Your AI GuardianAngel: A Deep Learning-Based Fall Detection System

Student: Qin Lu **Academic Supervisor:** Bryan Hennelly

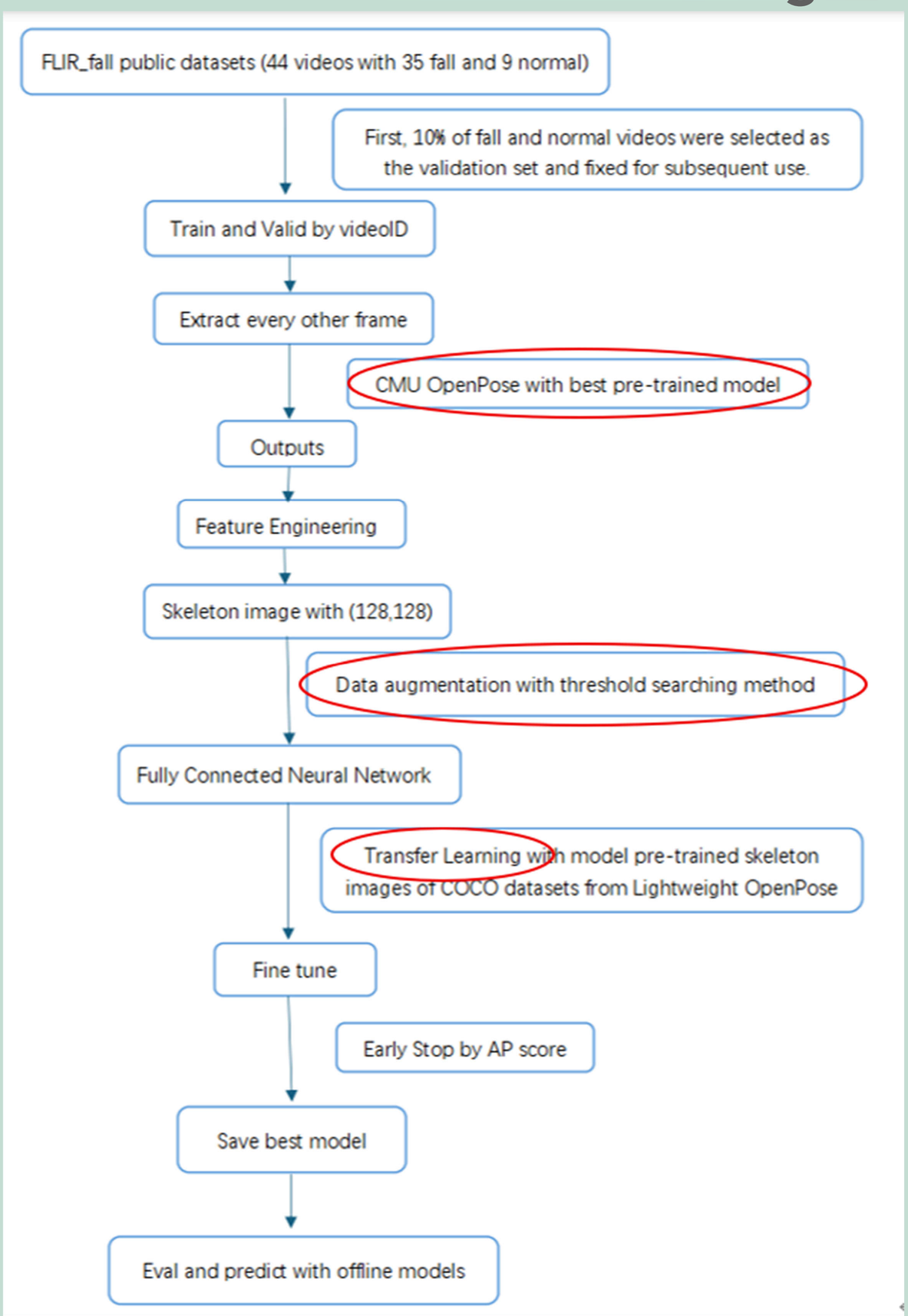
Introduction

Problem Statement: Falls are severe, yet vision-based detection faces major challenges: environmental noise, extreme class imbalance, privacy concerns.
Core Target: Can we train a high-performance model using fast and efficient data under privacy-protection?

