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Stress Detection Methods Using Hybrid Ontology through Social Media: Psychological Concerns

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Abstract: The intensive stress state of an individual depends upon his social interaction with people. The stressful microblogs shared among people are causing a major threat to the lives of people leading to severe health problems such as weakening of the immune system, heart diseases, obesity, psychiatric illness, and negative emotions that adversely influences the social life of humans. Necessity is the mother of creation; the vital need is to spy on those messages shared among people by scrutinizing stress-related messages and formulating robust prevention strategies. Previous methods of collecting the data by Psychologists, such as interviews and surveys, were time-consuming and expensive. The (ISDF) Improved Stress Detection Framework is the proposed Strategy to detect Stressful messages in Microblogs. The proposed strategy utilizes hybrid ontology, which is a Keyword matching process that assists in the matching of stressful words with the aid of predefined stress words. This approach reduces the extraction complexity by inculcating domain knowledge in the form of concepts and relationships which was not done in earlier works. The experimental analysis includes the dataset named user-generated content which includes the test cases. The proposed ISDF is tested using the predefined rules resulting in the detection of stressful words efficiently and reported to the crime department. The Proposed Strategy shows a high precision rate as compared to the existing methods. ISDF framework outperformed the Tensistrength system of stress detection which additionally added Pre-defined rules and Emoticons utilizing the hybrid wordnet ontology which was ignored in earlier works.

Keywords: *Intensive stress state, stressful microblogs, Social Media Environment (SME), hybrid ontology, high precision rate, Improved Stress Detection System (ISDF), Tensistrength system, Hybrid wordnet Ontology.*

1. Introduction

The consciousness of the stress state of individuals plays a pivotal role to develop and enhance the life of personalities. Excessive usage of social media leads to various health disorders mental strain and stress. This results in the diminishing of the health system and long-term pressure lead to various chronic mental health disorders [1]. Furthermore, the nervousness even results in suicide [2]. The major threat among individuals is due to continuous interaction [3]. Because of their social interaction on a similar social platform, a major threat is mostly among children.

Technology has transformed the lives of individuals. Without proper physical activities and the immense usage of social connections, there is a huge disorder in physical and mental abilities [4]. By using Deep Learning, the identification of the Stress state of various users can be done. The social interactions can be viewed through the log details of the users [6].

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The lives of individuals can be enriched by identifying the stress criteria and proposing strategies for stress reduction [5]. Various emotions of individuals are identified [5], together with their behavior, sentiments, etc. The resultant information helps in the improved life of individuals by applying stress reduction strategies [5]. The stress state of individuals can also be analyzed using deep learning and how long the user is active, and trends among social interconnections can also be analyzed [6]. Hybrid Ontology utilizes the keyword-matching process for stress detection systems with improved accuracy.

The proposed ISDF framework outperformed the Tensistrength approach of stress detection for social interaction among individuals and it supports other predefined rules of stress detection such as Pre-defined rules, Emoticons, unlike Tensistrength. Word net Ontology plays a vital role in performing these activities. Report generation with details such as Email-Id and Mobile-No is also described, unlike Tensistrength Stress Detection System.

2. Literature Survey

Stress may lead to severe physical and psychological health issues. Through the Twitter account of a user's post, a real-time snippet is taken, which shows several stress words,

emojis, images, likes, and comments depicted in Fig.1 and Fig.2.

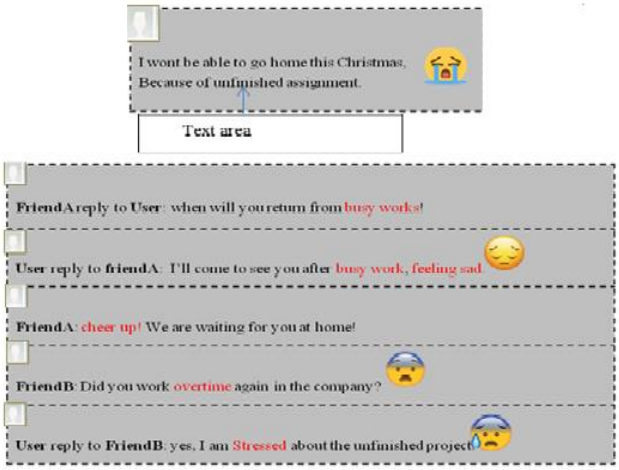

Fig. 1. Snippet posts on Twitter with several stress words and emojis

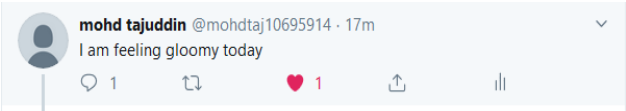

Fig. 2. Snippet posts on Twitter with likes and comments.

The ISD (Improved Stress Detection System) is a stress discovery as well as prediction strategy that uses ontology for analyzing the stress words in messages shared among individuals. The hybrid ontology is integrated into the Improved Stress Detection system together with GSHL and Tree alignment as probabilistic model algorithms, text, and linguistic words. The new system ISDF has shown good accuracy when compared to the TensiStrength system with a 95.2% of stress detection rate. Furthermore, it has improved features such as predefined logical rules including stress lexicon words such as linguistics, emojis, and social interactions [8]. The user's stress state along with the time the user is active on social media, various social interconnections can also be analyzed using deep learning [6].

