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REVIEW ARTICLE

Detection of Suicide Ideations in Social Media Posts: A Review using Deep Learning

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ABSTRACT

Suicide is one of the rising concerns in this techno savvy world. Around 8,00,000 people succumb to suicide every year according to the reports of the WHO (World Health Organization, 2018). In such a scenario, Machine learning and Artificial Intelligence has far-reaching effects. In this paper, we shall review the role of deep learning in detection of Suicide ideations. Deep learning has its own advantages over traditional statistical analysis methods which lack accuracy. The main objective is to review automatic recognition of suicidal posts as many at-risk individuals use social media forums to discuss their problems or get required information for their dilemmas from various sources. With early exposure of information received on Social media, the hidden symptoms of suicidal ideations can be found out to save lives. We will review the LSTM-CNN combination model of deep learning which is a tool for detecting suicide ideations. This is an emerging genre of research in recent times which is challenging as it is more subjective in nature. There are various risk factors involved and deep learning helps prevent these risk to some extent.

Keywords: Deep learning, LSTM, CNN, Suicide detection, social media.

INTRODUCTION

In recent times, mental illness has moved from being just a two-word phrase to a growing concern of today's society. With the younger generation getting more prone to depression, isolation, anxiety disorders and so on, it is indeed essential to address these issues with an undeviating urgency. Suicide, is the second leading cause of death among adults and adolescents like. Nearly 800,000 people die by suicide each year[1]. The death rate is anticipated to rise to

one every 20 seconds by 2020. Nearly 79 percent of suicides take place in countries with low and intermediate incomes, where it is frequently difficult to find and manage resources insufficient and rare[1]. Suicide ideation is considered as a tendency to terminate ones' life spanning from depression, through a plan to commit suicide, to a strong obsession with self-destruction. People who are in risk can be distinguished from those who plan or attempt to commit suicide and those who succeed in doing so. Suicide ideators (or planners) and suicide attempters (or completers) can be identified as at-risk people.

Social media, which is primarily used by young people, has developed into a potent "window" into the mental health and wellbeing of its users in recent years. It provides anonymous participation in various online communities to create a forum for open discourse on socially taboo subjects. In general, more than 20% of people who attempt suicide and 50% of people who successfully commit suicide leave suicide notes[2]. Therefore, any written indication of suicidality is considered to be concerning, and the writer should be questioned about their own thoughts. Social media text, including blog posts, forum messages, tweets, and other online notes, is typically recorded. It can reduce any incorrect text interpretations created by a retrospective analysis when compared to an offline text. A new topic of study in computational linguistics is social media and its forums dedicated to mental health. It offers a useful research environment for the creation of cutting-edge technical innovations that could revolutionise suicide risk reduction and suicide detection. It can provide as a useful entry point for intervention. Reddit Suicide Watch users who follow news about celebrity suicides.

Deep learning techniques have already significantly advanced the fields of computer vision and pattern recognition in comparison to conventional text categorization techniques. On several Natural language processing (NLP) applications, neural networks based on dense vector representations can outperform classic machine learning algorithms, which rely largely on labour-intensive and frequently insufficient handcrafted features[3].Word embedding's and [4]deep neural networks' rising popularity. The study's main goal is to use powerful deep learning architectures and data analysis to share knowledge about suicide thoughts in Reddit social media forums. The primary goal of our review is to examine the potential of Long Short-Term Memory (LSTM), Convolutional Neural Network (CNN), and their combined model when applied to various categorization tasks for those struggling with suicidal ideation. We attempt to determine whether combining CNN and LSTM classifiers into a single model may enhance the performance of language modelling and text categorization. We will attempt to show that, for themes connected to suicide, the LSTM-CNN model can surpass both the performance of its component CNN and LSTM classifiers as well as more conventional machine learning systems[5]. It might be possible to incorporate it in data from any online forums and blogs.

