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Identifying Associations between Smartphone usage and Mental Health during Depression, Anxiety and Stress Using Mobile Social Network

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Abstract **—** Mental health problems have become increasingly common these days. One of the major factors contributing to this drastic health situation is the overwhelming increase in workload. This leads to stress and mood instability. Due to stress and unstableness of personal mood, assessing and analyzing daily mood is both difficult and inconvenient, which is a major challenge in mental health care. In this App, we propose a framework for analyzing mood in daily life. We make use of uses mobile -phone data, his usage, to extract human behavior pattern and assess daily mood .We interact with user by asking him questions, giving him some suggestions. Our approach helps user to lighten their mood and feel happy. The proposed design is built on windows platform and uses id3 to analyze behavior. Here we use Iterative Dichotomize decision tree algorithm that constructs decision tree by working on the data that is provided to it by the user. It finds optimal solution in which the data set can be classified.

Keywords- Reality Mining, Correlation and regression analysis, Psychology

I. INTRODUCTION

People are complex individuals. They have bunches of considerations, perspectives and viewpoint, this prompts them feeling emotions which prompts have an assortment of dispositions. This felt dispositions can have unfriendly and also beneficial outcome on individual's profitability. As indicated by numerous inquires about a man with great state of mind and an inspirational standpoint has a tendency to perform tastefully well then that of a man with bleak mentality and not all that positive perspective. It is additionally watched that people who are tragic are more disposed to invest more energy in their cell phones and on online networking locales. This albeit incidentally gives some accomplice yet again the client feels desolate. Work by Anmol Madan et. al on examining impacts of social interactions on weight change is likewise a case of how reality mining can be connected to zones that were tentatively out of reach before [1]. The investigation done in this work uncovered that closeness to hefty or idle associates can impact a people way of life. Sai T Moturu et. al have investigated in their paper the relationship between rest, mind-set and friendliness [2]. Jun-Ki Min et. al have performed grouping of contacts into family, work and social aspects with ˜90% exactness [3]. Such examinations have been instrumental in examining different parts of human conduct from a completely new point of view. In our project We have utilized linear regression procedure for model selection and the whole process is done utilizing R, the statistical analysis tool [4][5].

In this paper we recommend an application that gathers client's data from the phone itself and gives day by day redesign of one's enthusiastic state for that reason we utilize DASS and choice tree.

1. DASS: Emotional syndromes like depression and tension are inherently dimensional - they shift along a continuum of seriousness (free of the particular conclusion). Thus the decision of a solitary slice off score to speak to clinical seriousness is essentially subjective. Here, we utilize DASS. The vital capacity of the DASS is to survey the seriousness of the center side effects of Depression, Anxiety and Stress. In like manner, the DASS permits not just an approach to gauge the seriousness of a tolerant's side effects yet a methods by which a persistent's reaction to treatment can likewise be measured. DASS can prompt a valuable evaluation of aggravation, for instance people who may miss the mark concerning a clinical cut-off for a particular determination can be accurately perceived as encountering significant side effects and as being at high danger of further issues. The individual DASS scores don't characterize proper intercessions. They ought to be utilized as a part of conjunction with all clinical data accessible to you in deciding fitting treatment for any person.

2. Decision Tree: A decision tree comprises of nodes and curves which associate nodes. To settle on a choice, one begins at the root node, and makes inquiries to figure out which bend to take after, until one achieves a leaf node and the decision is made. The primary thoughts behind the ID3 calculation are:

- Each non-leaf node of a decision tree compares to a data trait, and every circular segment to a conceivable estimation of that quality. A leaf node compares to the normal estimation of the yield characteristic when the info qualities are depicted by the way from the root node to that leaf node.

- In a "good" decision tree, each non-leaf node ought to compare to the data trait which is the most instructive about the yield property amongst all the info qualities not yet considered in the way from the root node to that hub. This is on the grounds that we might want to anticipate the yield quality utilizing the littlest conceivable number of inquiries by and large.

- Entropy is utilized to decide how instructive a specific information property is about the yield characteristic for a subset of the training data.

II. LITERATURE REVIEW

1.Title: **Mining Smartphone Data to Classify Life-Facets of Social Relationships**
Author: Jun-Ki Min, Jason Wiese, Jason I. Hong, John Zimmerman

Description: People engage with many overlapping social networks and enact diverse social roles across different facets of their lives. Unfortunately, many online social networking services reduce most people's contacts to "friend." A richer computational model of relationships would be useful for a number of applications such as managing privacy settings and organizing communications. In this paper, we take a step towards a richer computational model by using call and SMS logs from mobile phones to classifying contacts according to life facet (*family*, *work*, and *social*). We extract various features such as communication intensity, regularity, medium, and temporal tendency, and classify the relationships using machine-learning techniques. Our experimental results on 40 users showed that we could classify life facets with up to 90% accuracy. The most
relevant features include call duration, channel selection, and time of day for the communication.

