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Mental Health Risk Prediction

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I. OVERVIEW

Globally, an estimated 264 million people suffer from depression, one of the leading causes of disability, with many of these people also suffering from symptoms of anxiety. A recent WHO-led study estimates that depression and anxiety disorders cost the global economy US$ 1 trillion each year in lost productivity. Unemployment is a well-recognized risk factor for mental health problems, while returning to, or getting work is protective. A negative working environment may lead to physical and mental health problems, harmful use of substances or alcohol, absenteeism and lost productivity. Workplaces that promote mental health and support people with mental disorders are more likely to reduce absenteeism, increase productivity and benefit from associated economic gains.
This information sheet addresses mental health and disorders in the workplace. It also covers difficulties which are not mental disorders but which may be created or exacerbated by work such as stress and burnout.

A. Work-related risk factors for health

There are many risk factors for mental health that may be present in the working environment. Most risks relate to interactions between type of work, the organizational and managerial environment, the skills and competencies of employees, and the support available for employees to carry out their work. For example, a person may have the skills to complete tasks, but they may have too few resources to do what is required, or there may be unsupportive managerial or organizational practices.

Risks to mental health include:

1) Inadequate health and safety policies;
2) Poor communication and management practices;
3) Limited participation in decision-making or low control over one's area of work;
4) Low levels of support for employees;
5) Inflexible working hours; and
6) Unclear tasks or organizational objectives.

Risks may also be related to job content, such as unsuitable tasks for the person's competencies or a high and unrelenting workload. Some jobs may carry a higher personal risk than others (e.g. first responders and humanitarian workers), which can have an impact on mental health and be a cause of symptoms of mental disorders, or lead to harmful use of alcohol or psychoactive drugs. Risk may be increased in situations where there is a lack of team cohesion or social support.
Bullying and psychological harassment (also known as "mobbing") are commonly reported causes of work-related stress by workers and present risks to the health of workers. They are associated with both psychological and physical problems. These health consequences can have costs for employers in terms of reduced productivity and increased staff turnover. They can also have a negative impact on family and social interactions.

B. Creating a Healthy Workplace

An important element of achieving a healthy workplace is the development of governmental legislation, strategies and polices as highlighted by the European Union Compass work in this area . A healthy workplace can be described as one where workers and managers actively contribute to the working environment by promoting and protecting the health, safety and well-being of all employees.

An academic report from 2014 suggests that interventions should take a 3-pronged approach:

1) Protect mental health by reducing work–related risk factors.
2) Promote mental health by developing the positive aspects of work and the strengths of employees.
3) Address mental health problems regardless of cause.

Building on this, a guide from the World Economic Forum highlights steps organizations can take to create a healthy workplace, including:

a) Awareness of the workplace environment and how it can be adapted to promote better mental health for different employees.
b) Learning from the motivations of organizational leaders and employees who have taken action.
c) Not reinventing wheels by being aware of what other companies who have taken action have done.
d) Understanding the opportunities and needs of individual employees, in helping to develop better policies for workplace mental health.
e) Awareness of sources of support and where people can find help.

Interventions and good practices that protect and promote mental health in the workplace include:

- Implementation and enforcement of health and safety policies and practices, including identification of distress, harmful use of psychoactive substances and illness and providing resources to manage them;
- informing staff that support is available;
- involving employees in decision-making, conveying a feeling of control and participation; organizational practices that support a healthy work-life balance;
- programmes for career development of employees; and
- recognizing and rewarding the contribution of employees.

Mental health interventions should be delivered as part of an integrated health and well-being strategy that covers prevention, early identification, support and rehabilitation. Occupational health services or professionals may support organizations in implementing these interventions where they are available, but even when they are not, a number of changes can be made that may protect and promote mental health. Key to success is involving stakeholders and staff at all levels when providing protection, promotion and support interventions and when monitoring their effectiveness.

Available cost-benefit research on strategies to address mental health points towards net benefits. For example, a recent WHO-led study estimated that for every US$ 1 put into scaled up treatment for common mental disorders, there is a return of US$ 4 in improved health and productivity.

