Learning to Predict Autism Spectrum Disorder Based on the Visual Patterns of Eye-Tracking Scanpaths

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Background: Autism Spectrum Disorder

- Autism Spectrum Disorder (ASD) is a pervasive developmental disorder characterised by a set of impairments including social communication problems. [1]
- ASD has been considered to affect about 1% of the world's population (US Dep. of Health, 2018). [2]
- The hallmark of autism is an impairment of the ability to make and maintain eye contact. [3]

[1] L. Wing, and J. Gould, "Severe Impairments of Social Interaction and Associated Abnormalities in Children: Epidemiology and Classification". Journal of Autism and Developmental Disorders, 9(1), pp.11-29, 1979.

[2] U.S. Department of Health & Human Services. Data and statistics | autism spectrum disorder (asd) | ncbddd | cdc, 2018. URL: https://www.cdc.gov/ncbddd/autism/data.html.

[3] Coonrod, E. E. and Stone, W. L. (2004). Early concerns of parents of children with autistic and nonautistic disorders. Infants & Young Children, 17(3), 258–268.

Background: Eye-Tracking Technology

Screen-based eye trackers

Glasses

Gaze Scan-path →

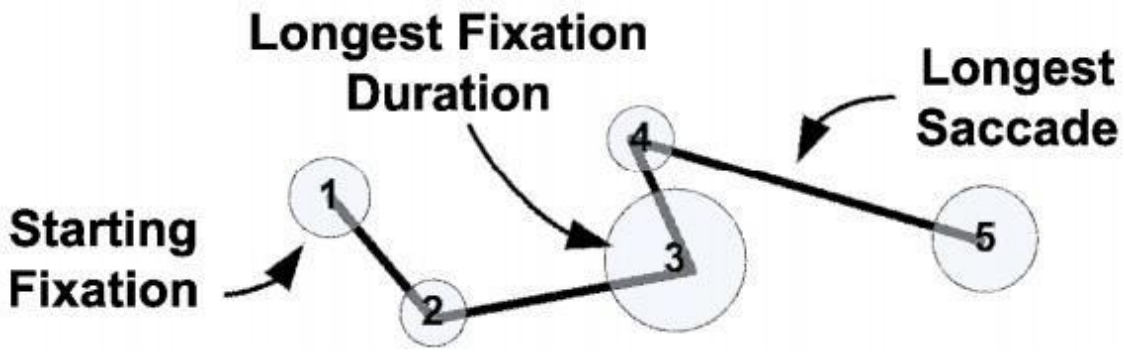

Image Source: https://imotions.com/blog/eye-tracking/

J.H. Goldberg, and J.I. Helfman, “Visual scanpath representation”, In Proceedings of the 2010 Symposium on Eye-Tracking Research & Applications, ACM, 2010, pp. 203-210.

