WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Analyzing People's Emotions from the Feedback using Artificial Intelligence

Dr.D.Anitha*, Ms.S.Arunadevi, Ms.G.Gangalakshmi, Ms.N.K.Gavya, Ms.S.Ranjini

Department of Information Technology,Muthayammal Engineering College(Autonomous),Rasipuram,Namakkal-637408,Tamilnadu,India
Address of Corresponding Author: Dr.D.Anitha,M.E.,Ph.D.,Associate Professor, Department of Information Technology,Muthayammal Engineering College(Autonomous),Rasipuram,Namakkal-637408,Tamilnadu,India*

ABSTRACT

Over the past decade, smart city applications have gained significant attention in industrial informatics. However, little attention has been given to perceiving the emotions and perceptions of citizens who have a direct impact on smart city initiatives. In existing system, they make use of publicly available, abundant social media conversations that contain contextual information encompassing citizens; emotions and perceptions which could be considered to provide the means to feel the emotional pulse of a city. They evaluated the applicability of the framework using 29,928 social media conversations towards the much-debated topic of self-driving vehicles which will become increasingly relevant to smart cities. The patterns and transitions of citizens collective emotions were modelled using the NLP and Markov models while the negativity (toxicity) in conversations was evaluated using a deep learning-based classifier. We propose an automated AI-based observation framework to detect the emergence of public emotions and negativity in conversations by using optimization algorithm. The framework could be adopted by industry leaders and government officials for smart observation of citizen opinions to improve security, communication and policy making.

Keywords: Artificial Intelligence, Emotion Analysis, Optimization Algorithm

ARTIFICIAL INTELLIGENCE

In today's world, technology is growing very fast, and we are getting in touch with different new technologies day by day. One of the booming technologies of computer science is Artificial Intelligence which is ready to create a new revolution in the world by making intelligent machines. The Artificial Intelligence is now all around us. It is currently working with a variety of subfields, ranging from general to specific, such as self-driving cars, playing chess, proving theorems, playing music, Painting, etc. Artificial Intelligence is composed of two words Artificial and Intelligence, where Artificial defines "man-made", and intelligence defines "thinking power", hence AI means "a man-made thinking power". Artificial Intelligence is not just a part of computer science even it's so vast and requires lots of other factors which can contribute to it. To create the AI first we should know that how intelligence is composed, so the Intelligence is an intangible part of our brain which is a combination of Reasoning, learning, problem-solving perception, language understanding, etc.

Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past

experience. Artificial intelligence is a theory and development of computer systems that can perform tasks that normally require human intelligence. In the advancement of intelligent industrialization towards what is being called the fourth industrial revolution, it is important to utilize Artificial Intelligence (AI) to understand citizens' emotions and perceptions towards industrial applications. Even in cognitive automation, it is mentioned that the further optimization and development of many smart applications rely on the subjective wishes of the user indicating the importance of recognizing the citizens' perspective.

SUBSETS OF AI

- Machine Learning
- Deep Learning
- Natural Language processing
- Expert System
- Robotics
- Machine Vision
- Speech Recognition

DEEP LEARNING

Deep learning is a subset of machine learning which provides the ability to machine to perform human-like tasks without human involvement. It provides the ability to an AI agent to mimic the human brain. Deep learning can use both supervised and unsupervised learning to train an AI agent.

Deep learning is implemented through neural networks architecture hence also called a deep neural network. Deep learning is the primary technology behind self-driving cars, speech recognition, image recognition, automatic machine translation, etc. The main challenge for deep learning is that it requires lots of data with lot of computational power.

HOW DEEP LEARNING WORKS:

Deep Learning Algorithms work on deep neural networks, so it is called deep learning. These deep neural networks are made of multiple layers.

- The first layer is called an Input layer, the last layer is called an output layer, and all layers between these two layers are called hidden layers.
- In the deep neural network, there are multiple hidden layers, and each layer is composed of neurons. These neurons are connected in each layer.
- The input layer receives input data, and the neurons propagate the input signal to its above layers.
- The hidden layers perform mathematical operations on inputs, and then performed data forwarded to the output layer.
- The output layer returns the output to the user.

EXISTING SYSTEM

In Existing model, they made use of publicly available, abundant social media conversations that contain contextual information encompassing citizen's emotions and perceptions which could be considered to provide the means to feel the emotional pulse of a city.

This framework is able to

(1) extract data from multiple social media channels

(2) extract emotions from social media content using Natural Language Processing (NLP),

(3) model the transitions of emotions of the public via probabilistic models and

(4) detect the level of toxicity using deep learning.

The patterns and transitions of citizens collective emotions were modeled using the NLP and Markov models while the negativity (toxicity) in conversations was evaluated using a deep learning-based classifier.