2.Title: Happiness Recognition from Mobile Phone Data
Author: Andrey Bogomolov, Bruno Lepri,

Description:
In this paper we provide the first evidence that daily happiness of individuals can be automatically recognized using an extensive set of indicators obtained from the mobile phone usage data (call log, sms and Bluetooth proximity data) and "background noise" indicators coming from the weather factor and personality traits. Our final machine learning model, based on the Random Forest classifier, obtains an accuracy score of 80.81% for a 3-class daily happiness recognition problem. Moreover, we identify and discuss the indicators, which have strong predictive power in the source and the feature spaces, discuss different approaches, machine learning models and provide an insight for future research.

3.TITLE: EXPLORING EMOTIONAL PREFERENCE FOR SMARTPHONE APPLICATIONS

Author: Hyun-Jun Kim , Young Sang Choi.

Description:
Emotion is an essential element of human behaviours. In this research, we investigated human behaviours related with the touch interface on a smartphone as a way to understand users' emotional states. As modern smartphones have various embedded sensors such as accelerometer and gyroscope, we aim to utilize data from these embedded sensors for recognizing human emotion and further finding emotional preferences for smartphone applications. We collected 12 attributes from 3 sensors during users' touch behaviours, and recognized seven basic emotions with off-line analysis. Finally, we generated a preference matrix of applications by calculating the difference between prior and posterior emotional states to the application usage. The pilot study showed 0.57 of an average f1-measure score (and 0.82 with decision tree based methods) with 455 cases of touch behaviour. We discovered that a simple touching behaviour has a potential for recognizing users' emotional states.

4.TITLE: IDENTIFYING ASSOCIATIONS BETWEEN SMARTPHONE USAGE AND MENTAL HEALTH DURING DEPRESSION, ANXIETY AND STRESS

Author: J. Mehta ; A. Mishra ; K. Gawande

Description:

Reality mining in behavioral studies is one of the highly researched topics in computational science. The reason behind this great deal of experimentation is the particularly dynamic and potentially latent nature of human behavior. In this work, we have showcased our efforts in analyzing the associations between the smartphone usage and the mental state of the person during depression, stress and anxiety. We have particularly focused on descriptive modeling of data using multiple linear regression to find correlations between the passive smartphone data stream and the user filled survey. Finally we estimate the predictive capability and outline the major challenges of such a system.

III. MATHEMATICAL MODEL

Let S be whole System,
S={I,P,O}
Where,
I-input,
P-procedure,
O- Output.
Now,
Input (I):
I= {U,H}
U= user of android phone
H= Human Behavior
Procedure (P)-
P= { ER, E, B, DC}
Where,
ER= Emotion Recognition Model
ER={Ex,LR,M}
Ex=Extraction
LR=Linear regression
M=Mapping
E=Evaluation model
E={N,V}
N=Normalization
V=Validation
B=Behaviour Model
B={DT,DE,R}
DT=DASS test
DE=Decision
R=Results
DC= Data Collection
Output={R} Get result on android phone.

1. Decision Tree Algorithm:

- It establish a decision tree algorithm with no backtracking, top-down approach
- data gain is used to choose best one attribute for classification
- Entropy : it's a measure of uncertainty about a source of message, range is 0 to 1
  1 means homogeneous data
  Formula:
  E
  p(xi)=P(X=xi) is probabilistic mass function of X
- Information gain: it measures expected result in entropy
- Gain(S,A)=E(S)-I(S,A)
  = E(S) - Σ|Si| / |S| . E(Si)
  E(S) is constant for all attributes A
  A is the attriute

S is set of variables that is divided into subset Si

- Id3 calculates gain of all variables and selects one with the highest gain, which is located as root node position in decision tree
- In establishing a decision tree ID3 choose the feature which minimizes the entropy function and thus best discriminates among the training objects.