LITERATURE REVIEW

Numerous attempts have been made in recent years to draw attention to the influence that social media may have on suicidal ideation. Facebook Social Media for Depression Detection in the Thai Community is one such trial (Katchapakirin et al., 2018). In order to psychologically evaluate and develop a depression identification algorithm in Thai using Natural Language Processing Techniques, this article offers a tool to identify depression on Facebook. Using a user's Facebook activity, including their interactions with others, the number of posts they make, the day and time they publish, and their privacy settings, depressive symptoms were identified. Facebook users who were above 18 and willing to share their microblogs for depression were chosen for the study from the internet. The Thai Mental Health Questionnaire (TMHQ) separated 35 of the chosen users into two categories, with 22 being classed as depressive and 13 as not depressed. 1105 posts were gathered, and the properties were retrieved. Numerous Machine Learning (ML) methods were used, including Support Vector Machine (SVM) (Zhang, 2012), Deep Learning (DL) procedures, Random Forest (RF) (Donges, 2019), and Deep Learning (RF) algorithms. The dimension of the collected data was too tiny for the SVM algorithm, making it impossible to partition the training set and test set as in traditional validation without suffering a considerable modelling loss. Utilizing eight-cross validation, the model prediction performance was assessed. The SVM model's accuracy was marginally higher than that. Table 1. Comparison of related work

METHODOLOGY

Researchers evaluated the data by using secondary data obtained by a database 'An ensemble deep learning technique for detecting suicidal ideation from posts in social media platforms' on mentioned topic to detect suicidal posts on various social media platforms like facebook, YouTube and so on. The collected data was analysed by using evaluating metrics(accuracy -percentage)

Models used

Proposed Design

In other studies Researchers used a mix of the LSTM and CNN (Saha, 2018) model, the attention model, and Reddit to find suicidal messages. The output vector from the LSTM is used as an input value for the Attention layer in the suggested model, while the output of the Attention layer is used as an input for the Convolutional layer. The proposed LSTM-Attention-CNN coupled model divides input posts into four groups that represent varying degrees of suicidal or non-suicidal tendencies, as shown in Figure given below.

The first layer of the model is a word embedding layer, as depicted in the picture, where each token or word in each sentence is mapped to a distinct index, generating a real-valued vector of a specific length. A dropout layer is used to avoid over-fitting. Convolutional layer aids in feature extraction while the LSTM layer helps identify long-distance dependencies over the textual input.[8] The attention model emphasises crucial information and gives each word a weight. The feature map is down sampled by the pooling layer, which lists all the features that are present in a certain area. The information gathered by the pooling layer will be transformed into a column vector by the flatten layer. In the output layer's final step, the input

Data: Using the Reddit dataset, where users submit their thoughts and opinions, we train our classification model. Through the comment threads that are linked to each user's submission or post, they communicate. For this research, we used the Philip Resnik-created University of Maryland Reddit Suicidality Dataset, which includes both non-suicidal and suicidal submissions (Zirikly et al., 2019).[9] By substituting a unique ID for the user's personal information, their privacy is maintained. The dataset was taken from the 2015 Full Reddit Submission Corpus and used postings from the SuicideWatch (SW) subreddit to identify (anonymous) people who may have suicidal tendencies. Four categories were used to classify these Reddit articles.[2]

No risk: No possibility that the user has suicidal tendency. Eg: ZOINKS! I just realized how much I'm starting to look like shaggy (scooby doo) help with a new haircut?[6]

Low risk: Some factors might be present here depicting that this user might have suicidal tendency, but chances are very low[3][4]: I have had a bad childhood. I wish no child to experience is this

Moderate Risk: There are chances that the user has a tendency to attempt suicide.[8]Eg: Im so sorry this is happening to you. Everytime i hear something like this i wish i could be of help. But im incapable. I don't want to help anyone. I just want to die peacefully...fast.[10]

Severe risk: There is high chance that the user will attempt to suicide.[7]Eg: Looks like.. even alcohol won't help my pain now.. that sucks... I will even worse when am drunk... and am afraid that i will say something bad to my friends about me... I guess its time to give up.

