CARACTERIZACIÓN DE PATRONES DE LA ENFERMEDAD DE PARKINSON UTILIZANDO MODELOS DE APRENDIZAJE DE MÁQUINA.

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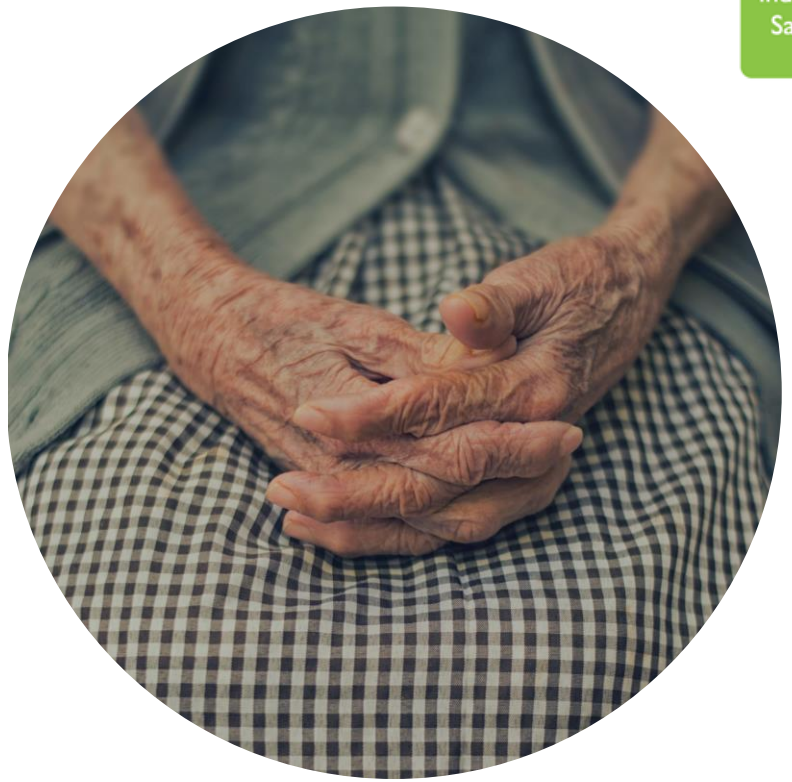
OUTLINE

- Parkinson’s Disease
- Proposed Method
- Evaluation and Results
- Conclusions

Parkinson's Disease

- Second most common neurodegenerative disorder
- **6,2 Million** people
- 12 Million People in 2030

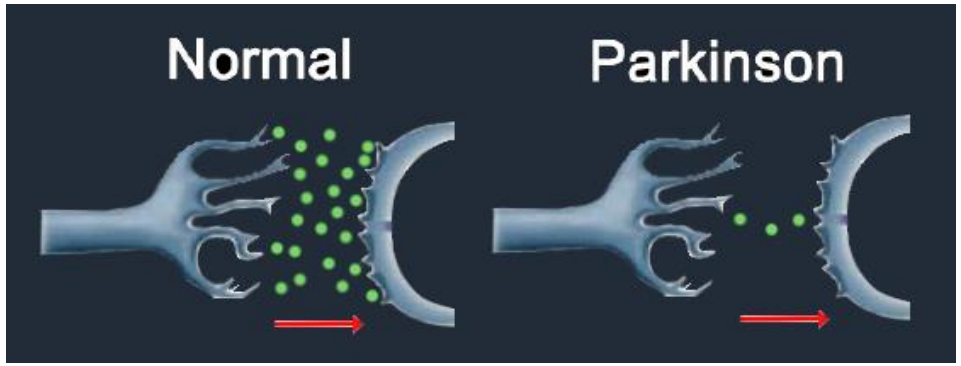


[1] Vos, T. et al. (2017). Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet, 390(10100), 1211-1259.