Implemention of ID3 Algorithm:

```
function ID3 (I, 0, T) {
/*I input attributes
*O output attribute
*T training data
**function ID3 returns a decision tree*/
if (T is empty)
{
return a single node with the value
"wrong";
}
if (all records in T have the same value for O) { 11
return a single node with that value;
}
if (I is empty)
{
return a single node with the value of the most frequent
value of O in T;
}
compute the information gain for each attribute in I relative to T;
let X be the attribute with largest Gain(X,T) of the attributes in I;
Let {x_j| j = 1,2, .., m} be the values of X;
Let {T_j| j = 1,2, .., m} be the subsets of T when T is partitioned according the value of X;
return a tree with the root node labelled X and arcs labelled x1, x2, x3... xm, where the arcs go to the
trees ID3(I-{X}, O, T_1), ID3(I-{X}, O, T_2)...
ID3(I-{X}, O, T_m);
}
```

Severity	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

As previously mentioned, the DASS should not be used on its own to assess the presence or absence of Depression or Anxiety. High scores on the DASS would certainly alert the clinician to a high level of distress in the patient and this would need to be explored further within the interview process. Similarly, low scores on the DASS should not be a substitute for a comprehensive clinical interview. High DASS scores which are not changing, may prompt the clinician to look for explanations and perhaps augment dosages or change medication. Here again, the DASS should be interpreted along side the clinical interview. Changes in scores in one scale (EG: Depression), with consistently high and unchanging scores in another scale (Anxiety) may alert the clinician to pay particular attention to the presence of a coexisting anxiety disorder which may need specific treatment in its own right. Similarly, decreasing Depression scores alongside

unchanging Stress scores may alert the clinician to the presence of some life event or problem, which may need to be addressed directly.

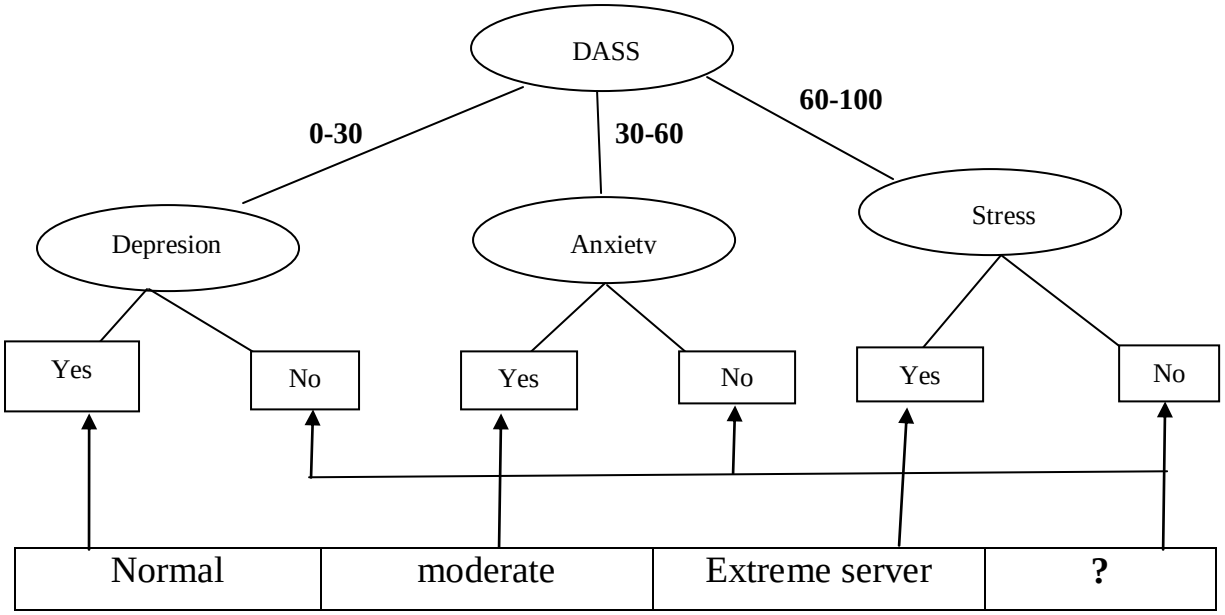
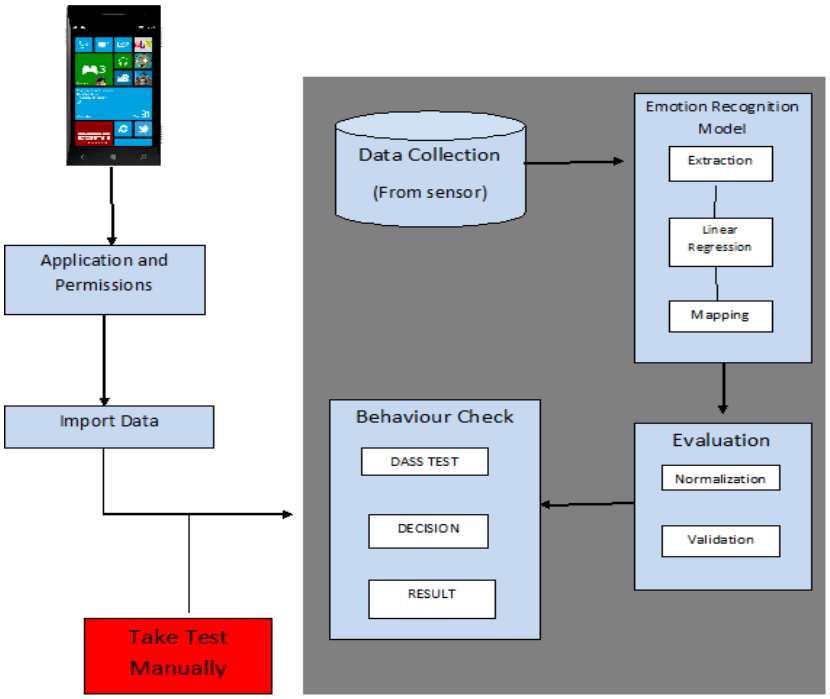