ALGORITHM

CONVOLUTIONAL NEURAL NETWORK

Step 1: Word Embedding Layer

Used a pre-trained GloVe for word embedding which takes an inputas a word and give the numeric representation.

Step 2: Convolutional Layer

Word embedding is given to the convolutional layer as input and filteris applied then soft-max activation function is applied to the matrix.

Step 3: Pooling Layer

In this layer it reduces the dimensionality size. Output of the poolinglayer is given to fully connected layer.

Step 4: Fully Connected Layer

This layer is used to produce outputs for each label.

LIMITATIONS

- It takes more time to analyze the emotions
- The algorithm sometime leads to data losses
- Using the algorithm cannot train the model properly
- It has security threats

PROPOSED SYSTEM

In the recent years, Artificial Intelligence has begun to take over the technology industry. It gave us many solutions to the problems we face and increased higher efficiency to solutions that we overcame and yet to overcome. However, it still undergoes the process of perfection as it still copes up with the ability of learning and understanding of enabling itself to replicate into a human's intelligence. We proposed an AI-based emotion observation framework to analyze the people emotions. The proposed framework collects data from user. Emotional expressions are extracted from the collected feedback. A deep learning based multi-label classifier developed using layers of word embedding and convolutional networks.

ALGORITHM

CONVOLUTIONAL NEURAL NETWORK

Step 1: Word Embedding Layer

Used a pre-trained Word2Vec for word embedding which takes an input as aword and give the numeric representation.

Step 2: Convolutional Layer

Word embedding is given to the convolutional layer as input and filter isapplied then ReLU activation function is applied to the matrix.

Step 3: Optimizer

Stochastic gradient descent

- Randomly shuffle the dataset
- for i=1..m

$(w, b) \leftarrow (w, b) - \eta \cdot \nabla C$ x (i) (w, b) where (w,b) is the vector containing all thevalues of weights and biases

Step 4: Pooling Layer

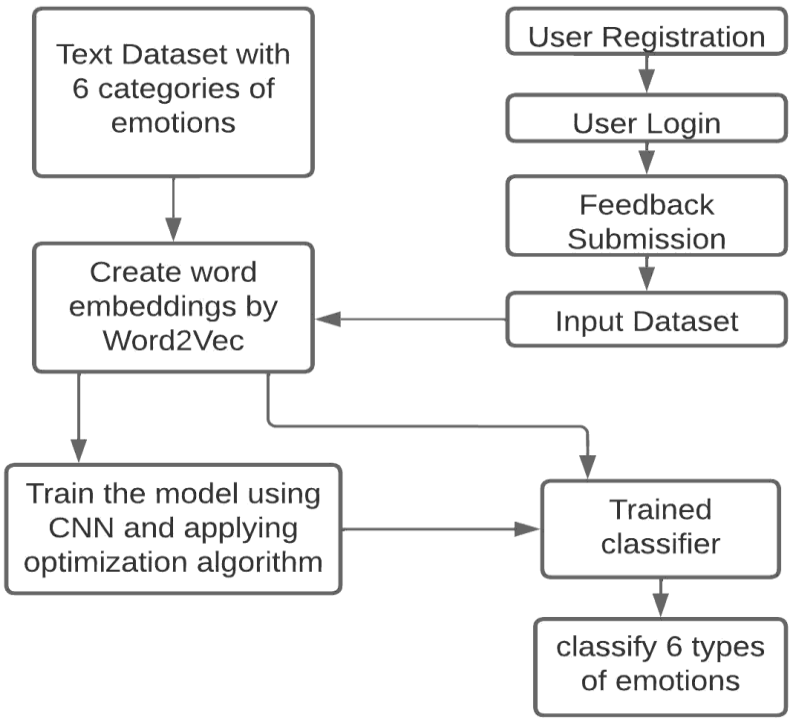
In this layer it reduces the dimensionality size. Output of the pooling layer isgiven to fully connected layer.

Step 5: Fully Connected Layer

This layer is used to produce 6 outputs for each label.

ADVANTAGES

- An artificial Intelligence can make an impact to close the barriers between human and a machine
- Compared to Existing model, it takes less time to analyze the emotions
- Using this algorithm there is no data loss
- It can help in fields like medical, consultation, education, and more as well as provide new opportunities by equal treatment



SYSTEM ARCHITECTURE

EMOTION ANALYSIS FROM THE FEEDBACK

There are 6 emotion categories that are widely used to describe human's basic emotions, based on facial expression or voice tone or by the speech: anger, disgust, fear, happiness, sadness and surprise. Emotional recognition has arisen as an essential field of study that can expose a variety of valuable inputs. Emotion can be articulated in several means that can be seen, like

speech and facial expressions, written text, and gestures. Emotion analysis is the process of identifying and analyzing the underlying emotions expressed in textual data. Emotion analytics can extract the text data from multiple sources to analyze the subjective information and understand the emotions behind it. Advanced machine learning and deep learning techniques can help you analyze the emotions expressed by the people in a piece of text. It can be easily done based on the types of feelings expressed in the text such as fear, anger, happiness, sadness, love, inspiring, or neutral. Gather and analyze large volumes of text data to analyze the emotions of customers or users. Emotion detection (ED) is a branch of sentiment analysis that deals with the extraction and analysis of emotions. Textual Emotion Analysis (TEA) aims to extract and analyze user emotional states in texts.