The overall framework for ISDF is presented in this section. Ontology is used for extracting the stress words from the database [9], it can be integrated with other messengers (instant) and social networking sites like Yahoo, Skype, GTalk, MSN, Instagram, WhatsApp, Twitter, Facebook, etc. [9]

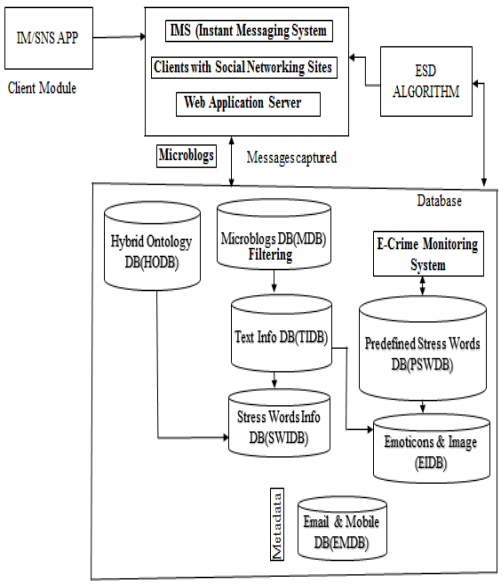

Fig. 3. ISDF-Improved Stress Detection Framework Using Hybrid Ontology

The Major tasks performed by the above figure of ISDF:

Extraction of words from imprecise text using Hybrid Ontologies

Principle of Information theory using probabilities

Hierarchy construction algorithm using domain or topic

Algorithm: Tree alignment

Component: Security

Monitoring system: E-crime

Improved Stress detection algorithm (ISDA)

Messages communicated between the clients i.e. microblogs are captured from the web application server into MDB (Microblogs Database). The ISDs (improved stress detection system) include a monitoring system for the entire process. Purposely we are using the databases (MDB, TIDB, SWIDB, EIDB, PSWDB, EIDB, and Metadata). In ISDSs, an Effective stress detection system, the messages shared between the users (clients) are recorded in MDB (microblogs database). The HODB (hybrid ontology database) is a database i.e. a vocabulary that identifies concepts, concept hierarchies, axioms, relationships, or rules. The stress words are filtered from MDB, the text words are stored in Text Information DB (TIDB) and the relevant words are mapped with predefined logical rules stored in a Predefined stress words database (PSWDB). The significant stress words are stored in SWIDB with the help of HODB. Stress words in SWIDB are outlined by the psychology department and are depicted in Table I. The PSWDB is compared with SWIDB with the guidance of HODB for ambiguity if any. HODB supports multilingual languages: WordNet and Euro WordNet are the variants. The multilingual versions like WordNet and Euro WordNet [10] consist of a set of cross-related WordNet in several languages (English, Estonian, Czech, Italian, Dutch, Spanish, German, and French), including the semantics for each word provided in the above languages and the relations among the terms and their equivalent [10]. After the detection of stress words, the monitoring system for crime is initiated by the ISDA (Improved stress detection framework) shown in Fig. 3. In the EIDB (email information database) the short biography of users is stored such as (First name, last name, father's name, DOB, location, profession, email_id, address, mobile, etc). Another important module is metadata that deals with the history of all DBs (databases) and ISDs (Improved Stress detection systems) details such as (sender and receiver details).

3. Proposed Work

1.1 INDEFINITE SCRIPT BY HYBRID ONTOLOGY

The probabilistic models like Greater similarity hierarchical learning (GSHL) and Tree Alignment algorithms are helpful for the organization of words. The GSHL algorithm [11], builds the concept hierarchy based on the information theory principle [12]. The Relative entropy also known as Kullback-Leibler divergence is the measure of probability distribution between two variables over a discrete random variable X [13, 12].

The term 'D (L||M)' which is relative entropy can be defined as shown in equation 1.

$$D(L||M) = \sum_{x \in X} p(x) \log l(x)/m(x) \quad (1)$$

Description 1: The Kullback-Leibler divergence or entropy is defined in equation 2, relatively, over the same discrete space S and between two probability distributions P & Q.

$$D_{KL}(L||M) = \sum_{i \in S} L(i) \log 2\ L(i)/M(i) \quad (2)$$

Through Gibbs inequality [12], the value of divergence KL: DKL is greater than or equal to 0.

Description 2: A term Cl is broader than another term Cm if it's satisfying the following two conditions:

The measure of similarity between the terms Cl and Cm is > certain threshold THREs OR The measure of divergence is < certain threshold THREd

The measure of divergence i.e. the difference between Kullback-Leibler divergences:

$$D_{KL}(L||M) - D_{KL}(L||M) < 0.$$

L and M are latent terms for Cl and Cm respectively in the above definitions. The Jensen-Shannon (JS) or Cosine similarity divergence measures are used for calculating the similarity and divergence measures. The parameters i.e. THREs and THREd are the similarity and divergence baseline values that can be tuned for excellent results.

1.2 *Subject i.e. a Domain, construction of hierarchy algorithm*

After establishing the relationships among terms, the next step is to establish hierarchies between the terms. The two recursive algorithms for the same purpose have been defined [20]. The verification of definition 2 whether it holds or not is measured by KL divergence. The termination of algorithms happens when all the topics are selected and when all predefined iterations are reached.