Fig.1

Regression Analysis:

In statistical modeling, **regression analysis** is a statistical process for calculating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables (or 'predictors').

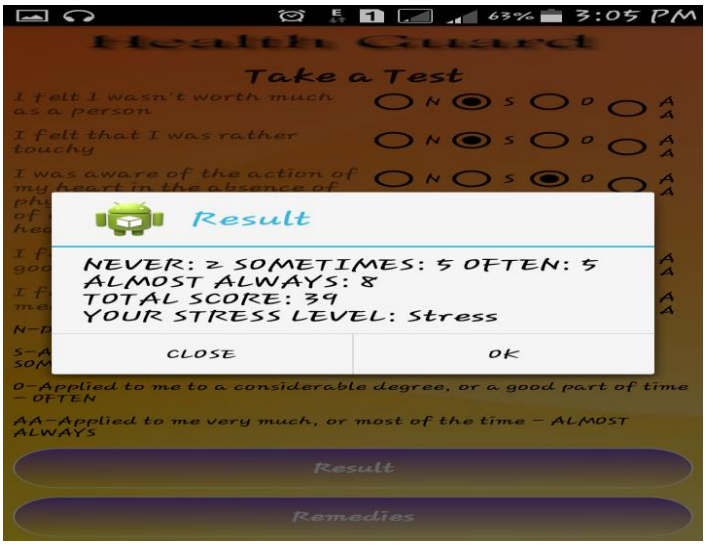
IV. SYSTEM ARCHITECTURE



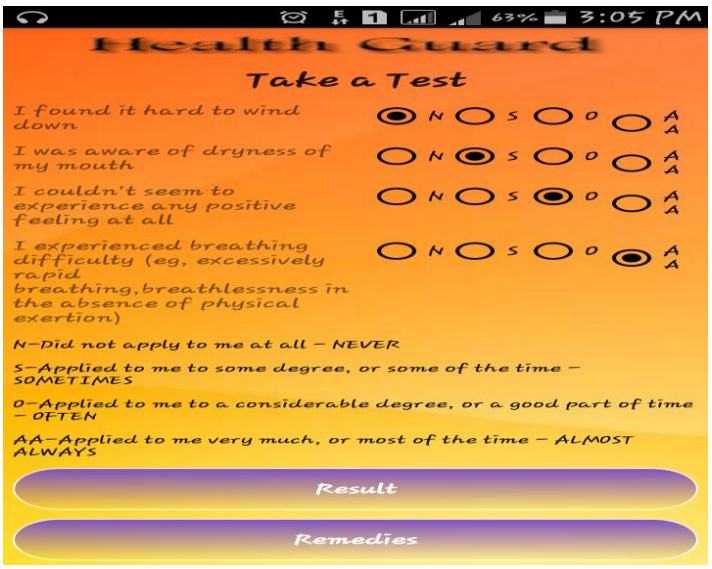
V. CONCLUSION

In this paper we build up an application that gathers clients information from the phone itself and gives day by day overhaul of one's enthusiastic state. What's more, if there are any strange behavioral exercises then client is given a test to check one's perspective. We fabricated our own application to screen cell phone use with the point of investigating and conceivably refining the sorts of components that could be utilized as a part of such examinations. We attempted to incorporate components, for example, screen status and system use in our models and discovered them as contributing elements in our investigation. Utilizing numerous direct relapse we tried different parameters and found that most ordinarily explored different avenues regarding components, for example, approaching and active call span and in addition system insights were frequently suitable to be incorporated into a prescient model.
For future degree there is work required in taking after points, which are improvement the procedure of reporting information by one self to check it with behavioral information, just select information required from the given dataset.

