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Stress Prediction Using CNN: A Deep Learning Approach for Employee Well-Being Analysis

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Abstract:
Workplace stress is a critical factor affecting employee productivity, mental well-being, and overall job satisfaction. This project presents a deep learning-based stress prediction model using Convolutional Neural Networks (CNN) to analyze employees' textual feedback and determine their emotional state. The system processes text input provided by workers, classifies their emotions into categories such as happy, sad, stressed, ext…and predicts the intensity of stress levels. The CNN model is trained on a labeled dataset containing textual expressions of different emotional states, utilizing Natural Language Processing (NLP) techniques for feature extraction. By leveraging CNN's ability to capture complex text patterns, the model provides an accurate and efficient stress-level assessment. This solution can help organizations monitor employees' emotional well-being, enabling proactive interventions to improve workplace mental health.
Keywords: CNN, NLP

1. Introduction

- To develop a stress prediction model using Convolutional Neural Networks (CNN) to analyze employees' textual feedback.
- To classify emotions into different categories such as happy, sad, stressed, relaxed, and anxious based on text input.
  To help organizations monitor employee well-being and take proactive steps for mental health support.fic.

2. Deep Learning Introduction

Deep Learning is a branch of Artificial Intelligence (AI) that enables machines to learn patterns from large amounts of data using multi-layered neural networks. It is widely used in image recognition, speech processing and natural language understanding.

- Learns automatically from large datasets
- Uses multi-layer neural networks
- Powers modern AI applications like chatbots and self-driving cars

Introduction to Neural Networks

Neural Networks are the foundation of deep learning and are inspired by the structure of the human brain. They consist of interconnected neurons arranged in layers that process input data and learn patterns.

- Neural Networks
- Biological Neurons vs Artificial Neurons
- Single Layer Perceptron
- Multi-Layer Perceptron
- Artificial Neural Networks (ANNs)
- Types of Neural Networks
- Architecture and Learning process in neural network
- Practical Applications
- Challenges in Deep Learning

- Deep Learning Framework

Basic Components of Neural Networks

Neural networks consist of several components that control how data flows through the network and how learning occurs during training. These components help the model adjust parameters and improve predictions

- Layers in Neural Networks
- Weights and Biases
- Forward Propagation
- Activation Functions
- Loss Functions
- Backpropagation
- Learning Rate
- Deep Learning Algorithms

Optimization Algorithm in Deep Learning

Optimization algorithms are used to minimize the loss function by updating the weights and biases during training. These algorithms help the model converge faster and improve performance.

- Gradient Descent
- Stochastic Gradient Descent (SGD)
- Mini-batch Gradient Descent
- Momentum Optimizer
- Adagrad Optimizer
- RMSProp Optimizer
- Adam (Adaptive Moment Estimation)

Convolutional Neural Networks (CNNs)

Convolutional Neural Networks are specialized deep learning models designed for processing image and spatial data. They automatically detect important visual features such as edges, textures and shapes.

- Introduction
- Padding
- Convolutional Layers
- Pooling Layers
- Fully Connected Layers
- Backpropagation in CNNs
- CNN based Image Classification

CNN Architectures

- LeNet-5
- AlexNet
- VGGnet
- VGG-16

- GoogLeNet/Inception
- ResNet (Residual Network)
- MobileNet

Existing System:

- Traditional stress detection methods rely on self-assessment surveys and physiological sensors.
- These methods are time-consuming, subjective, and less scalable.
- Many existing models use rule-based or basic machine learning techniques that may not effectively capture contextual meaning in text.
- Limited real-time analysis capabilities for continuous employee monitoring.

Proposed System:

- Develop a CNN-based deep learning model for stress prediction from textual input.
- Utilize Natural Language Processing (NLP) to extract meaningful features from text data.
- Implement a multi-class emotion classification (e.g., happy, sad, stressed, relaxed, anxious).
- Predict the intensity of stress levels using CNN's ability to capture textual patterns.
- Provide real-time stress analysis for organizations to monitor employee well-being.
- Improve accuracy and efficiency compared to traditional methods using deep learning.

Appendix (12pt bold)
Well-being is a dynamic construct that evolves over time and fluctuates within individuals, presenting challenges for accurate quantification. Reduced well-being is often linked to depression or anxiety disorders, which are characterised by biases in visual attention towards specific stimuli, such as human faces. This paper introduces a novel approach to screening of affective disorders by analysing visual attention scan paths using convolutional neural networks (CNNs).
Risk Prediction (multi-class classification). Quantitative results show that the proposed HDLF achieved superior performance over Logistic Regression (LR), Random Forest (RF), Gradient Boosting (GB), and single-branch neural networks. For retention prediction, it achieved an accuracy of 91%, a precision of 90%, a recall of 93%, an F1-score of 91%, and a ROC-AUC of 0.94. For burnout risk prediction, it achieved macro-averaged accuracy of 88%, precision of 86%, recall of 87%, and F1-score of 86%. Confusion matrices indicate improved detection of "At Risk" and "High Burnout" employees, critical for HR interventions, while ROC-AUC confirms strong class separability. The proposed framework demonstrates scalability and reliability, with future work focusing on real-time analytics, cross-industry datasets, and explainable AI for transparent HR decision-making.
Keywords-work-life balance; IT sector; tele commuting; employee monotony; burnout; gender bias.

Table 1: Sample Physiological Sensor Dataset

cases	sections	Mean	LF Box (HRV)	Median RR	SD1_Cox	Stress_Level
case_01	1	78.5	4.21	810ms	25.1	0 (No Stress)
case_01	2	95.2	2.15	650ms	12.3	1 (Stressed)
case_02	1	72.1	4.88	850ms	28.9	0 (No Stress)
case_02	2	102.3	1.9	580ms	9.7	2 (H

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References 2 - Additional Study

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4. Conclusion

Researchers are always working to improve many approaches, tools, and procedures that have been developed to date in order to discover breaches in computer networks. This survey highlights recent studies on models of detection and integrating models to support intrusion detection and datasets. Several articles and research papers are discussed in this paper to evaluate the effectiveness and performance of various ensemble learning algorithms with feature selection. In the future, we'll concentrate on developing an effective retraining method to make it easier to deploy on real-time datasets and deliver a superior IDS solution.