



DEPRESSIKA: An Early Risk of Depression Detection through Opinions

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Abstract

Deep learning is a very dynamic area in Sentiment Classification. Text analytics is the process of understanding text and making actionable decisions and acting on it. be it Amazon Alexa, Siri, Cortana everything is made up of Natural Language Processing. Text to speech and Speech to text are generating so many data sets every day. The internet has the largest repository of data, it is hard to define what to exactly do with it. sentiment are the opinions or the way of feelings of the public usually in the sequential form, in which many people face difficulty in living their daily life. Some are even ending their life just they are depressed. The approach here is to help the people suffering from depression with appropriate methodology to use in this work. Depressika: Early Risk of Depression Detection with opinions is a web application which detects the early risk of depression from the social media posts created by the users with appropriate Recurrent Neural Networks [RNN]. This is a classification problem of the Machine Learning [ML]. Depressika builds on Waterfall Methodology of application development using the Keras, Tensor Flow, Scikit-Learn and Matplotlib to carryout and process sequential data and the overall process of development is carried out by Python programming Language.



Article History

Received: 27 January 2020
Accepted: 13 March 2020

Keywords

Depression detection;
Deep Learning [DL];
Machine Learning [ML];
Recurrent Neural
Networks [RNN];
Sequential;
Sentiment Classification.

Introduction


Depressika: An Early risk of Depression Detection through Opinions is based on identifying early risks through sentiments of social media such as twitter posted by the users. Approaching this problem demands powerful techniques such as learning a

powerful subset of machine learning algorithms identified as the neural networks. Depressika requires a sentiment classifier that categories or classifies early risks of depression with the non-risk of depression and the percentage visualizer that clarifies the state of mind. Social media and

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Doi: 10.13005/ojcs13.01.03

upon analyzing it, if high-risk features are identified, then the web application supports mapping those patients towards medical homes and doctors' profile with the data applying the principles of neural networks and understanding the maturity of text processing and analytics capabilities in sentiment classification. Neural networks mature the handling of sequential data in the aspect of early risk of depression for health care providers in automating of time-consuming tasks. Text analytics is one of the most beautiful branches of data science and artificial intelligence which is contributing to the world by making people's lives better and easier. Today most powerful algorithm supports automation of tasks with increased accuracy and optimization and among the top contributors, neural networks drive ground-breaking techniques to leverage the power of big data in the medical and health care domain.

Background of the Work

The work starts its roots in understanding depression and its types which is prevailing in this world. Peoples are defying reality and consciously living in the unreal, imaginary, hallucinatory state of mind and lost hope and faith that leads to the identification of depression and ends with taking their imaginary life not to be true. This problem leads to suicide and is faced by one-third of the population in the world. Another state of the awareness might be true but from the analysis of the human mind this state of mind keeps on fluctuating, but these roots progress rapidly which in the case is the lack of reality of the external world which is frequently termed as depression in a medical encyclopedia.

Machines have been an integral part of life in today's world, especially computers. The Association of Computing Machinery [ACM] definition of computing is any goal-oriented activity, which requires, benefits from computers or creating computers (Machinery, 2005). This definition is the accepted direction of machines and their computations. Machine Learning [ML] is a technique to analyze data that automates the building of the Analytical models (SAS, 2019). ML is born from the pattern recognition and with the idea that computers can learn from data, can identify patterns and make informed decisions by the theory stating, computers can learn anything without being explicitly being programmed to perform specific tasks such as Early risk of depression detection

with improved performance over time. There are mainly two approaches in machine learning such as Supervised Learning [SL] and Unsupervised Learning [UL], but recently Semi-Supervised Learning [SSL] and Reinforcement learning have emerged but for the scope of *Depressika*, we limit our exploration till supervised learning for predicting depression from the opinions of social media. Out of many ML approaches, Deep Learning [DL] is one of the techniques to achieve human-level accuracy in building and running models (SAS, 2019). DL sets up demanding parameters of the data and trains the machine to think like a human-brain and learn as directed with the type of learning by identifying patterns using many layers of processing known as the hidden layers. In this work, we apply deep learning algorithms for predicting the mental health state of the users because this technique is necessary for mission-critical sensitivity like the health care domain. Recurrent Neural Network [RNN] is an algorithm of deep learning, a subset of Machine Learning which is fully capable of identifying and detecting any kind of disease from a sequential data such as texts and speech. It is on the ground of an input layer, a hidden layer, and an output layer. The input layer when passed the input, many hidden layer processes then the output is received. Each hidden layer has its own weights and biases with their activations, which enables neurons to behave independently, and the main objective is to understand the correlations of the input (Dishashree gupta, 2017).

Problem Context

Understanding human life itself is a mystery. It is the main evidence due to its unlimited potential to grow and progress. The mind has infinite potential and capabilities to process unlimited information that needs to be stress-free, but we are suffering from not knowing its potential and despite knowing this we are not able to process it. (Anxiety and Depression Association of America, 2019).