CONCLUSION

In this paper, three Deep Learning based models, particularly RNN, LSTM, and C-LSTM are employed for the task of

suicidal ideation detection in tweets. For this purpose, a lexicon of terms was first generated by scraping and manually annotating anonymized data from known suicide Web forums[3]A dataset of tweets was collected using the Twitter REST API by using search queries corresponding to the generated lexicon[6]Human annotators labeled tweets with suicidal intent present or absent, which were then used to train both three machine learning-based baseline models as well as the three proposed deep learning models. A quantitative comparison between the various models revealed the effectiveness of a C-LSTM based model in suicidal ideation detection in tweets[9]This was attributed to the ability of CNNs [11]to spatially encode the tweets into a one dimensional structure to be fed into LSTMs along with the ability of LSTMs to capture long-term dependencies. In the future, this work can be extended by investigating other deep learning based architectures for the tasks of suicidal ideation detection on Twitter as well as other Web forums and Social media.[4] Also, nature-inspired heuristics can be explored for efficient feature selection as done by Sawhney *et al.* (2018b,c).

REFERENCES

1. W. H. O. WHO, "Suicide in the world: Global Health Estimates," *World Heal. Organ.*, p. 32, 2019, [Online]. Available: https://apps.who.int/iris/bitstream/handle/10665/326948/WHO-MSD-MER-19.3-eng.pdf?ua=1.
2. J. Gao, Q. Cheng, and P. L. H. Yu, *Detecting comments showing risk for suicide in YouTube*, vol. 880. Springer International Publishing, 2019.
3. G. Coppersmith, R. Leary, P. Crutchley, and A. Fine, "Natural Language Processing of Social Media as Screening for Suicide Risk," *Biomed. Inform. Insights*, vol. 10, p. 117822261879286, 2018, doi: 10.1177/1178222618792860.
4. Y. Luan and S. Lin, "Research on Text Classification Based on CNN and LSTM," *Proc. 2019 IEEE Int. Conf. Artif. Intell. Comput. Appl. ICAICA 2019*, pp. 352–355, 2019, doi: 10.1109/ICAICA.2019.8873454.
5. A. Roy, K. Nikolitch, R. McGinn, S. Jinah, W. Klement, and Z. A. Kaminsky, "A machine learning approach predicts future risk to suicidal ideation from social media data," *npj Digit. Med.*, vol. 3, no. 1, pp. 1–12, 2020, doi: 10.1038/s41746-020-0287-6.
6. K. Katchapakirin, K. Wongpatikaseree, P. Yomaboot, and Y. Kaewpitakkun, "Facebook Social Media for Depression Detection in the Thai Community," *Proceeding 2018 15th Int. Jt. Conf. Comput. Sci. Softw. Eng. JCSSE 2018*, 2018, doi: 10.1109/JCSSE.2018.8457362.
7. A. E. Aladag, S. Muderrisoglu, N. B. Akbas, O. Zahmacioglu, and H. O. Bingol, "Detecting suicidal ideation on forums: Proof-of-concept study," *J. Med. Internet Res.*, vol. 20, no. 6, 2018, doi: 10.2196/jmir.9840.
8. M. M. Tadesse, H. Lin, B. Xu, and L. Yang, "Detection of suicide ideation in social media forums using deep learning," *Algorithms*, vol. 13, no. 1, pp. 1–19, 2020, doi: 10.3390/a13010007.
9. J. Wang, L. C. Yu, K. R. Lai, and X. Zhang, "Tree-Structured Regional CNN-LSTM Model for Dimensional Sentiment Analysis," *IEEE/ACM Trans. Audio Speech Lang. Process.*, vol. 28, pp. 581–591, 2020, doi: 10.1109/TASLP.2019.2959251.
10. F. Huang, X. Li, C. Yuan, S. Zhang, J. Zhang, and S. Qiao, "Attention-Emotion-Enhanced Convolutional LSTM for Sentiment Analysis," *IEEE Trans. Neural Networks Learn. Syst.*, pp. 1–14, 2021, doi: 10.1109/TNNLS.2021.3056664.
11. J. Du, L. Gui, Y. He, R. Xu, and X. Wang, "Convolution-based neural attention with applications to sentiment classification," *IEEE Access*, vol. 7, pp. 27983–27992, 2019, doi: 10.1109/ACCESS.2019.2900335.