The following notations are used in the algorithms:

Table 1: Notation used

1st RULE (PSWDB)	
Categories of Stress (Domain)	**Stress words/Emoticons to be detected**
Stress Lexicon →	Secluded, abandon, fear, anxious, emotional, halt, distress, dispute, superior, vicious, orphan, heartbroken, uneasy, unhappy, weaken, annoyance, ache, anguish, agitated, alert, disappointment, regret
Negative emotion Lexicon →	Upset, horrible, rage, annoyed, tedious, gloom, grief, disapproval, low self-esteem, callous, despair, devastate, disgust
Negating words Lexicon →	Shouldn't, won't, should not, won't, wouldn't, hardly, can't, no more, no longer, never, no, not at all, only, nothing, unknown, someone, not an iota, useless, without, against, certainly not, neither
Emoticons and Emojis → **(*Mean Value)***	":(", ":*(", ":,(", ":-", ":-&", ":-(“,"%-(", ")-:", "):", ")o:",
RULE 2	
Social Interaction ***Mean Significance*** →	Comments, Likes, and dislikes
3rd RULE (beginning value)	
Verification of pre-defined onset value for the branch words that may belong to various areas, using Mean & accurate values *(rules)* **ISDA framework** ***(Fig. 5)***	
4th RULE (unnoticed words to be snubbed)	
Special characters as well as Unknown image formats are sent through SNS which is ignored	

Num – Total quantity of words or nodes of the root in a domain

• Mc – All sub-nodes i.e. word for a specific word in a domain

• THREs and THREd – The baseline for a measure of similarity and divergence.

• THREn – Noise factor i.e. variance between divergence measures (DKL (L||M) & DKL (M||L))

• I – total No. of iterations.

For accuracy and precision baseline constants such as THREs, THREd, and THREn are tuned.

Algorithm1: The GSHL (Greater Similarity Hierarchical Learning)

1. Initialize Mc, THREd, THREn, V, Ms, I, and THREs;

2. While (i < I and V is not empty) do

3. Adding current root into V;

4. Select the most similar Mc nodes of Root words from the Ms;

5. Enhance analogous nodes into Vtemp;

6. Removal of Nodes in V_{temp} in contradiction of Similarity and Divergence Measures //Definition 2; for (all nodes n, in Vtemp) do

7. If (Sim (ni, root) > Sim (ni, Sibling (root))) then

8. Broader relationships (Assert) amongst root and topic ni; //declare (bond amongst root and the topic is broader)

9. Else default

10. Correlated relation (Assert) amongst roots and topic ni;

11. End if

12. Moving topic ni from V_{temp} to V;

13. Increment i by 1;

14. End for

15. Removal of present root from V;

16. End while

Furthermore, terms are grouped and are similar to each other. On the other hand, dissimilar terms are grouped in the form of clusters. The algorithm LSHL starts classifying root topics and summing them into vectors (V). The vector (V_{temp}) stocks the utmost analogous topics of the existing 'root' node.

The filtering of V_{temp} is done according to a procedure:

• Terms detached from Vtemp, whose KL divergence values do not satisfy the existent root (source).

• A bigger relation is affirmed between a left-out term in Vtemp, if the resemblance value between the present root and terms is greater than the similarity value. It is done between the term and any of the sub-nodes of the present root; or else, a similar relation is affirmed. The while loop will give a terminate algorithm signal, according to specified conditions.

1.3 Tree alignment algorithm

Mapping of stress words is done in the below Fig.5. The messages shared among the users are vigorously captured using the ISDF framework, and HODE (hybrid ontology data extraction). The plotting between SWIDB and PSWDB can be seen in the below figure.

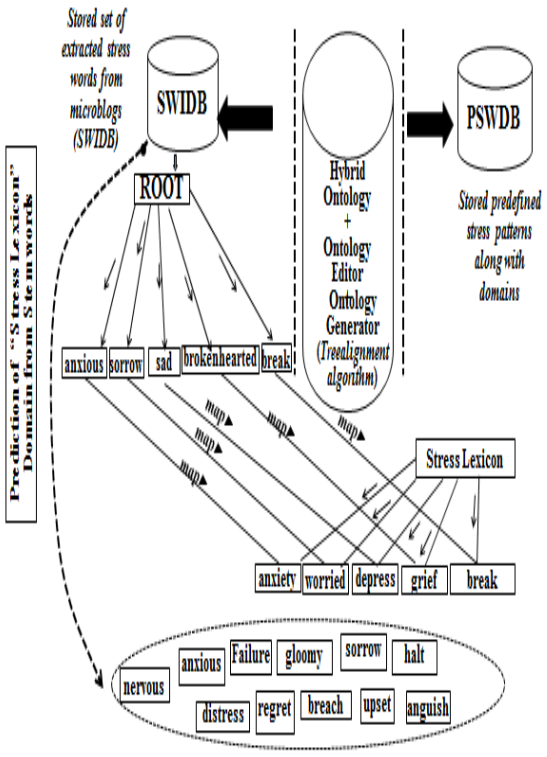

Fig. 4. Stress Lexicon: Mapping process extracted stress words (SWIDB) and Predefined Stress Words

The anxious branch word is explored using the hybrid (wordnet) ontology, synonyms recognized: anxiety, dying, nervous, Queasy, uneasy, and unquiet. Among them, anxiety can be plotted to anxiety as shown in fig.5 Stress Lexicon Domain. Thus the hybrid ontology leads to the creation of the Parent-child relationship i.e. the branch words (SWIDB) are plotted with Domain words (PSWDB).