Parkinson's Disease

Decresed production of dopamine

causes gait disturbances



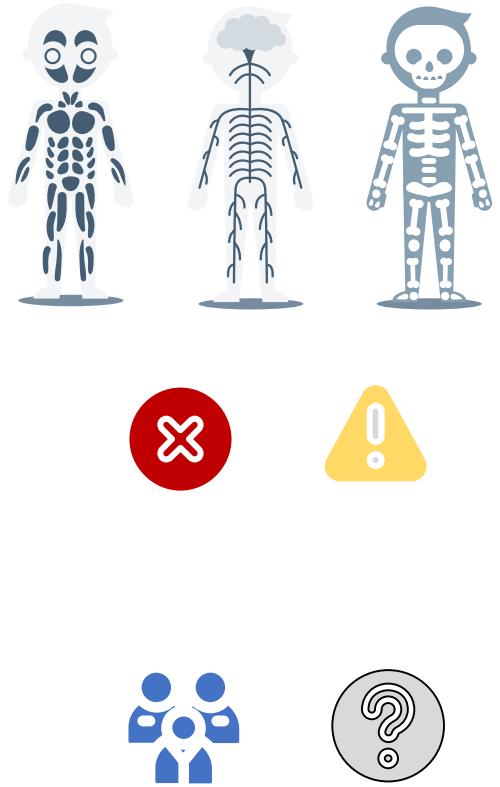
Body stiffness

Bradykinesia

[2] Morris, M. et al. (2001). The biomechanics and motor control of gait in Parkinson disease. Clinical biomechanics, 16(6), 459-470.

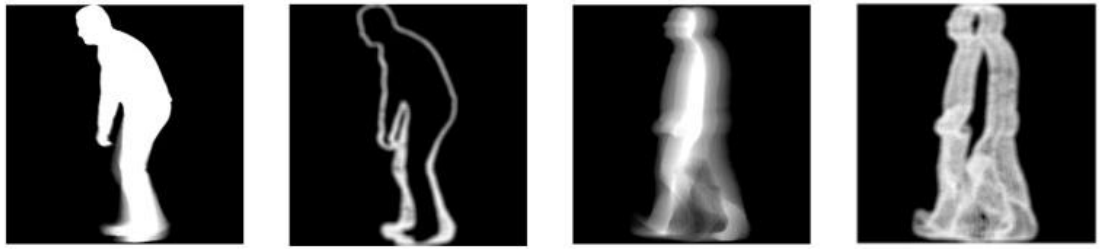
Understanding the Problem

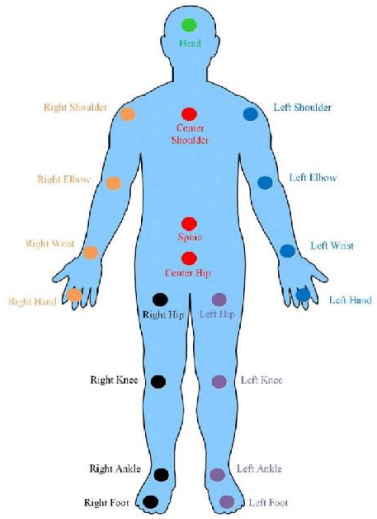
- **Lack of biomarkers:** There is no definitive test or biomarkers to quantity PD.
- **Misdiagnosis:** This results in a false positive rate up to 25%.
- **Subjectivity:** The diagnosis varies with respect to the stage of the disease and the physician's criteria.