(America, 2019) The mind constantly endeavors for finding the reality and truth but most of the time we live in an illusion and lack of reality that dwindles our thought processes. We get caught up in some aspects of our memory basically on sad memories losing hope and faith that could come up as a

dangerous disability. This disability is causing major issues in healthcare. Peoples are even ending their lives due to mental disabilities and depression is on the top of the list (booker, Cory, Jon Greenberg, 2019 March 21st).

Today one-third of the population is suffering from one or some kinds of mental difficulty. To be exact 322 million till date are suffering from depression (ADAA, 2018). Depression is an inability to understand things as it is. It is a sense of feeling of worthlessness, inability to contact with the human and social interactions (Ritchie, 2018). From the famous celebrities, politicians to the scientist, namely Abram Lincoln after his son died went into depression, J.K Rolling before writing Harry Potter Manuscript went into depression, Angelina Jolie caught up with depression but came out after social and community services, similarly Charles Darwin got depression but managed to get out of it. Shah Rukh Khan got depression when he suffered from the tragedy in 2010, Sir Isaac Newton also got depressed but came out of it and became successful in their journey (Safal Stories, 2018 February 26). They have gone through depression once in their lifetime. It is a self-consuming behavior where a patient is always in a low mood, frustrations, and lack of enjoyment in life. The feelings of the gut have fallen and suffering and battling with self on the mind and not understanding the world as it really is. This is frequently identified when a person suffers from loss of sleep, inability to eat, study and enjoy life for more than two weeks (Health, 2016). This is a Major Depressive Episode in Medial Encyclopedia.

Rationale

An early risk of depression detection by opinions 'Depressika' will become an insightful web application that can automate the process and assist doctors in detecting their patient's mental health with opinions provided from their patients. This application will be able to reduce the hectic wait to visit doctors and reduce time in dull tasks like filling up forms and people can contact and get valuable insights in the form of suggestions from doctors online enabling on the face to face chat with the doctors. The marketing peoples can use this system to provide the recommendations to their health products and provide value to patients in helping with their treatment process if classified with depression.

Potential Benefits

Tangible Benefits

- This application is to automate the task of Doctors in diagnosing their patients so that they can avoid hectic queues.
- Enables the recommendation and suggestions from the doctors for time-saving treatments from where they are.
- 'Depressika' web application will be able to show the levels of depression in the percentage so that it becomes easy for doctors to recommend the strategies for treatments.
- Contribute Technology on automating psychological areas.

Intangible Benefits

- To master Deep Learning and Natural language processing concepts and techniques
- To gain practical skills in building a model and web applications
- To further progress in higher studies professionally.
- Contributing to the process of computational psychiatry.
- Easy interaction with the patients and better-quality healthcare provided.
- Gain trust from patients and recommend products and suggestions.
- Increase in technological awareness among health care providers.

Target Users

The survey form is distributed to various categories of the users such as General Public including students, The Doctors, and Mental Health professionals and Information Technology Professionals to gain insights for future improvements as well as obtaining new reflections and know the best value use case of the system. The primary users would be the Doctors and Mental health professionals who can use for automating their productivity. The Secondary users are the General Public including students who can gather facts about their current mental state and the third category includes the Information technology professionals who can refer to this system as for learning and optimizing purposes. The data will be analyzed, and improvements will be made based on their feedback and opinions. The Questionnaire is to prepare among 50 persons who are interested in Computational Psychiatry.

Aim & Objectives

The paper aim to provide the Web Application of early risk of depression detection based on Machine Learning Application with high accuracy. The objectives of this work are

- To study and Analyse various types of depression with the collection and analysis of various opinions from social networks.
- To study on various types of Machine Learning Algorithms and to extract distinguished features of depression using Machine Learning.
- To develop a depression classifier model using the Machine Learning Algorithms.
- Design a web application to detect depression based on features extracted and integrate it into a web application with Depression classifier model.

Literature Review

Study and Analysis of Depression and its Types

Depression is widely common and critically serious mental illness that negatively affects how a person feels, the way that person thinks of, and the way of actions performed by that person. A person faces variety of functions at work or at home. For instance, it can be one person whom he thinks about every time or some work relatable which he commits doing it, but due to some negative influence, he blames himself for those regrets and fills his heart with guilt and misery. He tries to seek the help of surrounding peoples in his environment about the negativity he has published in his own life the world around and those moments become the part of his daily living. He cannot accept the reality and seeks more unacceptance to the situations with which he attracts more unpleasant and ultimately with those bad and unhealthy living standards and accepts that he has lost all the abilities to think far ahead leading to failures to everything. He hears the society criticizing him and he adopts to the illicit way of life, losing interest in regular tasks and all the hopes, hobbies blaming everyone, complaining the state of his existence which he cannot come out. He wins or loses the battle against his own survival and state of being, though he does not admit being depressed. When a family member acknowledges his state of stress, frustrations he is living with, it has become too late because he attempts to quit

the faith and ends his life with those memories. This story is of a man who has been very dear to my family (name not disclosed). There are 12 most common types of depression (Ranna Parekh, M.D., M.P.H., 2017 January).