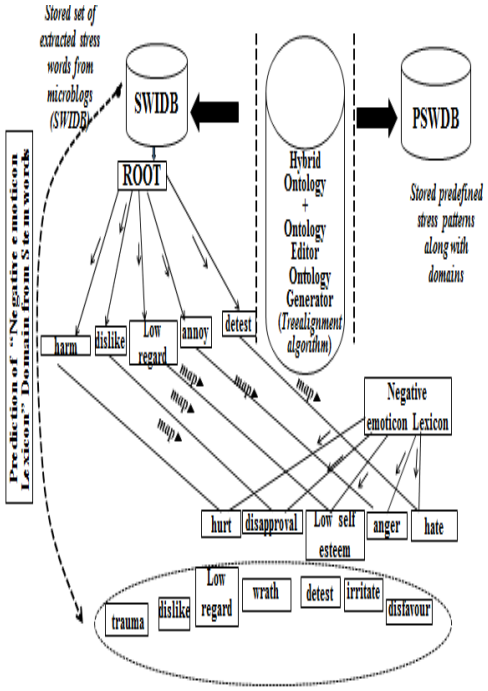

Fig. 5. Negative emoticon

The harm branch word is explored using the Hybrid ontology, synonyms recognized: injury, hurt, trauma, damage, impairment, and scathe. Among them, harm can be mapped to hurt as shown in fig.6. Negative Emotion Lexicon Domain. Therefore other words present in SWIDB are plotted with PSWDB. Thus the hybrid ontology guides the creation of the Parent-child relationship i.e. the branch words (SWIDB) are mapped with Domain words (PSWDB). Among them certainly not is mapped to never as shown in Fig.7. Negating words Lexicon Domain. Therefore other words present in SWIDB are mapped with the PSWDB database. Thus Ontology monitors the structure of Parent-child relationships i.e. the branch words (SWIDB) are mapped with Predefined stress words (PSWDB).

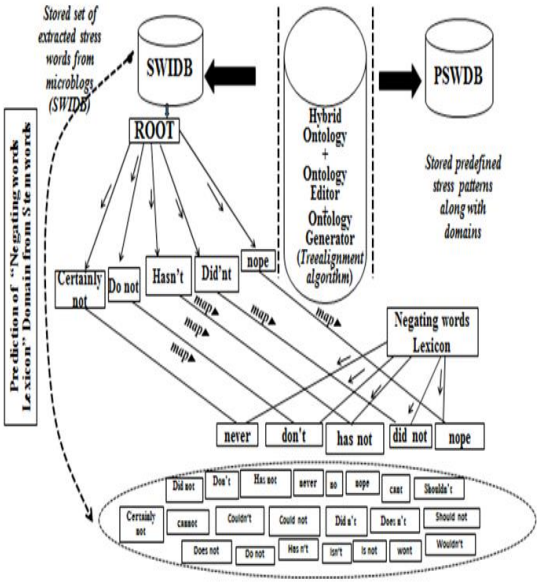

Fig. 6. Negating Words

Algorithm2. Use of Hybrid Ontology:

Tree Alignment (node, Root Node) for extraction of the Domain (Topic) with Hybrid Ontology concepts Need: Node [], Set Root Node []

Outcome: Extraction of Domain (subject) from branch words.

Require: Initialize Node(s), and Root Node

Ensure Domain (topic) extraction from branch words.

1 for (int i: 1 to nos Domain Topic {//navigate tree for Domain Topic i.e. i

2 Nos Levels=2; //tree size is 2 i.e. parent & child

3 for (int j: 1 to Nos Levels){

4 Root Node [ ] Nodes = Empty // utmost level 1

5 nodes Node [] = get Nodes At level (nodes); //All the // branch words from SWIDB at level 2

6 Nodes Root Node [ ] = Node [ ] nodes // branch words are

// assigned to Root Node

7 For Repetitive Data check (Nodes); //check for the branch words (SWIDB) that match through other domain (topics) (PSWDB) by means of Hybrid Ontology

8 Disjunctive Data check (nodes); //check for

//branch Words that belong to supplementary domain // (topic)

9 }//end for

10 }//end for

11 check For Repetitive Data (Node [ ] nodes) {

12 for (int i: 1 to nodes. length) {

13 If (node[i]! =nodes[j]) {//nodes of SWIDB does not match with PSWDB words

14 check For Hybrid Ontology (Node [ ] nodes)

15 If (nodes[i] == nodes[j]){ //compare nodes[i] and nodes[j] if corresponding then

16 //SWIDB words are compared with PSWDB words

17 call GSHL ((node, Root Node), Min Inception) // GSHL algorithm calculates threshold for branch words i.e. (SWIDB) concerning Domain (topic) nodes then assigns Domain (topic) from PSWDB

18 Root Node [ ] Nodes = Domain Node [ ]

19}// end if

20}// end if

21}// end for

Branch words stored in SWIDB (Stress Words Information Database) are to be matched with PSWDB (Predefined stress words Database) from existing domains (Subject) type. This is done by the function check For Repetitive Data (). Another function i.e. checks For Disjunctive Data () does the duty of finding the branch Words within a domain depending upon the user-defined threshold values.