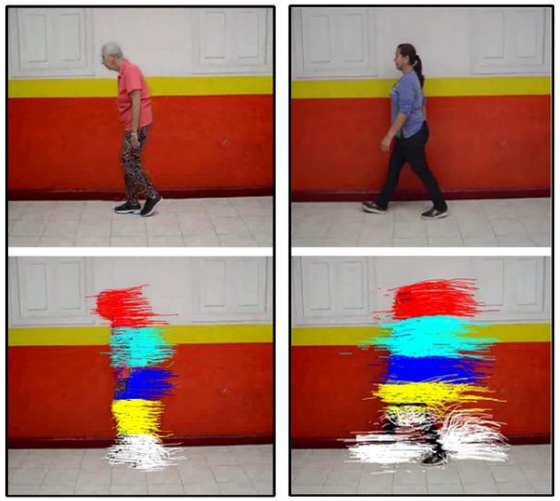


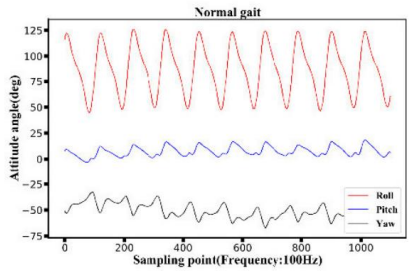
[3] World Health Organization. (2006). Neurological disorders: public health challenges. World Health Organization.