Emotion Detection and Recognition from text is a recent field of research that is closely related to Sentiment Analysis. Sentiment Analysis aims to detect positive, neutral, or negative feelings from text, whereas Emotion Analysis aims to detect and recognize types of feelings through the expression of texts, such as anger, disgust, fear, happiness, sadness, and surprise. Detecting a person's emotional state by analyzing someone's written text seems challenging. One of the biggest challenges in determining emotion is the context-dependence of emotions within text. A phrase can have element of anger without using the word "anger" or any of its synonyms. For example, the phrase "Shut up!". Emotion analysis helps to identify early problems and resolve them before they escalate any further. Emotions can be easily understood and categorized by analyzing facial expressions, vocal tones, gestures, and physiological signals, but emotions can also be easily understood and categorized by analyzing textual data by using deep learning methods. Emotion can be observed with text emotion recognition, and it is a matter of information classification involving natural language processing and deep learning principles.

OBJECTIVE

The aim of analyzing people's emotions from the feedback is to achieve quality enhancement. So, we presented an AI-based framework to understand the emotions and perceptions of citizens which is useful when designing and planning future applications.

DATASET COLLECTION

The dataset used in this project consists of 300 samples of English words, with 6 emotion classes: Happiness, Sadness, Surprise, Fear, Anger and Disgusted are used for training.

CREATE WORD EMBEDDINGS

Word Embedding is a language modeling technique used for mapping words to vectors of real numbers. Word Embeddings are a method of extracting features out of text so that we can input those features into a machine learning model to work with text data. Word Embeddings or Word vectorization is a methodology in NLP to map words or phrases from vocabulary to a corresponding vector of real numbers which used to find word predictions, word similarities. The process of converting words into numbers are called Vectorization.

Goal of Word Embeddings

- To reduce dimensionality
- To use a word to predict the words around it

Usage of Word Embeddings

- Word Embeddings are used as input to machine learning models. Take the words and give their numeric representation then it is used in training or inference
- To represent or visualize any underlying patterns of usage in the corpus that was used to train them

Word2Vec

Word2Vec is one of the most popular techniques to learn word embeddings using neural network. The Word2Vec model is used to extract the notion of relatedness across words or products such as semantic relatedness, synonym detection, concept categorization, selectional preferences, and analogy. Consider the following similar sentences: Have a good day and Have a great day. They hardly have different meaning. If we construct an exhaustive vocabulary {Have, a, good, great, day}. The encoding will be Have = [1,0,0,0,0], a=[0,1,0,0,0], good=[0,0,1,0,0], great=[0,0,0,1,0], day=[0,0,0,0,1].

TRAINING THE CNN MODEL

Convolutional neural network (CNN) models use convolutional layers and maximum pooling or max-overtime pooling layers to extract higher-level features. CNN is an advanced and high-potential type of the classic artificial neural network model. The word embeddings are given to the convolutional layer as input. Then, we slide the filter over these embeddings to find convolutions and these are further dimensionally reduced in order to reduce complexity and computation by the Max Pooling layer. Lastly, we have the fully connected layers and the activation function on the outputs that will give values for each class.

OPTIMIZATION ALGORITHM

Optimization algorithms or strategies are responsible for reducing the losses and to provide the most accurate results possible. Optimizers are algorithms or methods used to change the attributes of your neural network such as weights and learning rate in order to reduce the losses. Optimizers are used to solve optimization problems by minimizing the function. Optimization is the problem of finding a set of inputs to an objective function that results in a maximum or minimum function evaluation. It is a procedure which is executed iteratively by comparing various solutions till an optimum or satisfactory solution is found. Function optimization is the reason why we minimize error, cost, or loss when fitting a deep learning algorithm.

Stochastic Gradient Descent

In this, the model parameters are altered after computation of loss on each training example. So, if the dataset contains 1000 rows SGD will update the model parameters 1000 times in one cycle of dataset instead of one time as in Gradient Descent.