4. The Proposed Methodology: Security Management

The encrypted messages shared between the sender and receiver need rigorous encryption and decryption algorithms [14], which require public and private keys to decrypt the encrypted messages sent via phone or any other medium. Human intervention is required with strong expertise in domain security is required in this scenario. The ISDs framework is tested for common messages in the form of text.

1.4 Methodology for monitoring E-Crime:

The discovery of the correct path and getting the evidence i.e. extraction is a challenging task in Social Media. In ISD the cybercrime department monitors the messages sent between the sender and receiver, if any stressful messages are identified, they are reported with the details. The details include: person_Id, First_Name, Last_Name, DOB, Place, Address, Contact_No, Email_Id, Stress_Words, Type_of_Stress, Place and IP_Address. Finally, after detecting stress-related disorders in people, the necessary action is taken by the e-Crime department. The e-Crime department uses the R2D (RDF-Database) relational wrapper to find out the relationships, attributes, and entities that exist amongst the senders of stressful messages in social media. Without an RDF wrapper, the cyber-crime department can't identify the stressful messages shared among individuals [15], because normal querying is not sufficient to identify the culprits due to the many types of joins among the tables. The metadata is a crucial part of this process.

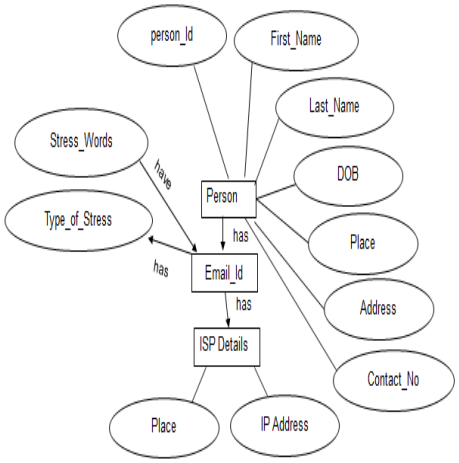

Fig. 7. Plotting of persons related to stress using R2D relational wrapper in ISD Contact Emails

ISDA (Improved Stress Detection algorithm)

Below Fig.10 is the flowchart representation of the ISD framework. The following are the generalized steps as shown below.

The filtering is done in the microblogs shared among individuals. Unnecessary words are removed. Through rigorous checks, the identification of stress words is done using algorithms mentioned in Figure 4 & Figure 8.

After stress word identification, stress words remain deposited in Stress Words Information Database (SWIDB). These words are compared with the PSWDB (Predefined Stress words database) as depicted in Table I. The log contains the sender and receiver email _ id information i.e. maintained in the metadata.

The relational wrapper process [15] is used to extract relevant information from the e-mail accounts database. Personal details such as person_Id, First_Name, Last_Name, DOB, phone_ no, contact_details, and user information are traced by browsing history and the profile.

The location details [16] including computer (IP address), and ISP address [16] are tracked by the monitoring system of cyber-crime and the generation of the report is depicted in Figure 9.

The summary in the report contains the types of threats.

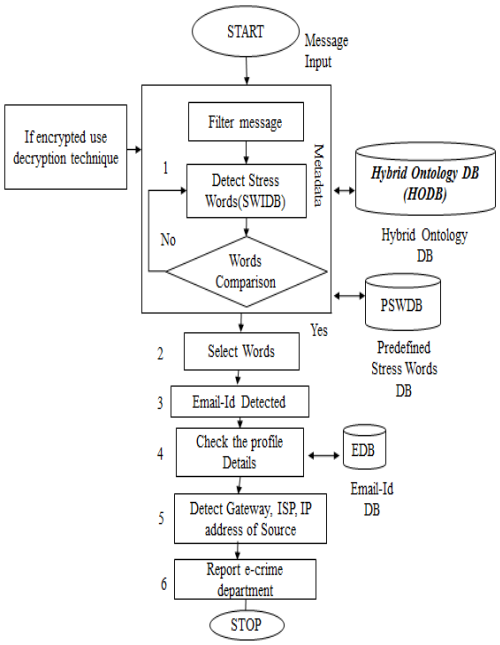

Fig. 8. Flowchart to trace the stress-related individuals in ISDS using Hybrid Ontology

TABLE 2. HYBRID ONTOLOGY-BASED PREDEFINED LOGICAL RULES

Area of Stress Detected	Client 1	Client 2
Stress Lexicon (Rule 1) Worried	Hello Tim, I am ***worried*** about my low Salary	Ok, Tim. I will guide you with a new Job oriented course
	Tim, I have started the course but it seems to be complex	Practice as much as you can because practice makes you perfect
	I am very much ***sad*** about some personal issues.	Be cool don't be ***anxious***. Please come down to my place and I can arrange your practice sessions.
	I am in ***grief*** why I have selected this course; rather I would have started a small business.	I can guide you with some of my friends
	Now I have come up with a decision to take a ***break*** because I am starting my firm.	That's the best idea. Go Ahead.
Stress Words Detected	Anxious (Anxiety), worried (sorrow), depressed (sad), grief(broken heart), break	
Precision	5/22 = 22.7	

5. Result Analysis

5.1 Assessment Methods: Dataset

The accuracy metric [18], [19] is used to assess our effective stress detection system as shown in below equation no.3. The extracted stress words efficiency is based on two factors i.e. concerning domain, number of genuine words available in predefined stress words DB i.e. PSWDB, and the number of extracted stress words from chatting.