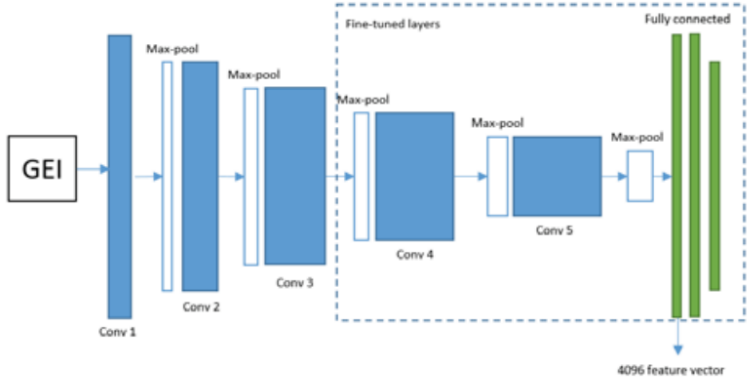
Parkinson's Disease





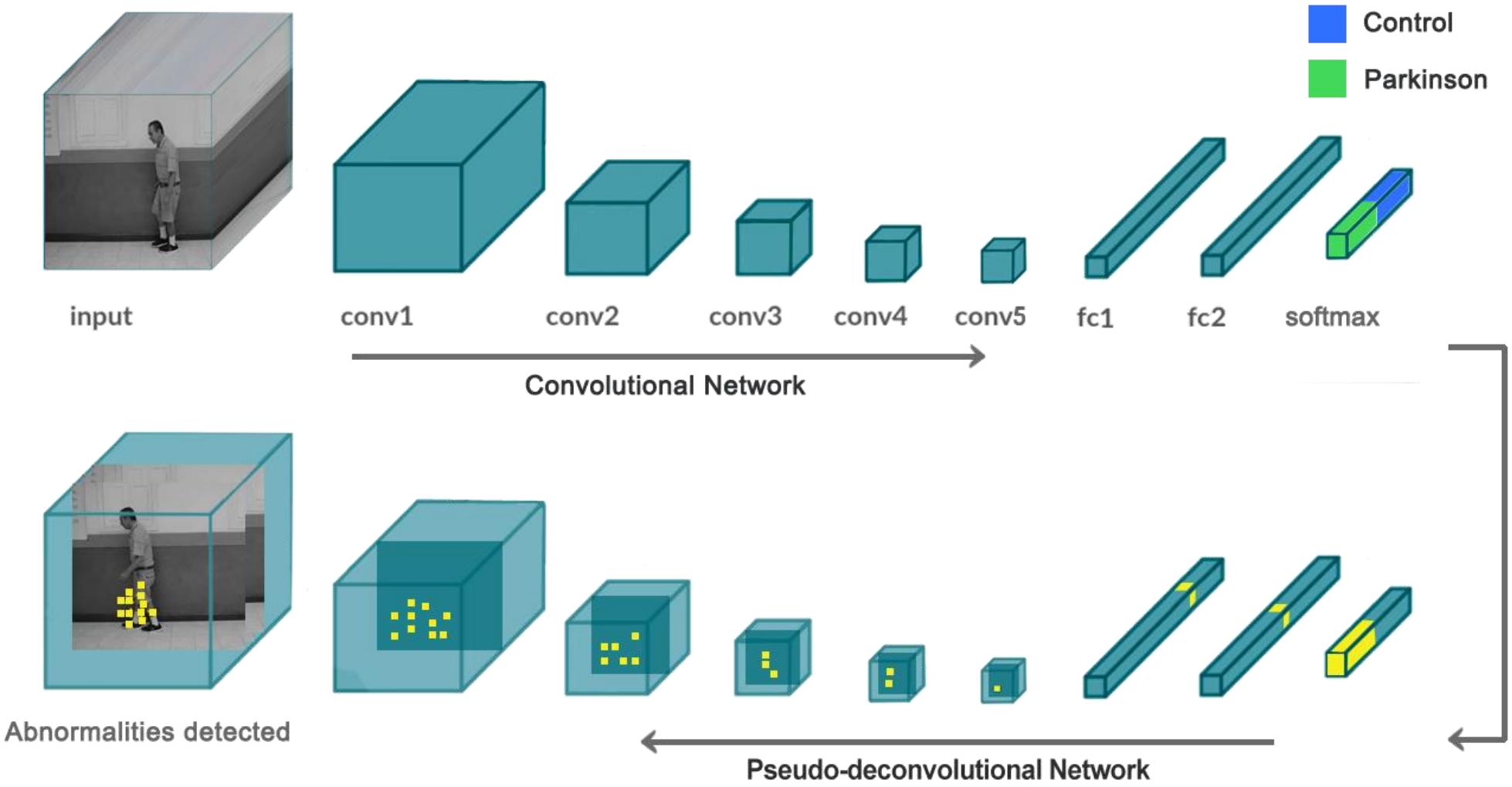






[4] Verlekar, T. et al. (2018). Automatic classification of gait impairments using a markerless 2D video-based system.
[5] Ren, P. et al. (2019). Multivariate Analysis of Joint Motion Data by Kinect: Application to Parkinson's Disease.
[6] Guayacán, L. et al. (2018, December). Parkinsonian gait characterization from regional kinematic trajectories.
[7] Gao, J. et al. (2019). Abnormal Gait Recognition Algorithm Based on LSTM-CNN Fusion Network.
[8] San-Segundo, R.et al. (2019). Increasing robustness in the detection of freezing of gait in Parkinson's disease.

Proposed Method



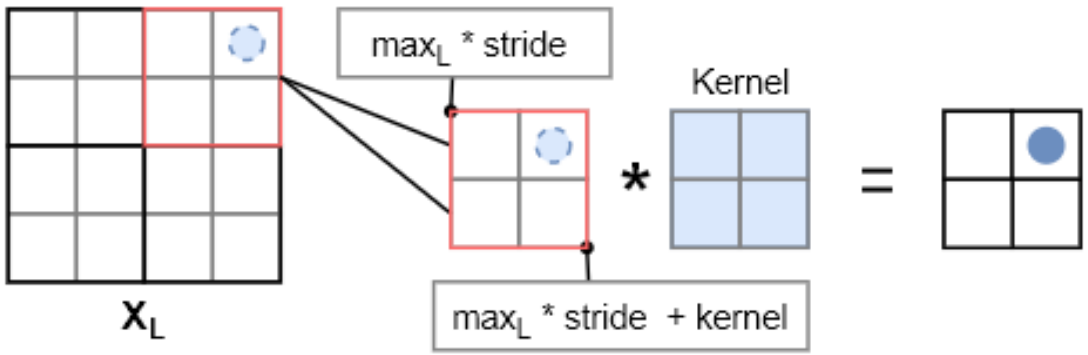
[9] Varol, G.et al. (2017). Long-term temporal convolutions for action recognition. IEEE transactions on pattern analysis and machine intelligence

Retropropagation Process

$$max_{L-1} = \arg\max_{j}(X_{L-1} \odot W_{L-1}^{j,max_L})$$

Where:

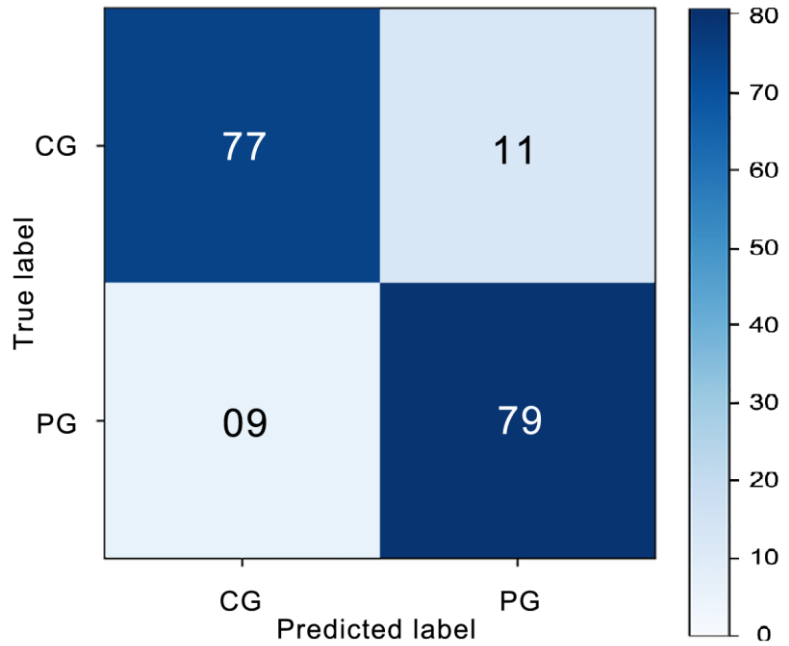
X is the input of the layer L-1
W are the weights of the layer L-1
j, **max**L are W row and column position, respectively