C. Supporting People with Mental Disorders at Work

Organizations have a responsibility to support individuals with mental disorders in either continuing or returning to work. Research shows that unemployment, particularly long term unemployment, can have a detrimental impact on mental health. Many of the initiatives outlined above may help individuals with mental disorders. In particular, flexible hours, job-redesign, addressing negative workplace dynamics, and supportive and confidential communication with management can help people with mental disorders continue to or return to work. Access to evidence-based treatments has been shown to be beneficial for depression and other mental disorders. Because of the stigma associated with mental disorders, employers need to ensure that individuals feel supported and able to ask for support in continuing with or returning to work and are provided with the necessary resources to do their job.

Article 27 of The UN Convention on the Rights of Persons with Disabilities (CRPD) provides a legally-binding global framework for promoting the rights of people with disabilities (including psychosocial disabilities). It recognizes that every person with a disability has the right to work, should be treated equally and not be discriminated against, and should be provided with support in the workplace.

II. INTRODUCTION

A. DNN Classifier

A deep neural network is an artificial neural network which has an input layer, an output layer and at least one hidden layer. Deep neural networks use mathematical modeling to process data and predict outputs. The model used in the discussed problem uses 3 hidden layers of 10 neurons each and takes as parameters, the feature columns, hidden layers and Optimizer. The Optimizer used is Adagrad Optimizer with learning rate 0.1 and regularization of 0.005. The model is trained over 500 steps, and the data is divided into batches of batch size 500.

B. Aim

To increase mental health awareness in working individuals so as to ensure early detection and prevention of mental health issues.

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C. Objective

This project applies Deep Learning to predict the risk of any mental health disorder based on certain characteristics such as age and family history.

D. Problem Statement

To predict the risk of a Mental Health Disorder in working individuals based on a survey dataset available at Kaggle.

III. TECHNOLOGIES USED

A. DNNClassifier by Tensorflow

DNNClassifier is a pre-built model available in Google's Tensorflow library. This model is generally used to perform classification.

B. Flask Micro-web Framework

Flask is a micro-web framework written in python. It is helpful in deploying machine learning models into web applications.

C. HTML & CSS Frontend

HTML & CSS are used to make the front end of the web application.

D. Model Used

tensorflow.estimator. DNNClassifier

The DNNClassifier calls tf.estimator.DNNClassifier from the tensorflow python API. This command builds a multilayer feedforward neural network that is trained with a set of labelled data in order to perform classification on similar unlabelled data.

IV. IMPLEMENTATION

```
age = tf.feature_column.numeric_column("Age")
gender = tf.feature_column.numeric_column("Gender")
family_history = tf.feature_column.numeric_column("family_history")
benefits = tf.feature_column.numeric_column("benefits")
care_options = tf.feature_column.numeric_column("care_options")
anonymity = tf.feature_column.numeric_column("anonymity")
leave = tf.feature_column.numeric_column("leave")
work_interfere = tf.feature_column.numeric_column("work_interfere")
feature_columns = [age, gender, family_history, benefits, care_options, anonymity, leave, work_interfere]

model = tf.estimator.DNNClassifier(feature_columns=feature_columns,
                                   hidden_units=[10, 10, 10],
                                   optimizer=tf.train.ProximalAdagradOptimizer(
                                     learning_rate=0.1,
                                     l1_regularization_strength=0.005
                                   ))

pred = model.train(input_fn=lambda:train_input_fn(X_train, y_train, batch_size), steps=train_steps).predict(y_test)
print(pred)
```

```
eval_result = model.evaluate(
    input_fn=lambda:eval_input_fn(X_test, y_test, batch_size))

accuracy = eval_result['accuracy'] * 100
print(accuracy)
print(eval_result)
```

```
INFO:tensorflow:Calling model_fn.
WARNING:tensorflow:Trapezoidal rule is known to produce incorrect PR-AUCs; please switch to "careful_interpolation" instead.
WARNING:tensorflow:Trapezoidal rule is known to produce incorrect PR-AUCs; please switch to "careful_interpolation" instead.
INFO:tensorflow:Done calling model_fn.
INFO:tensorflow:Starting evaluation at 2019-03-29T14:32:02Z
INFO:tensorflow:Graph was finalized.
INFO:tensorflow:Restoring parameters from C:\Users\DELL\AppData\Local\Temp\tmp8wbovc3p\model.ckpt-500
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
INFO:tensorflow:Finished evaluation at 2019-03-29-14:32:03
INFO:tensorflow:Saving dict for global step 500: accuracy = 0.8174603, accuracy_baseline = 0.5119048, auc = 0.88422513, auc_pre
cision_recall = 0.86193335, average_loss = 0.44097653, global_step = 500, label/mean = 0.48809522, loss = 111.12608, precision
= 0.76551723, prediction/mean = 0.5125101, recall = 0.902439
INFO:tensorflow:Saving 'checkpoint_path' summary for global step 500: C:\Users\DELL\AppData\Local\Temp\tmp8wbovc3p\model.ckpt-5
00
81.7460298538208
{'accuracy': 0.8174603, 'accuracy_baseline': 0.5119048, 'auc': 0.88422513, 'auc_precision_recall': 0.86193335, 'average_loss':
0.44097653, 'label/mean': 0.48809522, 'loss': 111.12608, 'precision': 0.76551723, 'prediction/mean': 0.5125101, 'recall': 0.902
439, 'global_step': 500}
```


