of the paper (Fang et al., 2019). Identifying continuity of a personality in social media and exploring the dissonance ((Tareaf et al., 2020), (Bai et al., 2019)).

Some of the algorithm and techniques found in these papers are Aspect Based Opinion, AuctionRules algorithm, and classifier with Word2Vec can be found in multiple papers ((Alsheikh et al., 2019), (Alashri & Alalola, 2020)). Lexicon-based machine learning (ML) techniques can be found while exploring factors of breastfeeding can influence people (Oyebode et al., 2021). Several stimulus metrics, Greedy algorithm, and maximization methods can be found on multiple papers as well ((Sousa et al., 2019),(Albota, 2020), (Fu et al., 2021))

Psychological aspect on these papers which analysing the psychological factors itself are widely found. Emotional intelligence and suicidal ideation causes can be seen hand to hand together ((Wei et al., 2019),(Liu et al., 2020)). Another suicidal tendency and creating depression roadmap from its factors are talking with the psychological sides of the research ((Gupta & Kaushik, 2019), (Giuntini, De Moraes, et al., 2021)). Understanding the predictability, dependability, and faith of human behaviour in trusting people online in Twitter (Narayan & Das, 2019). Another one focuses on the application of drug abuse in reddit's posts (Ghosh et al., 2020).

Table 5. Purposes of the papers in Psychological Analysis discussion category.

Analysing young people's behaviour of communication in the social network.	[43]
Having an in-depth analysis of user behaviour using psychological factor shown in the social network.	[44]
Examining the results of attitudes in cyber bullying.	[45]
Trying to understand the effect of personal psychological being on cyberbullying behaviour.	[46]
To build an approach to find a solution for impaired mental health problems.	[47]
To understand how psychological factors affect postural gait.	[48]
Investigating personality continuity and stability.	[49]
Understanding cognitive dissonance on social media	[50]
to understand the effect of predictive model in real-case consumer behaviour	[51]
Analysing political campaign done online.	[52]
Understanding factors that are influencing breastfeeding behaviour in public.	[53]
Studying the effect on application of predictive model in user behaviour with LastFM social network.	[54]
Analysing psychological and linguistic features in Reddit's posts.	[55]
Measuring the impact of influencers on individual.	[56]
To grasp a sense of user's emotional intelligence in social network	[57]
Summarizing the result of research on suicidal ideation causes.	[58]
Analysing and providing a general view on prognostics of suicide attempts.	[59]
Tracing the emotional roadmap of a depressive user on social media	[60]
Lebel of trust analyse based on Twitted psychological faucets.	[61]
Find a solution to help substance abuse and addiction using Reddit posts.	[62]

Evaluation and Discussion on Future Research

The widely use of SNA with social computing in tackling psychology field can be seen with this research paper. An open discussion on whether or not the application of SNA in psychology is proper enough or not. Judging from the findings of the result from the systematic literature review process we came to a decision that SNA is properly used and can be the factors of decision making and solution maker of psychology fields problems.

This also address the plan of future research that can be done following up this research. Another systematic review of SNA on another fields is always welcomed. Also utilising another analytical device such as proposed in some of the papers discussed here to tackle psychology fields are also encouraged.

in (Armstrong et al., 2011) research Systematic reviews use a transparent and systematic process to define research questions, search for studies, assess their quality and synthesize findings qualitatively or quantitatively. An important step in the systematic review process is to thoroughly define the scope of the research question. This requires an understanding of the existing literature, including gaps and uncertainties, clarification of definitions related to the research question and an understanding of the way in which these are conceptualized in the existing literature. Such reviews can be published as research results in their own right and are interesting because they produce a broad map of evidence, if transparent enough and widely available through publication, can be used by many people and for applications beyond the intended purpose by the authors. . Scoping reviews can inform systematic reviews, particularly reviews with a very broad range of topics, such as those edited by the Cochrane Public Health Group.

Conclusion

When social computing meets psychology resulting in multiple findings and insights. In this paper we aim to do a systematic review on the application of Social Network Analysis (SNA) on psychology as an academic and practice field. From the gathered data from IEEE Xplore, we picked 50 different journal articles and conference paper. Research questions are proposed to be answered by these papers. We found that the discussion and uses of SNA in psychology can be divided as to propose a model of early prediction, to propose a model on how to handle and process the data, also analysing psychological factors and problems using the SNA and social computing itself.

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