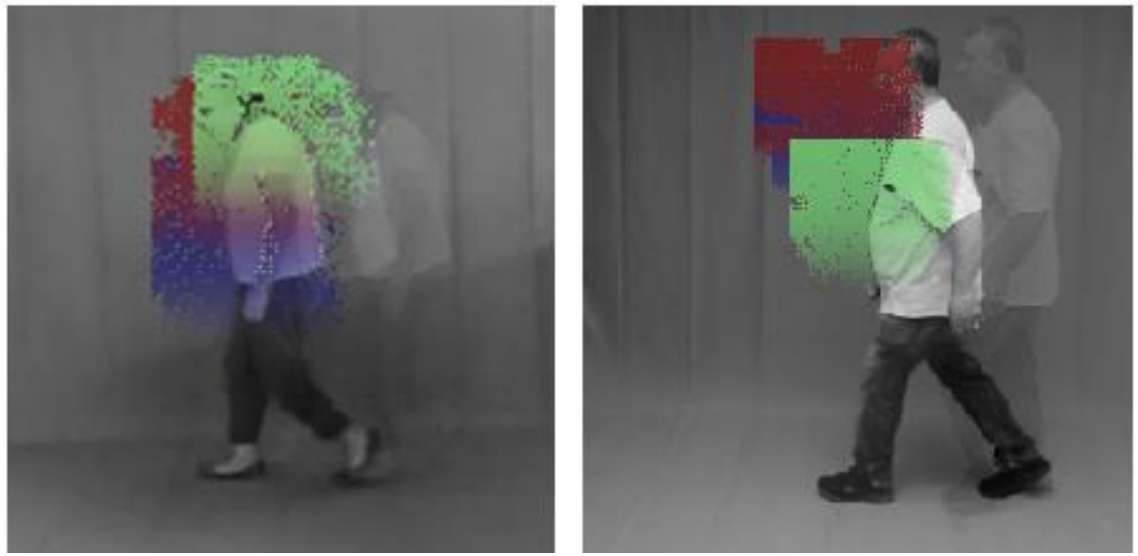
Evaluation and Results

Accuracy: **88%**

Dataset: 176 videos
11 PD patients, 11 control subjects
8 videos per patient

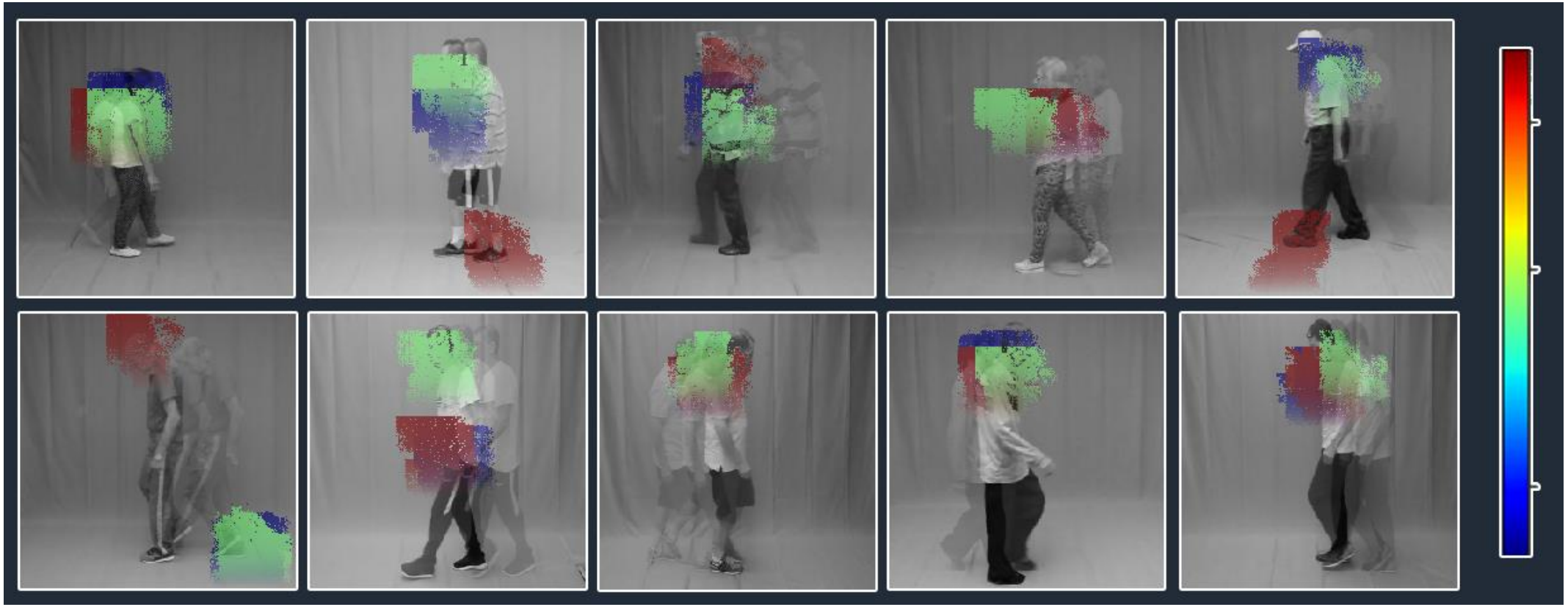


Confusion Matrix.



False positive and false negative patients.

Evaluation and Results



Salient maps. CNN architecture focuses the attention on non-common gait patterns but relevant parkinsonian biomarkers, i.e. head motion, abnormal trunk posture, and localized hand motions during swinging

Conclusions and future work

- This work introduced a markerless and learned spatio-temporal gait representation.
- A set of salience and parkinsonian related regions were computed from a proposed retro-propagation process.
- This regions could support physician observations and eventually could be ingegrated with diagnostic protocols of the disease.

- Future Works will include an exhaustive evaluation over a large dataset that include a description of different stages of the disease.

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Thanks!