In [94]:
```
# Generate predictions from the model
template = ('\nIndex: "{}", Prediction is "{}" ({:.1f}%), expected "{}"')

# Dictionary for predictions
col1 = []
col2 = []
col3 = []


for idx, input, p in zip(X_test.index, y_test, predictions):
    v  = p["class_ids"][0]
    class_id = p['class_ids'][0]
    probability = p['probabilities'][class_id] # Probability

    # Adding to dataframe
    col1.append(idx) # Index
    col2.append(v) # Prediction
    col3.append(input) # Expecter


results = pd.DataFrame({'index':col1, 'prediction':col2, 'expected':col3})
results.head()
```

Out[94]:

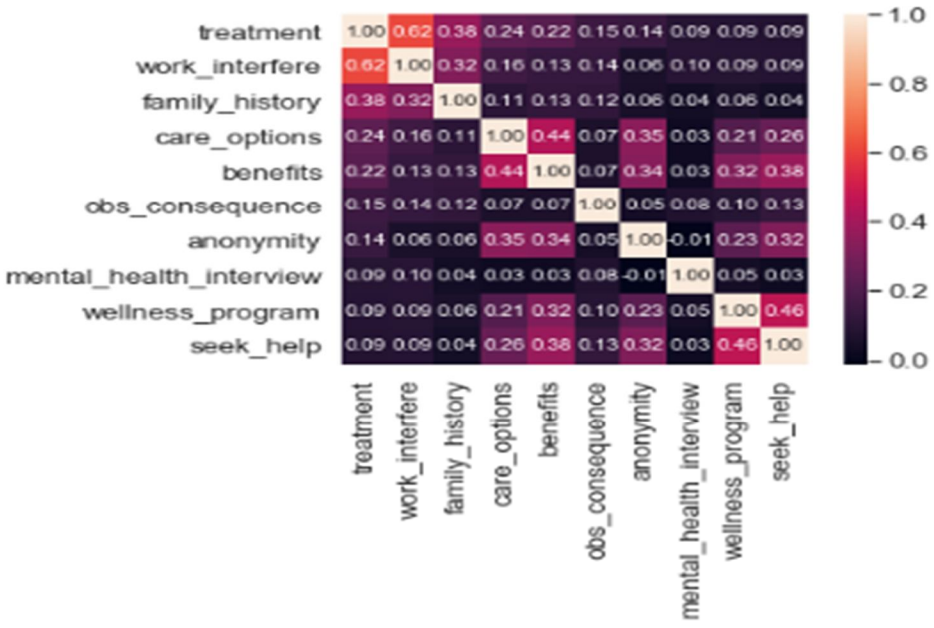
	index	prediction	expected
0	5	1	0
1	494	0	0
2	52	0	0
3	984	0	0
4	186	0	0

A. Input Features

Age?
Gender?
If you have a mental health condition do you feel that it interfaces with your work?
How easy is it for you to take medical leave for a mental health condition?
Is your anonymity protected if you choose to take advantage of mental health or substance abuse treatment resources?
Do you the options for mental health care your employer provides?
Does your employer provides mental health benefits?
Do you have a family history of mental illness?

V. EXECUTION

This model predicts whether user may or may not have a mental health risk with probability of the given prediction being true.