VI .RESULT ANALYSIS

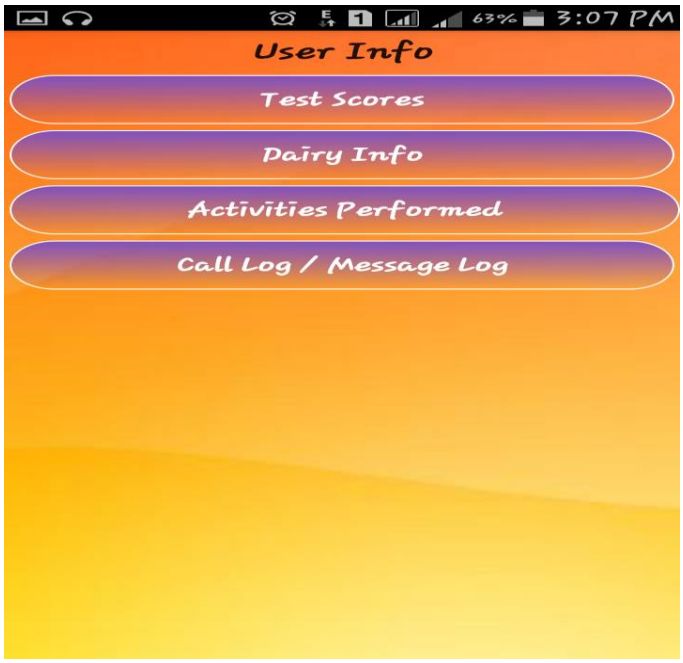


1)This is the result which we get. For the user.

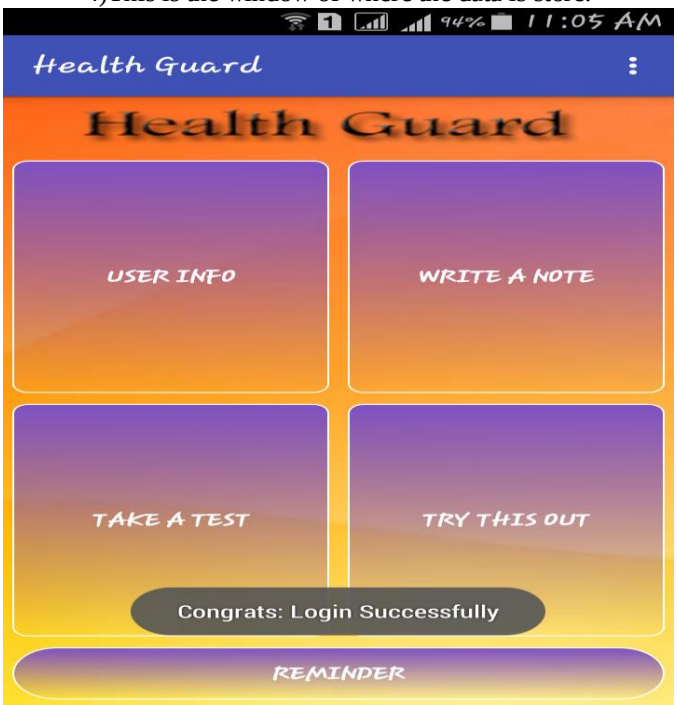


2)This is the window to give the Test for the Result.

3)This is the Diary info from which we are getting the info for result.

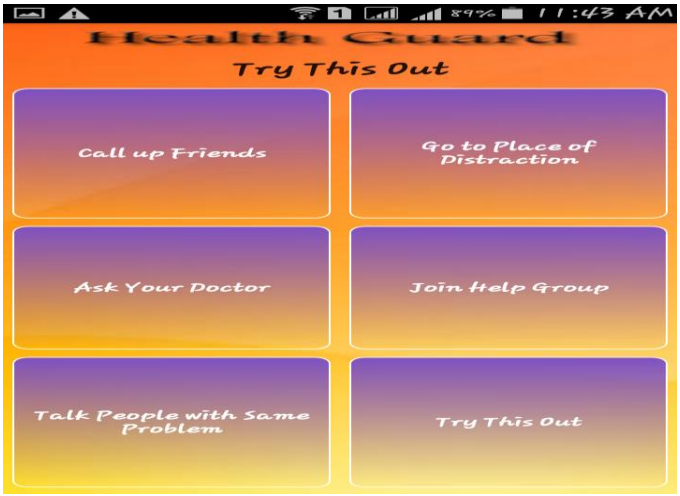


4)This is the window of where the data is store.



5) This is the window where the we can see the data.

6) This is the Login page .



7) This window is about to tell what precaution to be take for the problem.

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