Sentiments

The Merriam Webster Defines sentiments as an attitude, thought or judgement promoted by feelings, a specific view or notion or a refined feeling, sensibility especially as expressed in a work of an art or an emotional idealism, a romantic or nostalgic feeling verges, an idea colored by emotion and the emotional significance of a passage or expression as distinguished from its verbal context (Merriam Webster, 2019). The Oxford English Dictionary defines sentiments as a view or opinions that is held or expressed, a general feeling or opinions, a feelings or emotions, expression of view or desire specially as formulated, exaggerated and self-indulgent feelings of tenderness, sadness or nostalgia (English Oxford Living Dictionaries, 2019). Similarly, Cambridge English Dictionary defines sentiment as a feeling about a situation, or a way of thinking about something. It is a noun, meaning that it is related to the existential identity of someone with the verge of interest in a way of life and how things are done. There are various opinions about the sentiment itself and let us stick to the basics of sentiments which is to know what it is, how is it said and what do these means.

Deep Learning as Feature Learning

Adding scalability with the ability to perform automatic feature extraction from raw data (Jason Brownie, 2017 july 19) is another cited benefit of deep learning model called as feature learning. The notable scientist Yoshua Bengio started out with the strong interest in the automatic feature learning (Jason Brownie, 2017 july 19) that large neural networks can achieve. Yoshua elaborated perspective of deep learning methods to aim at learning features from higher levels of the hierarchy formed by the composition of lower level features where automatically learning features (Jason Brownie, 2017 july 19) at multiple levels of abstraction allow a system to learn complex functions which maps input to the output directly from the data, without depending on hand crafted features

(bengio, 2009). Yoshua describes deep learning as the algorithmic ability to explore unknown structures in input for discovering good representations with higher level learned features defined in terms of low-level features (Bengio, 2012).

Deep Learning as Artificial Neural Networks

Geoffrey Hinton is a pioneer (The Royal Society, 2019) in the field of artificial neural networks and co-published the first paper on the backpropagation (Jason Brownie, 2017 July 19) algorithm for training multilayer perceptron networks. He describes deep as the development of large artificial neural network. He describes an approach to training deep as in a many layered networks of restricted Boltzmann machines ((Salakhutdinov, 2009 April 15) (Hinton, 2006)) where we derive a fast, greedy algorithm that can learn deep, directed belief networks one layer at a time, provided the top two layers from an undirected associative memory. An undirected deep network was well received by the community because they were successful examples of greedy layer-wise training of networks allowing many more layers in feed-forward networks. The “deep” describes their approach to initializing weights which allows deep auto encoder networks to learn low-dimensional codes that work much better than principal components analysis as a tool to reduce the dimensionality of data. He commented that deep belief networks were the start of deep learning in 2006 and that the first successful application of this new wave of deep learning was to speech recognition in 2009 (Abdel-rahman Mohamed, 2006) achieving the state of the art results. (Brownie, 2019-May-7)

Time Stamp

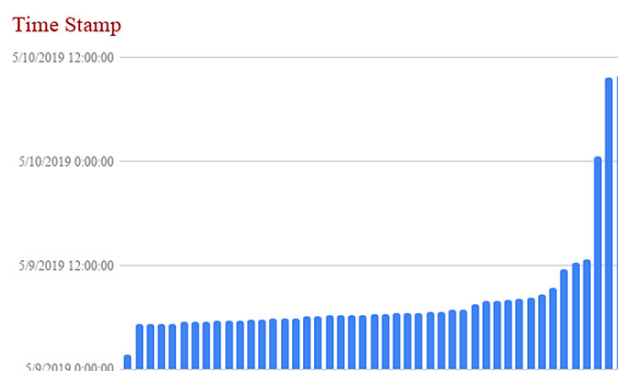


Fig. 1: Time Stamp Data Visualization

Deep Learning as Scalable Learning Across Domains

(Brownie, 2019-May-7) Yann LeCun is a father of the network architectures that excels at object recognition in image data called the convolutional neural network (CNN). This technique scales with data and model size and can be trained with back propagation (Jason Brownie, 2017 July 19). His definition of deep learning as the development of very large CNNs, which have great success on object recognition of photographs. He defines deep learning as a pipeline of modules all of which are trainable, deep because it has multiple stages in the process of recognizing an object and all of those stages are part of the training (Accelerating Understanding: Deep Learning, Intelligent Applications, and GPUs, 2016, Jan 21). (Brownie, 2019-May-7) Jurgen Schmidhuber is the father of another popular algorithm called the Long Short-Term Memory Network (LSTM), a type of recurrent neural network that very much like CNNs and MLPs, scales with model size and dataset size and can be trained with backpropagation but is instead tailored to learning sequence data. Schmidhuber interestingly describes depth in terms of complexity (Brownie, 2019-May-7) of the problem rather than the model used to solve the problem (Schmidhuber, 2014, October 8).