Table 3. THE BELOW TABLE DEPICTS OUTPUT: USER-CREATED TEST-1 DATASET

Area of Stress Detected	Client 1	Client 2
Stress Lexicon + Negating words Lexicon Nervous	Hello Crys I am feeling nervous about my position in my company	Why what's the matter

	The company is under transformation from old technology to a new one	Not bad, try for the new technology
	No, I cannot	What's the reason
	I am tense	No need to tense just be patient
	I am not having mental peace	Be confident
	The new technology is hardly user-friendly	Practice and it makes you perfect
	Will you guide me	Sure I can
	Awesome	Great
Stress Words Detected	Nervous, not, no, tense, hardly	
Precision	5/44 = 11.36	

$$\text{Accuracy (A)} = \frac{\text{No of Extracted Correctly}}{\text{Total Extracted}} \times 100 \quad (3)$$

5.2 Preparation of Datasets

We have gathered datasets and Questionnaires from the Pew Research Centre American life project August Tracking Survey of Facebook among 1800 individuals and 18+ age, across the nation. The dataset can be viewed on the link [20], the dataset we have named as User Generated Content (UGC) test. The size of the dataset is 354,320 bytes, with 24 columns out of 88 columns considered. The dataset is shown in Table II.

Table IV. Output for Upset obtained from user-created -test 3

Area of Stress Detected	Client 1	Client 2
Negative Emotion Lexicon Upset	Hello Cathy, I got *hurt* because the bank has disapproved my account opening process	I have a good plan for you

	What's the plan	I am inviting the bank manager to a party.
	I have low self-esteem	Be confident
	But the manager makes me anger	Be cool. I am confident that your work will be done.
	I think he hates me	No Issues think nice
Stress words Detected	Hurt, dislike (disapproval), low self-esteem, anger, hate	
Precision	5/13 = 38.4	

Table V. Output For Hardly Obtained From User-Created -Test 4 Dataset

Users	ISD System
Total	1800
Correctly Extracted	1719
Precision	95.5

Area of Stress Detected	Client 1	Client 2
Negating Words Lexicon Never	Hello Patrick. How Are you	I am well thanks, how about you?
	I *hardly* send the invitation	You *won't* remember me
	We are all friends we *should not* need an invitation	*No*, I follow my protocol
	We should *certainly not* think like this, no love if there are formalities	Well I have *no* concern
Stress Words Detected	hardly, won't, should not, certainly not (never), no	
Precision	5/22 = 22.7	

Table III pertains to the test case of stress that belongs to the chat session showing "Worried about the future". Table IV depicts the chat session representing the stress of type "Upset". Table V belongs to the stress chat session of negative thoughts faced represented as "Hardly". Table VI shows a stress chat session when the user enters into a depression mode when failed in the future named "Loser". Table VII shows the stress chat session when an employee is worried about the latest technologies and shows how he is mentally disturbed named "Nervous". Table VIII depicts how the stress of type "hatred" when mentally disturbed by the people living around him. Table IX shows the overall percentages of different types of stressfulness identified from chat sessions based on pre-defined rules.

TABLE VII. OUTPUT FOR NERVOUS OBTAINED FROM USER-CREATED TEST 6 DATASET

Area of Stress Detected	Client 1	Client 2
Stress Lexicon + Negative Emotion Lexicon (Depressed)	Hello Jack, I am a *loser*	What's the wrong jack
	I have *failed* my semester exams	*Don't* be *depressed*, there are advanced supplementary exams, you can write and get a pass.
	I am feeling *boredom*	There is nothing tedious
	I *hate* Mathematics and feel to take a *suicide* step	Please *never* take this step. I have a good tutor he can guide you
Stress Words Detected	loser, failed, boredom, hate, Don't, depressed, tedious, never	
Precision	8/35 = 22.85	

TABLE VIII. OUTPUT FOR LONELY OBTAINED FROM USER-CREATED -TEST 7 DATASET

Area of Stress Detected	Client 1	Client 2
Negative Emotion Lexicon + Stress Lexicon + Negative words Lexicon Hate	Hello, James, I am feeling *lonely*	Yes what's the matter
	I am in a *secluded* place	Good to come here to a gated community
	But my partner is *callous*	Be good and try to be cool
	My partner *hate*s people living in groups	We are in unity here and unity is a strength
	My partner *won't* agree to a gated community	*No* problem, you leave it to me to convince
	Nice idea	Most welcome
Stress Words Detected	Lonely(alone), secluded(secret), callous(thickened), hate(disgust), wont , no	
Precision	6/57 = 10.52	