Table 1. Comparison of related works.

Paper	Model	Evaluating Metrics
Facebook Social Media for Depression Detection in the Thai community (2018) (Katchapakirin et al., 2018)[6]	RapidMiner with Deep Learning algorithm	Accuracy – 85%
Detecting Comments Showing Risk for Suicide in YouTube (2018) (Gao et al., 2018)[2]	Cross Entropy Loss with SVM – no seed filter	Geometric Mean – 78.3%

Paper	Model	Evaluating Metrics
	Cross Entropy Loss with LSTM-no seed filter	Geometric Mean – 84.3%
	Focal loss with LSTM-no seed filter	Geometric Mean – 81.8%
Detecting Suicidal Ideation on Forums and Blogs: Proof-of-Concept Study (2018) [7]Aladağ *et al.*, 2018)	RF	Accuracy – 89%
	ZeroR	Accuracy – 50%
	SVM	Accuracy – 92%
	Logistic Regression	Accuracy – 92%
Natural Language Processing of Social Media as Screening for Suicide Risk (2018)[3] (Coppersmith *et al.*, 2018)	Bidirectional LSTM with Self Attention	AUC – 89%
Exploring and Learning Suicidal Ideation Connotations on Social Media with Deep Learning (2018)[4] (Sawhney *et al.*, 2018)	RNN	Accuracy – 73.7%
	LSTM	Accuracy – 78.7%
	C-LSTM	Accuracy – 81.2%

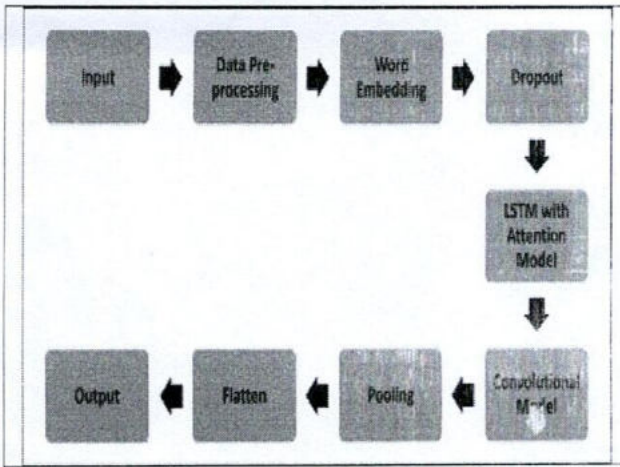

Fig. 1. Architecture for Suicidal Ideation Detection

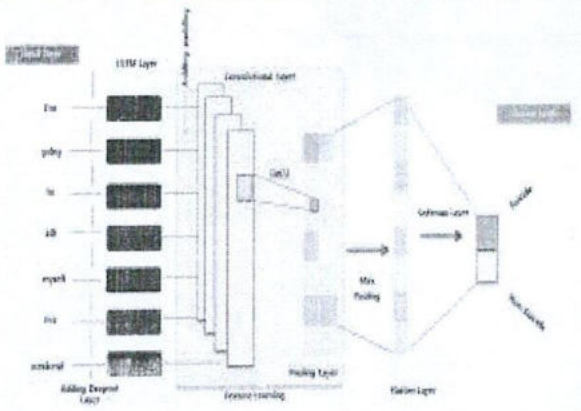

Fig. 2. LSTM-Attention - CNN Model for Suicidal Ideation Detection.