Analysis of Data

Generic Data Analysis

In generic data analysis, the general information for the population is sampled and find which background of peoples are mostly interested in computational psychiatry and that the profile for the Depressika is well defined.

Finding

This time stamp is new information that generated while survey. The time stamp shows the active hours of peoples in social media and the time people make out of their busy schedule in order to check

on the current trends in their feed. This signifies that social media data are indeed useful for finding peoples state of mind and peoples are contributing to generate data more during the peak hours of usages mostly after 5 PM in the evening.

Gender Data Visualization

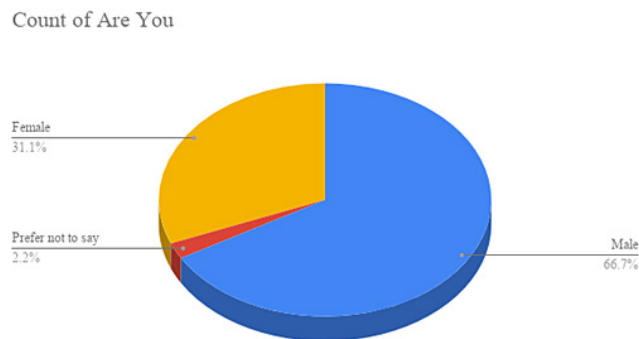


Fig. 2: Gender Data Visualization

Finding

The survey showed mostly male are interested in knowing analytics and technology while some people

prefer not to share their gender at all. From reviewing the past data for Women in Technology, women are showing trends of familiarity with the technology.

Nationality of People in Survey

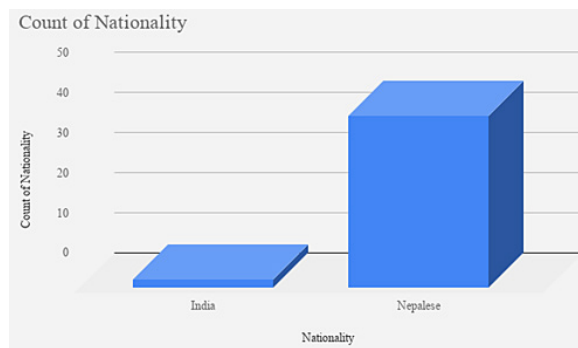


Fig. 3: Nationality Data Visualization

Finding

The responses mostly came from inside the country This information is vital because the Depressika is going to create value for Nepalese community and it is primarily targeted to be developed for Nepalese psychiatrists and mental health professionals currently researching and practicing in Nepal.

the components, their relationships with each other and the environment with the principles governing the design and evolution. In the systems architecting lifecycle, the need is expressed into a concept development. The needs are analyzed and transformed into requirements gathering. The next step involves designing the conceptual frameworks, models and views with pushing the development phase. After the development is done, the model or system is tested and maintained for production. In software engineering, this set of steps is known

System Architecture

Architecture is the fundamental organization (mitre, 2010 Feb 23) or a blueprint of a system assembling

as waterfall methodology. The best practices in architecting the system is based on ensuring, evaluating and constructing the solutions through the system development methodology lifecycle.

Abstract Architecture

Depressika, is a machine learning application which is aimed to predict risk of depression of the users by giving it text to learn from. The text entered into the system is processed by the classifier model that classifies the sentences into depressive and non-depressive ones. Each sentence is broken into words and words are vectorized for the machines to learn from. The clutters from texts are cleaned by the classifier model then trained using the recurrent neural network model. The validation specifies the system to predict the text is depressive or non-depressive, which informs users into the risk of depression. The system displays the confidence of its prediction and builds the pie chart showing the positive and negative opinions the user shares. The system shows the hospital and doctor recommendations if the depression levels are too high and the user can select the depression information page to learn more about depression. Each user records are stored in the database so the user can simply login into the system. Depressika is the Deep learning recurrent network model which is trained and tested to correctly classify depression from the textual data.

System Design

System Design is the systematic process of designing the components, architecture and modules, various interfaces of components and data that goes through the system. System Analysis is the process of defining how the components interact to achieve the requirements of the user. The main purpose of the system design process is to provide data and information about the system and its components to assess implementation that is consistent with architectural models and views of system architecture. Architecture is the conceptual model which defines structures, behaviors and views of a system. Modules are components which handles tasks in a system. Components are the functions which makes up the module (Odhiambo Didacus, 2018-September-24). Data is the flow of information which assembled makes up the complete system.