TABLE IX. PRECISION PERCENTAGE OF KNOWLEDGE-BASED PREDEFINED RULES

Predefined Logical Rules	Precision Percentage
Stress Lexicon	22.7
Negative Emotion Lexicon	38.4
Negating Words Lexicon	22.7
Stress Lexicon + Negative Emotion Lexicon	22.85
Stress Lexicon + Negating words Lexicon	11.36
Negative Emotion Lexicon + Stress Lexicon + Negating words Lexicon	10.52

6. Results Analysis

6.1Graphical representation of Categories of Stress

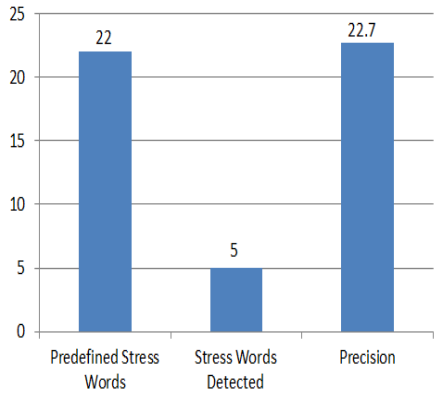

Fig. 9. Graphical representation of Stress Lexicon

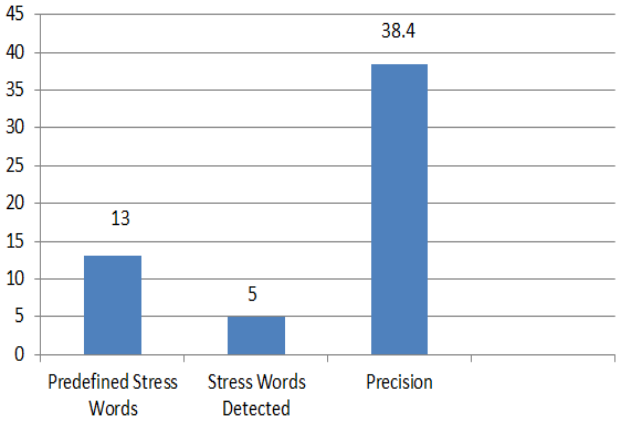

Fig. 10. Graphical representation of Negative Emotion Lexicon

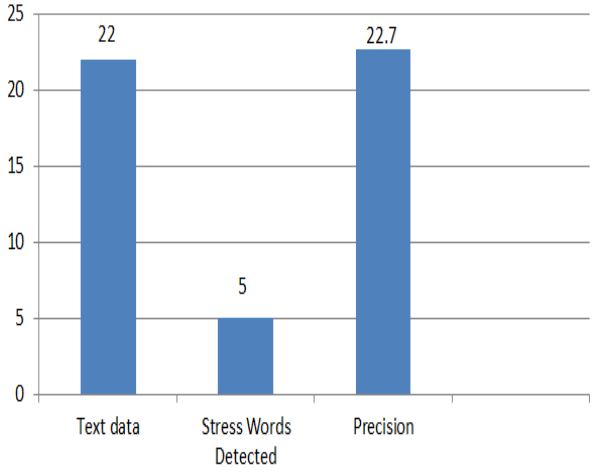

Fig. 11. Graphical representation of Negating Words Lexicon

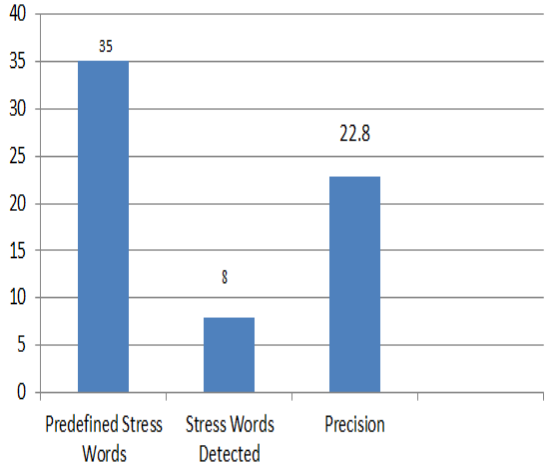

Fig. 12. Graphical representation of Stress Lexicon and Negative Emotion Lexicon

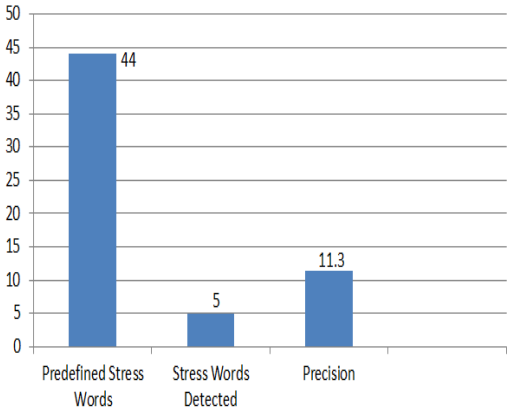

Fig. 13. Graphical representation of Stress Lexicon and Negating Words Lexicon

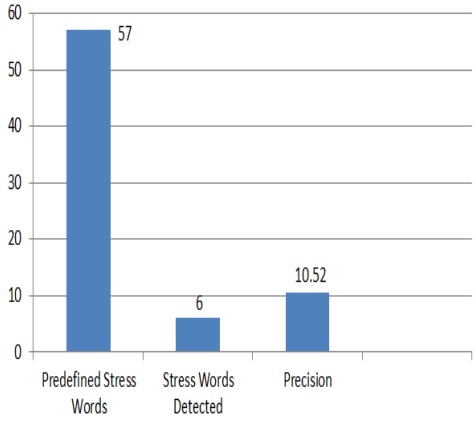

Fig. 14. Graphical representation of Negative Emotion Lexicon, Negating Words Lexicon, and Stress Lexicon