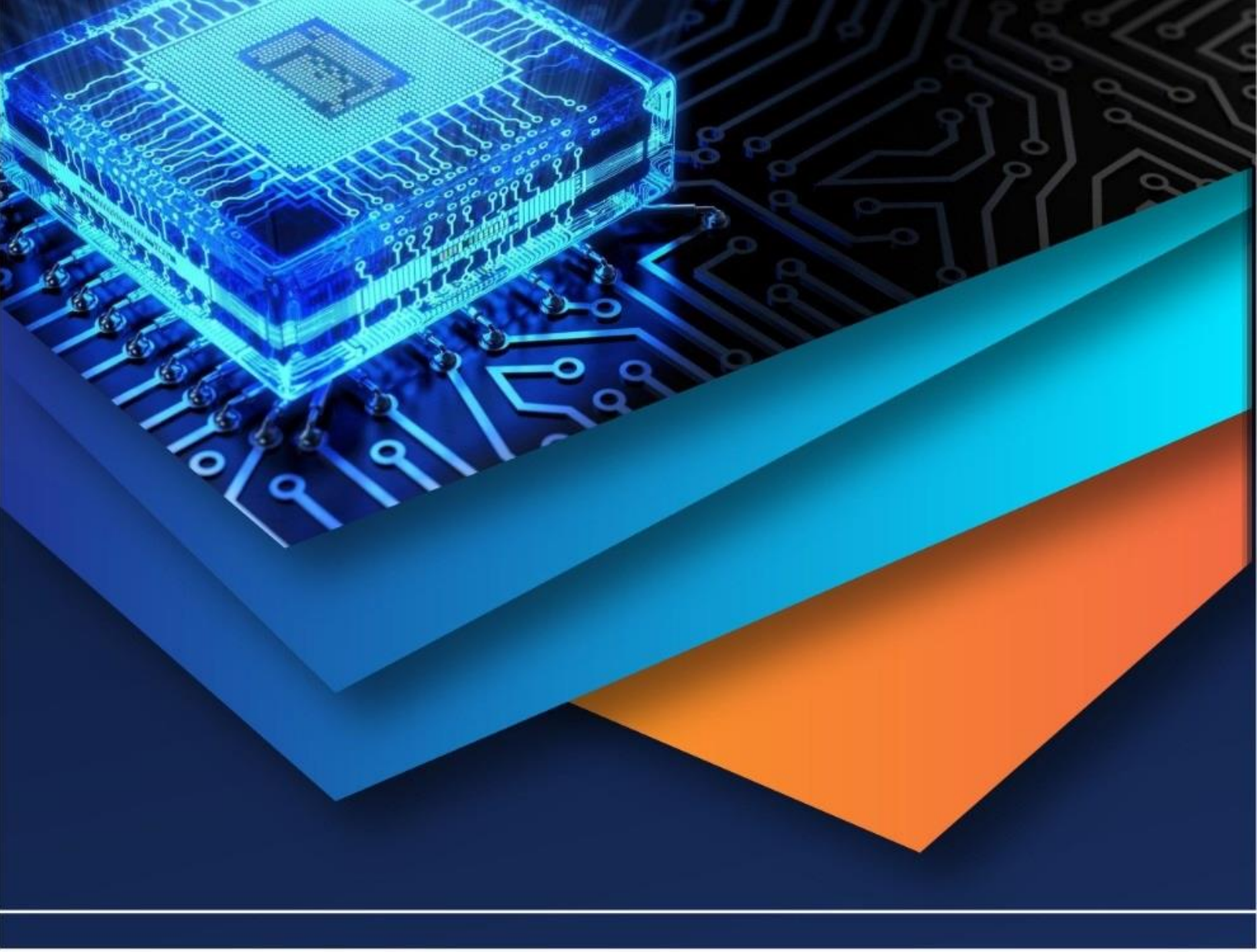
A. Results Obtained

An accuracy of 81.74% is obtained by the model, the model works fairly well in predicting whether or not an user has a mental health risk.

1) *Data Visualization:* Visualizing and understanding the data and dropping unnecessary features.
2) *Data Preprocessing:* Preprocessing the data to convert all features into numeric values and normalizing Age. Initializing Model We initialize the model with three hidden layers of 10 units each.
3) Training Training our model on preprocessed data so as to make predictions: Evaluating Accuracy We finally evaluate the accuracy which comes out to be 81.74% and make prediction on testing data.

VI. CONCLUSION

In this report, we looked at the DNN Classifier by the TensorFlow. We have implemented it for the MentalHealthPrediction to predict the Mental Health of a person in corporate sectors.



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