SSADM

Structured Systems Analysis and design Method (SSADM) is a systems approach to the analysis and design of information systems, produced for UK government office focused with the use of technology in government in the 1980's being a discipline within the software development industry that seeks to provide a framework for activity of capturing, storing, transforming and disseminating information as to enable economic development of computer systems that fit as per requirements (Select Business Solutions, 2018). SSADM is a waterfall method which an Information System design representing a pinnacle of rigorous document led approach to design contrasting with Rapid Application development. It is a type of implementation that builds of the works of development methods and stages such as Feasibility stage, Requirements stage, Requirements Specification stage, technical systems specification stage, Logical system specification stage and physical design stage. The techniques that are used in SSADM are Logical Data Modeling, Data Flow Modeling, Entity Behavior Modeling (Select Business Solutions, 2018)

Context Diagram- DFD Level 0

The context diagram is used to establish the scope of the system inside, outside and the relationship with the external entities are modelled. It identifies the flows of information between the system and external entities of the system (MIT, 2011 january).

Data Flow Diagram Level 1

DFD Level 1 provides a more detailed breakout of pieces of the context level diagram highlighting the main functions carried out by the system on breaking down the high-level process of the context diagram (Lucid Chart, 2018).

DFD Level 2

DFD Level 2 goes deeper into parts of Level 1 requiring more texts to reach the necessary level of detail about the systems functioning. These details enable developers and designers to use to write the pseudocode which supports the development of the actual code (Lucid Chart, 2018)