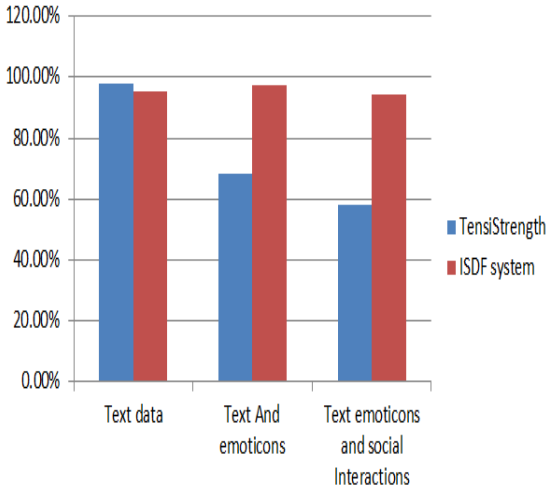

Fig. 15. Graphical representation of Negating Words Lexicon, Stress Lexicon, & Negative Emotion Lexicon

6.2 Stress Detection Framework and Tensistrength

Due to the privacy policy of the FISA Act, several stress detection strategies have tested their stress detection framework from local databases and other social media applications [23, 24, and 25]. Here we have used pre-defined rules that constitute stress-related linguistic words, to test our SDF architecture. WordNet supports each of these words that had produced synonyms for the present pre-defined stress words computation up to 432 documented stress words. The chatting session which is real is deliberately directed and experimental results between the two users are shown in Fig. 17.

Fig 16. Actual Tweet, consisting of Linguistic stress lexicon words and Emoticons

Table X. Precision rate obtained for Real Chatting Session

Parameters	TensiStrength	ISDF system
Text data	98.11%	95.43%
Text And emoticons	68.53%	97.21%
Text, emoticons, and Social Interactions	58.32%	94.20%

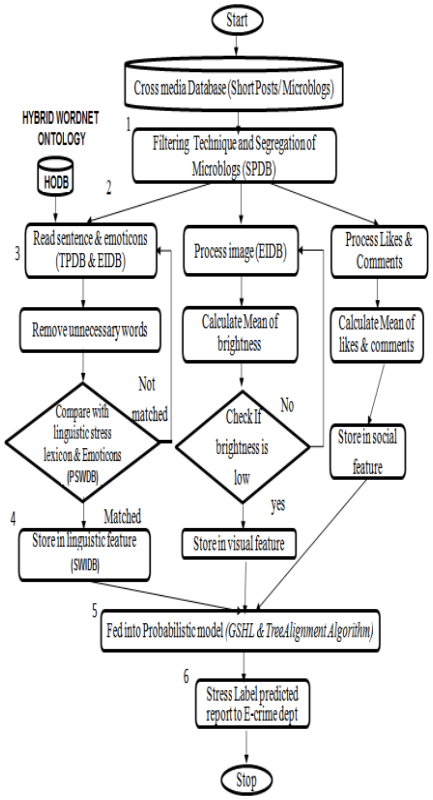

Fig. 17. Algorithmic steps of the Stress Detection Algorithm

Figure 17 above is tested using the Stress Detection algorithm. Stress words perceived are namely 'sad' and 'gloomy'. The value of 3% is set as the threshold. Emoticons that are exactly mapped are 4 in total, with our pre-defined database (PSWdB) as the 2nd rule. The precision rate gotten by the ISDF system is 94.2% and with tensistrength 58.32%.

7. Conclusion with Future Scope

7.1 The Conclusion

Previous stress detection and prevention strategies are hysteretic and inefficient. The well-being of individuals and society needs to notice and accomplish stress earlier it becomes problematic for humanity. The proposed ISDS (improved stress detection system) is acquainted with the integration of Hybrid OBIE (ontology-based information extraction). It comprises GSHL and Tree Alignment algorithms and the hybrid ontology acts as a keyword-matching process. Hence the accuracy is improved with faster stress detection.

The ISDF framework of the stress detection system is compared with the Tensistrength stress module giving better results as shown in Table X. Tensistrength has not taken into consideration of emoticons and Image memories for identifying stress. Tensistrength considered only Text and emoticons. In our work, we have considered a set of pre-defined stressful words, negative emotions, and image memories apart from textual stressful words as shown in Table I, this is the **novelty** of my research work. Thus, the

proposed ISDF outperformed the TensiStrength. ISDF is tested using various test cases picked from User Generated Content of various chat sessions as shown above from Table II to Table VIII. These chat sessions are taken about the PEW research center [20].

7.2 Future Challenges

In future work, we planned to identify the Stress detection process from various languages i.e., multilingual languages from various social media platforms [10]. When Linguistics is concerned the stress words from different types of people from various locations of the world are to be taken into consideration. This requires an excessive understanding of the type of culture adopted by the people where they live and their religious sentiments need to be considered to understand their critical type of stress in social media.

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