Fall Risk Prediction with Artificial Intelligence Models

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Outline

1. Introduction
2. Literature Review
3. Methodology
4. Results
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Introduction

1 Background

- The elderly are particularly affected.
- Serious health problems like disability and loss of independence.
- Psychological impact, increasing depression and stress.
- High mortality rates and frequent hospitalisations in older adults.

2 Problem Statement

The purpose of the study is to introduces a predictive model for fall risk classification, comparing deep learning and machine learning techniques to support the development of preventive measures in the health sector.

3 Objectives & Aims

- Video data from specific location.
- Computer vision for feature extraction.
- kNN, SVM, CNN and LSTM to classify
- Ensemble Methods to improve accuracy

Literature Review

1

McCall et al. (2024)

- Computer Vision
- Machine Learning

2

Chen et al. (2022)

- Computer Vision
- Kinect Motion system
- Machine Learning

3

Cedeno-Moreno et al. (2024)

- Tinetti scale
- Machine Learning

4

Sampath Dakshina Murthy et al. (2021)

- Deep Convolutional Neural Network (DCNN)
- ResNet 50 and Convolutional Neural Network (CNN)

Methods

Public dataset from the Mendeley Data website, consisting of 188 videos categorized into three subfolders: Knee Osteoarthritis (KOA), Parkinson's Disease (PD), and Normal/Healthy (NM) individuals with early (EL), mild (ML), moderate (MD), and severe (SV) categories.

Demographic information

Subject ID	Avg.age (in years)	Avg.high (in meters)
KOA-EL	47.1	1.54
KOA-MD	59.8	1.58
KOA-SV	62.4	1.54
PD-ML	66.5	1.67
PD-MD	69.8	1.61
PD-SV	70	1.66
NM	43.7	1.60
Average	59.9	1.60

Methods

Used Tools

- Jupyter Notebook
- Python
- NumPy
- Pandas
- OpenCV
- Scikit-Learn
- Seaborn
- Matplotlib
- TensorFlow

Applied Techniques

1. **Computer Vision**
   - 2D anatomical key points
2. **Machine Learning**
   - k-Nearest Neighbor (KNN)
   - Support Vector Machine (SVM)
3. **Deep Learning**
   - Convolutional Neural Network (CNN)
   - Long Short-Term Memory (LSTM)
4. **Ensemble Method**
   - Gradient Boosting
   - Random Forest

Results

Ensemble Methods

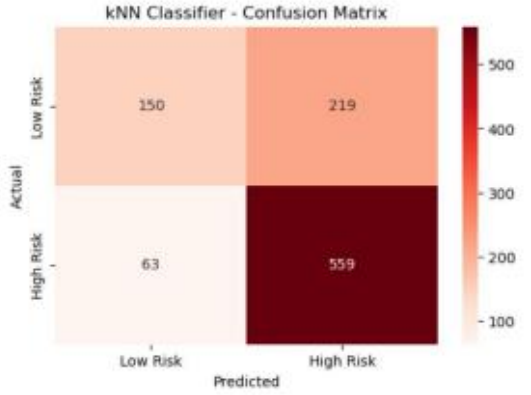
Random Forest Classifier:
Accuracy: 0.9162462159434914
Classification Report:

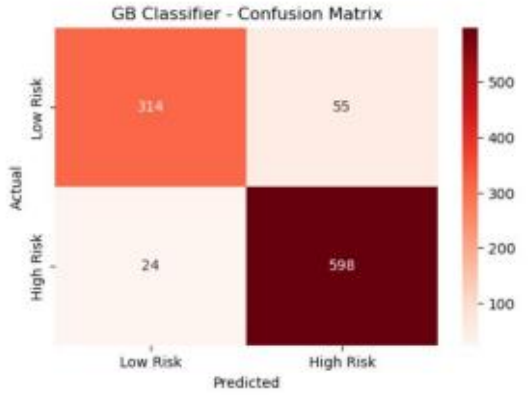
	precision	recall	f1-score	support
0	0.89	0.88	0.89	369
1	0.93	0.94	0.93	622
accuracy			0.92	991
macro avg	0.91	0.91	0.91	991
weighted avg	0.92	0.92	0.92	991

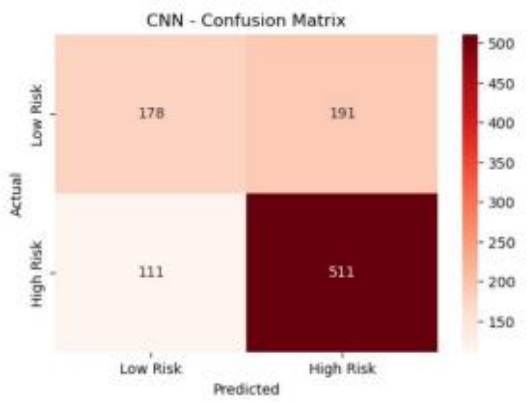
Gradient Boosting Classifier:
Accuracy: 0.9202825428859738
Classification Report:

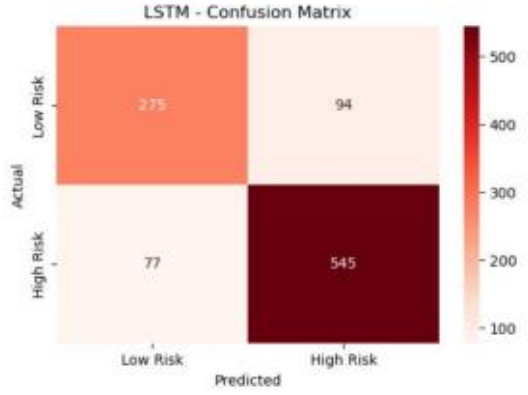
	precision	recall	f1-score	support
0	0.93	0.85	0.89	369
1	0.92	0.96	0.94	622
accuracy			0.92	991
macro avg	0.92	0.91	0.91	991
weighted avg	0.92	0.92	0.92	991

Confusion Matrices









Statistical Metrics

Method	Accuracy	Precision	Recall	F1-score
k-Nearest Neighbor (kNN)	0.72	0.71	0.65	0.66
Support Vector Machine (SVM)	0.64	0.61	0.59	0.59
Convolutional Neural Network (CNN)	0.83	0.82	0.81	0.81
Long Short Term Memory (LSTM)	0.70	0.67	0.65	0.66
Random Forest Classifier	0.91	0.91	0.91	0.91
Gradient Boosting Classifier	0.92	0.91	0.91	0.91

Conclusions

1

Limitations and Successes

Study Limitations: A limited, controlled dataset reduces the generalisability to real world scenarios.
Key Achievements: OpenPose integration with ensemble methods, especially gradient boosting, improved predictive accuracy.

2

Future Work

- Dataset Expansion
- Sensor Integration
- Exploring Alternative Algorithms

3

Real World Application

- Enhanced Fall Prediction and Prevention
- Applications in Rehabilitation
- Applications in Safety Protocols

References

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THANK YOU

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