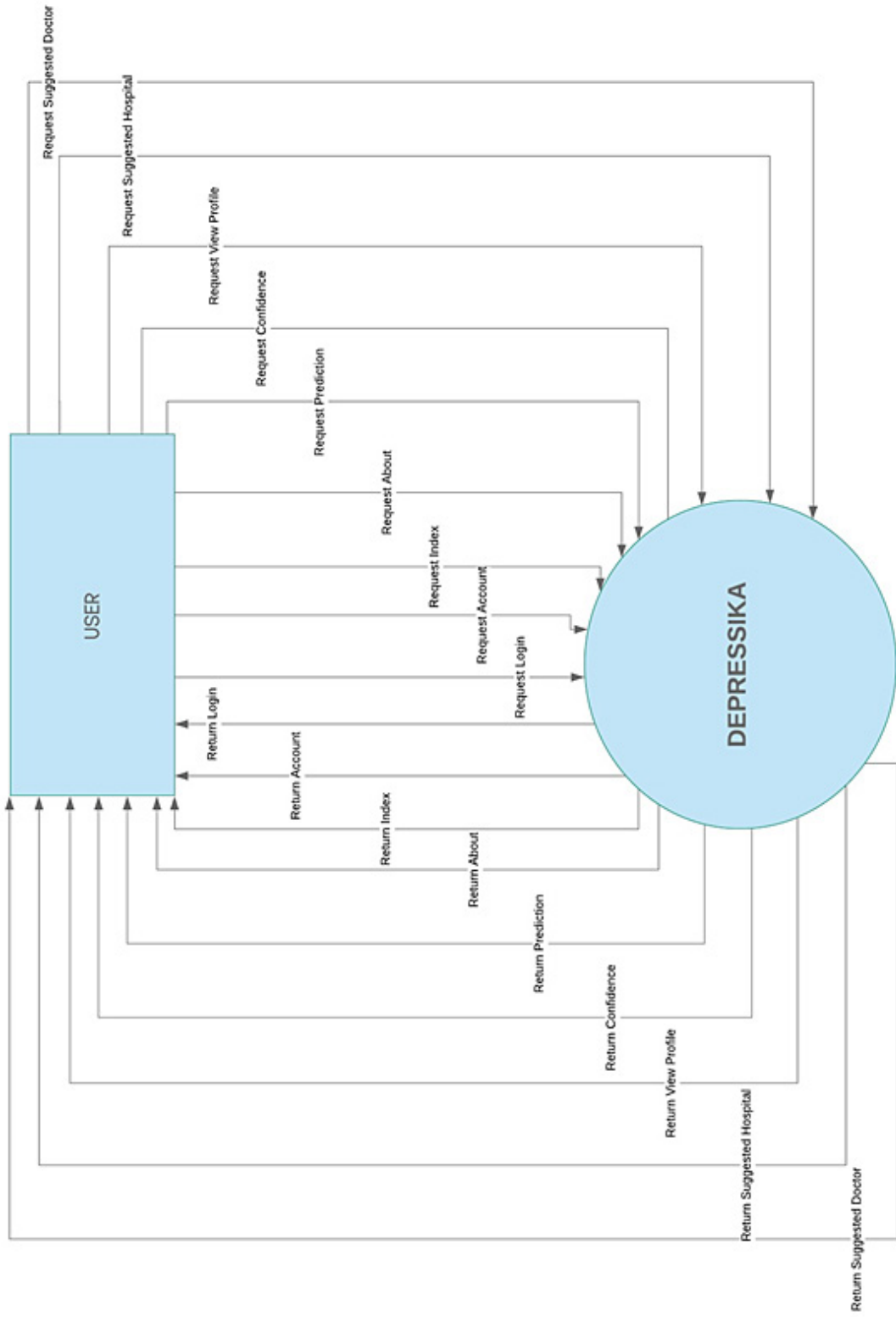


Fig. 4: Context Diagram (DFD Level -0) of Depressika

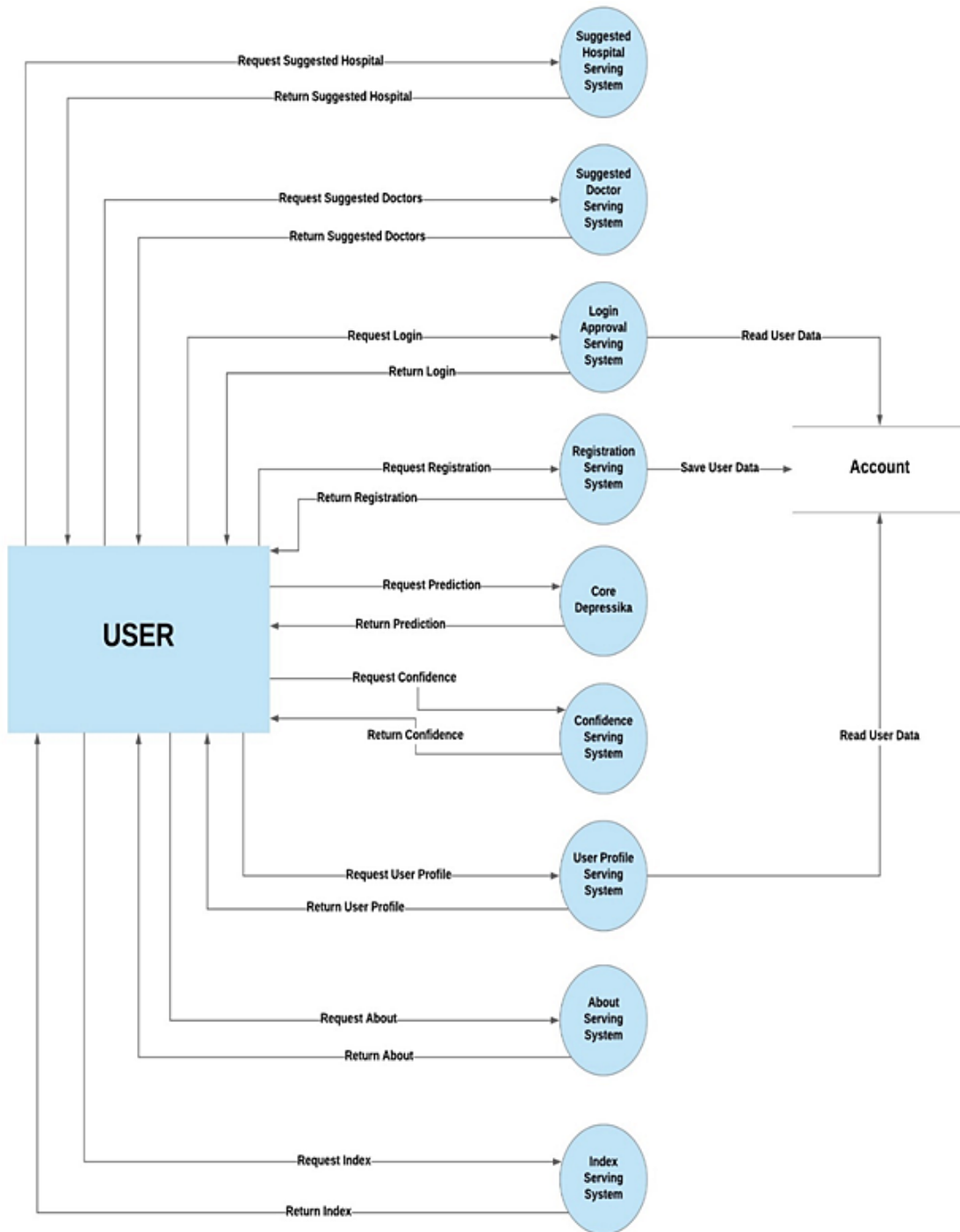


Fig. 5: DFD Level -1 for Depressika

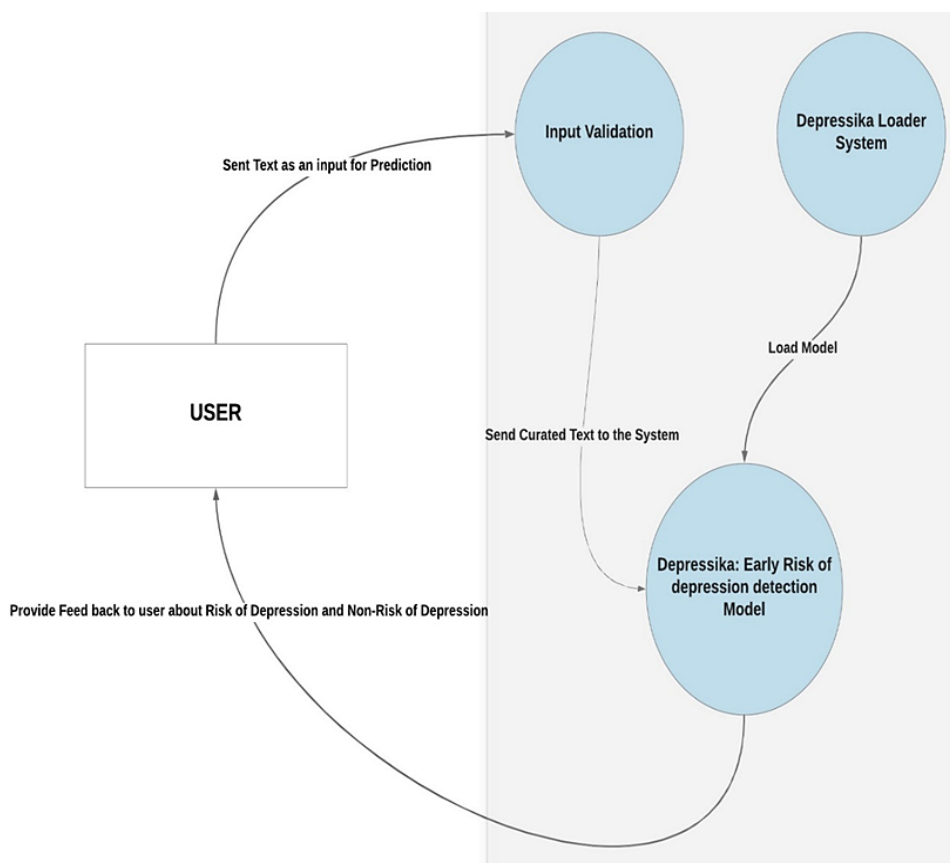


Fig. 6: DFD Level-2 for Depressika

Database Design

Database design is the collection of processes that provides simplicity to design, develop, implement and maintain the data management and systems. This produces database systems to meet requirements of users with enhanced high performance. Database are designed to produce logical and physical models that proposes the database design. Database design goes through requirement analysis phase which involves planning

and system definition leading to database designing phase involving logical and physical models to implementation phase involving data conversion and loading and testing. The techniques involved in designing database are normalization and ER modelling (Guru 99, 2018). In Depressika, only registration uses database to store, retrieve and present information to the users so account table is created to store username, email and password of the registered user.

Database Table Structure

Table 5: Data Dictionary of Depressika in Account Database

Attribute Name	Data Type and Size	Primary Key	Foreign Key	Unique	Example
fullname	Varchar (50)	Yes	No	No	abhusan chataut
email	Varchar (100)	No	No	No	abuchataut@gmail.com
password	Varchar (50)	No	No	No	abhusan123

Database Used

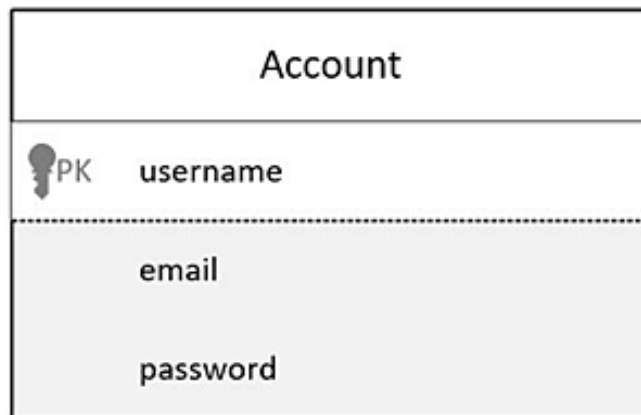


Fig. 7: Database used in saving user data from registration

Implementation

Fig. 8: Home.html

Screenshots for Home Page (Home.html)

Description

This is the Home Page of the Depressika web application where the information of the system is provided so that users have the options to be more aware of Depressika application, depression, Doctors working for prevention of depression and suggested hospitals for treating depression. The user

can log-in or register into the system to find their level of depression and take necessary actions. From the home page, the users are directed to log-in into the system and enter the opinions to identify depression. This system is for the prevention of mental health disorders before they become prevalent and take necessary actions to stop them before happening.

Sample Code Written for app.py for Importing Necessary Packages

```

app.py — Deepressika- Early Risk of Depression Detection through Opinions\abhushan x
1  from __future__ import division, print_function
2  from __future__ import print_function
3  from flask import Flask,render_template,url_for,request, flash, redirect
4
5
6
7  from flask import Flask, request, jsonify
8  from flask_restful import Resource, Api
9  import pickle
10 import numpy as np
11 import sys, os
12 import keras
13 import tensorflow as tf
14 from keras.preprocessing.sequence import pad_sequences
15 import re
16
17
18 path_model = 'depressika.h5'
19 path_config = 'config.pkl'
20
21 model = None
22 config = None
23 graph = None