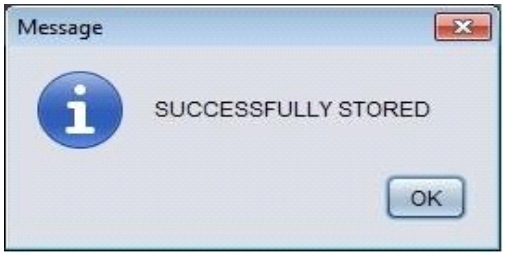
CLASSIFICATION OF EMOTIONS

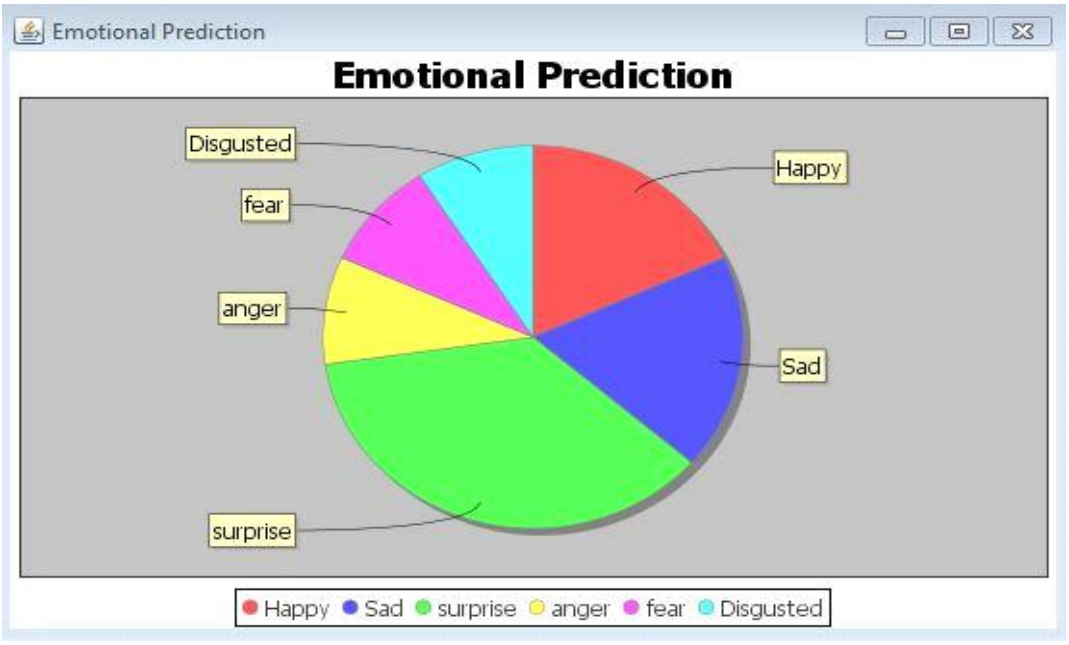
The input dataset consists of user feedbacks about the technology is now given to word embedding layer. It converts the texts into vectors. Then, these vectors are passed to the trained CNN classifier. This classifier predicts the types of emotions: Happiness, Sadness, Surprise, Fear, Anger and Disgusted.

COMPARISON BETWEEN EXISTING AND PROPOSED SYSTEM

EXISTING SYSTEM	PROPOSED SYSTEM
It takes more time to analyze the emotions	It takes less time to analyze the emotions
There is no optimizers used, sometimes it leads to data losses	We used Optimization algorithm,so there is no data losses
It has security threats	It does not have any privacy issues
In this system, it analyzes only positive and negative percentage	In this system, it predicts six types of emotions with percentage

RESULT





CONCLUSION

In this project, we presented an AI-based emotion observation framework to monitor the emotions and perceptions of citizens. We propose an automated AI- based observation framework to detect the emergence of public emotions and negativity in conversations by using optimization algorithm. By developing and evaluating this AI framework, we enable the capture and

representation of the emotional pulse of the city. We position this among pioneering studies to use AI to capture citizen's emotional pulse from digital data channels, thus create an overview of citizen's emotions related to smart city initiatives. The outcomes and the capability of using AI for understanding citizens' emotional pulse have the potential to inform strategy development and policymaking for industrial leaders as well as for elections, political campaigns, and governance.

FUTURE ENHANCEMENT

Compared to traditional survey opinions, social media data have numerous advantages as they capture publicly available, frequently updated and voluminous data, which are enriched with openly expressed emotions and feelings of citizens. This will serve as a strong foundation to utilize data via social media and other smart conversation platforms for representing citizen's emotions. This can be developed as a chatbot application that is used to predict the type of emotions, which may be integrated in robotics to analyze the feedbacks.

LIST OF ABBREVIATIONS

CNN - Convolutional Neural Network, EI - Emotional Intelligence, AI - Artificial Intelligenc,e NLP - Natural Language Processing, SGD - Stochastic Gradient Descent

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