

Gait Analysis Using Deep Learning

In this preliminary project, you will build functional deep learning systems for binary and multi-class problems using Matlab or Python and experiment with the different options in the different stages of the processing stack. The selected application for this project is the classification of gait from Gait Energy Images [1], with three datasets provided for binary, 4-class and 6-class problems. The following instructions apply to Matlab just for ease of debugging:

1. Load the data into the workspace as a datastore.
2. Start Deep Network Designer App and select a pretrained network (make sure you install it first). Customize the network to fit your dataset. Analyze the network to ensure that it has no errors before exporting to workspace.
3. Select appropriate hyperparameters for your network trainer.
4. Start the training and follow the progress in the validation to ensure that the network is getting better. If not, stop the training and go back to adjust the hyperparameters to improve performance before running the training again.
5. Assess the performance of the network by computing the confusion matrix as well as performance metrics such as the accuracy, sensitivity (recall for each class), specificity (recall for normal class), positive predictive value (precision for each class), etc. Comment on the results.
6. Repeat the experiments to develop three deep learning networks for binary, 4-class, and 6-class problems.
7. Experiment with changing hyperparameters including Solver, Initial Learning Rate, Validation frequency, Maximum number of Epochs, Mini-Batch size, and Shuffle. Report your observations.

Project Deliverables

- A detailed report that address the required tasks using screenshots, results, and your comments and explanation whenever available.
- Literature search on recent scientific articles on the same problem (preferably using the same data) and a comparison of their results with yours.

Reference

[1] Ortells J, Herrero-Ezquerro MT, Mollineda RA, Vision-based gait impairment analysis for aided diagnosis. Medical & biological engineering & computing. 2018 Sep; 56:1553-64.