```

Fig. 9: Sample Code for importing app.py

Sample Code for Routing app.py

```

74 #imprt Pyodbc for database connection to SQL Server
75 import pyodbc
76 conn = pyodbc.connect(
77     "Driver={SQL Server};"
78     "Server=ABHUSHAN-PC\SQLEXPRESS;"
79     "Database=Depressika;"
80     "Trusted_Connection=yes;"
81 )
82
83 @app.route('/index')
84 def index():
85     return render_template('index.html')
86
87 @app.route('/about')
88 def about():
89     return render_template('about.html')
90
91 @app.route('/doctor')
92 def doctor():
93     return render_template('doctor.html')
94
95 @app.route('/hospital')
96 def hospital():
97     return render_template('hospital.html')
98
99
100 def is_email_address_valid(email):
101     # Email Validation using regex
102     if not re.match("[a-zA-Z0-9.!#$%&'*/=?^_`{|}~-]+@[a-zA-Z0-9-]+(?:\.[a-zA-Z0-9-]+)*$", email):
103         return False
104     return True
105 def is_username_valid(name):
106     # Name Validation using regex
107     if not re.match("[a-zA-Z]*$", name):
108         return False
109     return True
110
111
112
113
114 @app.route('/login_register', methods=['GET', 'POST'])

```

Fig. 10: Sample Code for Routing in app.py

Critical Evaluation

The implemented application of natural language processing in detecting depression from texts allows users to respond to the health threats and minimize it by preventing it. The classification of opinions into depressive and non-depressive helps users to understand their mental health better and learn the most effective prevention mechanism by gaining more information and building knowledge from it. Nepal has seen uptrends in the depressive symptoms among students due to the pressure and stress which leads to serious hazards. Peoples are more likely to suffer from depression especially in the urban areas due to lack of proper interaction among fellow human beings. Depressika allows to check depression levels from texts like they enter towards the social media such as Facebook or Twitter. This system can calculate the percentage of Depression and can form insights toward what to do next if the user is in risk of Depression. The hospital suggestion options allow to search nearby hospitals for ease of getting treated and suggested doctors allows to know the doctors before they book and appointment. The about depression options provides information on depression and depressive episodes so they can learn better and prevent depression better.

Reflection

The insights creating process drove me to this extent of understanding wisdom and provided me with satisfying me deeply with the science I wanted to develop and learn with solving the related problem that is surrounding me and my known ones. I became able to variate between alternatives and not getting shucked on a single set of thoughts or beliefs that doesn't even matter. For Depressika, there were mostly psychological problems which I wanted to identify myself and learn from it and try to prevent others from getting it. with the beautiful algorithm of recurring neurons, which is able to control the state of being and develop deep appreciation over my life and the ones surrounding me. I saw technology as a solution to the depressive behaviors and constant mood swings. As an Early Risk detection of depression detection through opinions, the opinions are the things which I always struggle with, always worry about the social isolations and always seeking for something that I need. The thing I got from this research and information technology made my life

turning to the other direction. Now I see hope and it instills me deeper and these improvements to the extent of progress and learning with love towards my fellow beings. The greatest relief that is a true essence of joy and satisfaction and now with all these sentiments, there must be some use of it.

Conclusion

The ability to perform a research work on developing Early Risk of Depression detection through opinions using a Recurrent Neural Network has been completed. The foundation concept on the process of performing a research-oriented software development has been collected. I have a deep appraisal and gratitude for those pioneers who have devoted their entire life on discovering and inventing this science. In this research, the works created by those scientists has been understood and discussed to build on and reach the investigation goals step by step. In any research the first phase is a data collection about the problem or goal that is to be established. In Early Risk of Depression detection system, the very first step has been collecting the problems and similar systems that help understand about the dataset to collect and the tools and techniques to use after the collection of desired datasets. Following by the way those pioneers used those tools and techniques to real-world dataset to challenge, attack and solve those related problems. This research helped me to understand the intricacies and the way of doing the work of the Technology and product-oriented Software development.

Future Enhancement

With all the demands being fulfilled, there are further improvements and enhancements to the research. The first things to be enhanced on is an approach can go with the automation approach in development and the foundational concepts to go for advancements. The approach in developing portfolio and learning machine learning and using deep neural networks and deploying it on various types of problems. For Depressika, all of the objective has been fulfilled and advancing on these concepts would be the future enhancement of this research and I would love to explore in areas of practical analytical learning and growing on it till I master it. The system can be upgraded into booking an appointment with doctors

and hospitals from the classified results. Searching hospitals and Doctors in map to find their information to reach out to them and having one on one query to them using call or chat button. In advanced model development, speech and image processing functions can enhance ability of the system to perform better and optimize it completely to better suit it for production purposes. The research growth into other areas of natural language processing such as speech and sound generation using generative recurrent unit algorithms to be explored and research in domains other than health is to be explored and make use of data that is generated.

Acknowledgement

The authors acknowledge Lord Buddha Education Foundation (Asia Pacific University of Technology & Innovation) for providing us the opportunity to work in this research.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The authors do not have any conflict of interest.

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