Methods/Techniques

1 - Transfer Learning
2 - Data augmentation by threshold search method
3 - Early stop function with average precision score
4 - Data pre-process to avoid data leakage
5 - Multi-criteria evaluation
6 - Interface of privacy-protecting visualization

Creative Framework Design



Interface Visualization

Model Performance

	dataset@epoch-100	mAP	mean f1_score	mean loss
0	train	0.9846	0.9550	0.0519
1	valid	0.9932	0.9051	0.1403

1_fine_tune.ipynb U | 1_fine_tune.ipynb (output) | 2_eval.ipynb U

```
1 train | AP: 0.9158, F1: 0.8692, loss: 0.1745
1 valid | AP: 0.9978, F1: 0.9850, loss: 0.0356
@1 valid increased from (0.000000 → 0.997807).  Saving model ...
2 train | AP: 0.9644, F1: 0.9251, loss: 0.0921
2 valid | AP: 0.9949, F1: 0.9676, loss: 0.0651
EarlyStopping counter: 1 out of 100
3 train | AP: 0.9774, F1: 0.9402, loss: 0.0716
3 valid | AP: 0.9945, F1: 0.9423, loss: 0.0870
EarlyStopping counter: 2 out of 100
4 train | AP: 0.9818, F1: 0.9462, loss: 0.0621
4 valid | AP: 0.9949, F1: 0.9320, loss: 0.1076
EarlyStopping counter: 3 out of 100
5 train | AP: 0.9834, F1: 0.9496, loss: 0.0569
5 valid | AP: 0.9949, F1: 0.9341, loss: 0.1102
EarlyStopping counter: 4 out of 100
6 train | AP: 0.9841, F1: 0.9507, loss: 0.0553
6 valid | AP: 0.9947, F1: 0.9373, loss: 0.0998
EarlyStopping counter: 5 out of 100
7 train | AP: 0.9838, F1: 0.9509, loss: 0.0546
7 valid | AP: 0.9934, F1: 0.9373, loss: 0.1047
EarlyStopping counter: 6 out of 100
8 train | AP: 0.9844, F1: 0.9515, loss: 0.0543
8 valid | AP: 0.9919, F1: 0.8918, loss: 0.1423
EarlyStopping counter: 7 out of 100
9 train | AP: 0.9845, F1: 0.9517, loss: 0.0537
9 valid | AP: 0.9924, F1: 0.9331, loss: 0.1088
EarlyStopping counter: 8 out of 100
10 train | AP: 0.9845, F1: 0.9518, loss: 0.0535
10 valid | AP: 0.9924, F1: 0.9372, loss: 0.0999
EarlyStopping counter: 9 out of 100
11 train | AP: 0.9842, F1: 0.9522, loss: 0.0532
11 valid | AP: 0.9934, F1: 0.9373, loss: 0.1004
EarlyStopping counter: 10 out of 100
12 train | AP: 0.9848, F1: 0.9520, loss: 0.0533
12 valid | AP: 0.9922, F1: 0.9286, loss: 0.1173
EarlyStopping counter: 11 out of 100
13 train | AP: 0.9849, F1: 0.9516, loss: 0.0532
13 valid | AP: 0.9934, F1: 0.9373, loss: 0.1010
EarlyStopping counter: 12 out of 100
14 train | AP: 0.9846, F1: 0.9522, loss: 0.0531
14 valid | AP: 0.9922, F1: 0.9331, loss: 0.1112
```

Original Contributes

1.Innovatively introduce transfer learning to fall detection.
2.As a generalizable model applicable to both binary and multi-class tasks in human pose estimation.
3.Present feature engineering strategies and a creative two-tier model framework—integrating curriculum learning and transfer learning—to inspire new perspectives and exploration.

Maynooth University
Department of Electronic Engineering
Ollscoil Mhá Nuad
Roinn Innealtóireachta Leictreonaí

Maynooth University
National University of Ireland Maynooth