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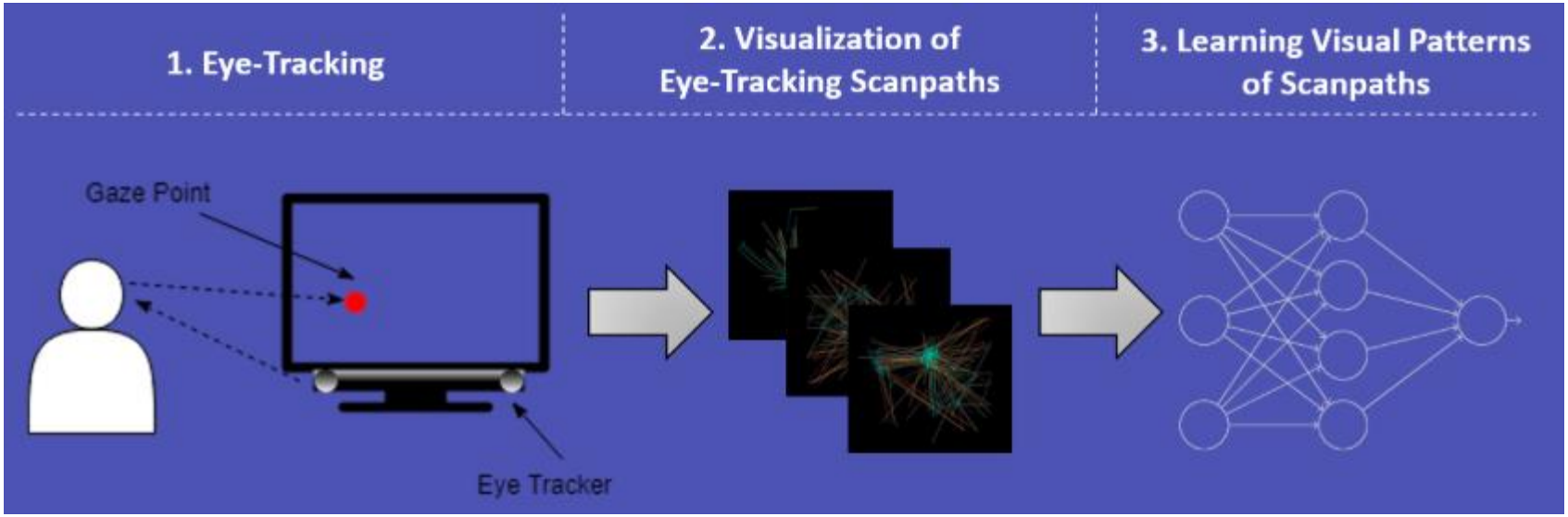
Key Idea:
Learning the Visual Patterns of Eye-Tracking Scanpaths



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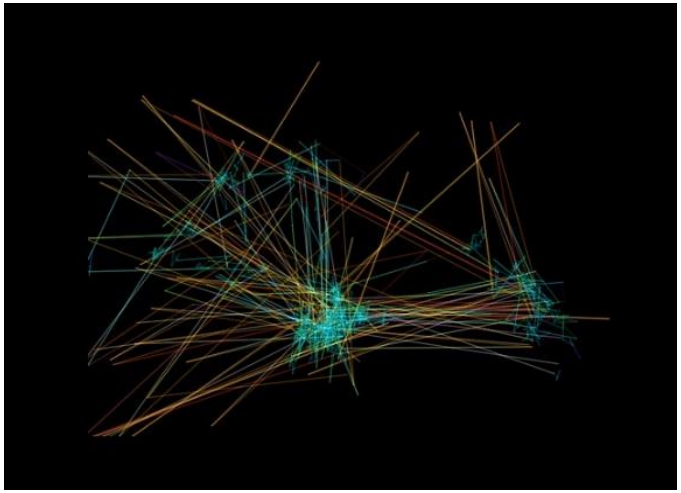
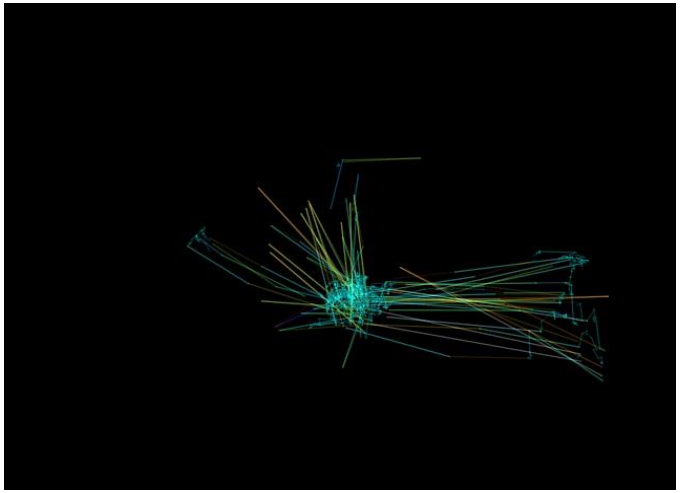
Data Description

- 59 participants.
- Avg age ≈7.88 years old.
- 547 images: 328 (Non-ASD), 219 (ASD)
- Image dimensions: 640x480



ASD



Non-ASD

Image Augmentation

- Augmentation was applied to produce variations of images based on a random set of transformations (e.g. rotation, shearing).
- The augmented dataset contained more than 3K samples.
- Implemented using Keras.

https://github.com/Mahmoud-Elbattah/Predicting_ASD

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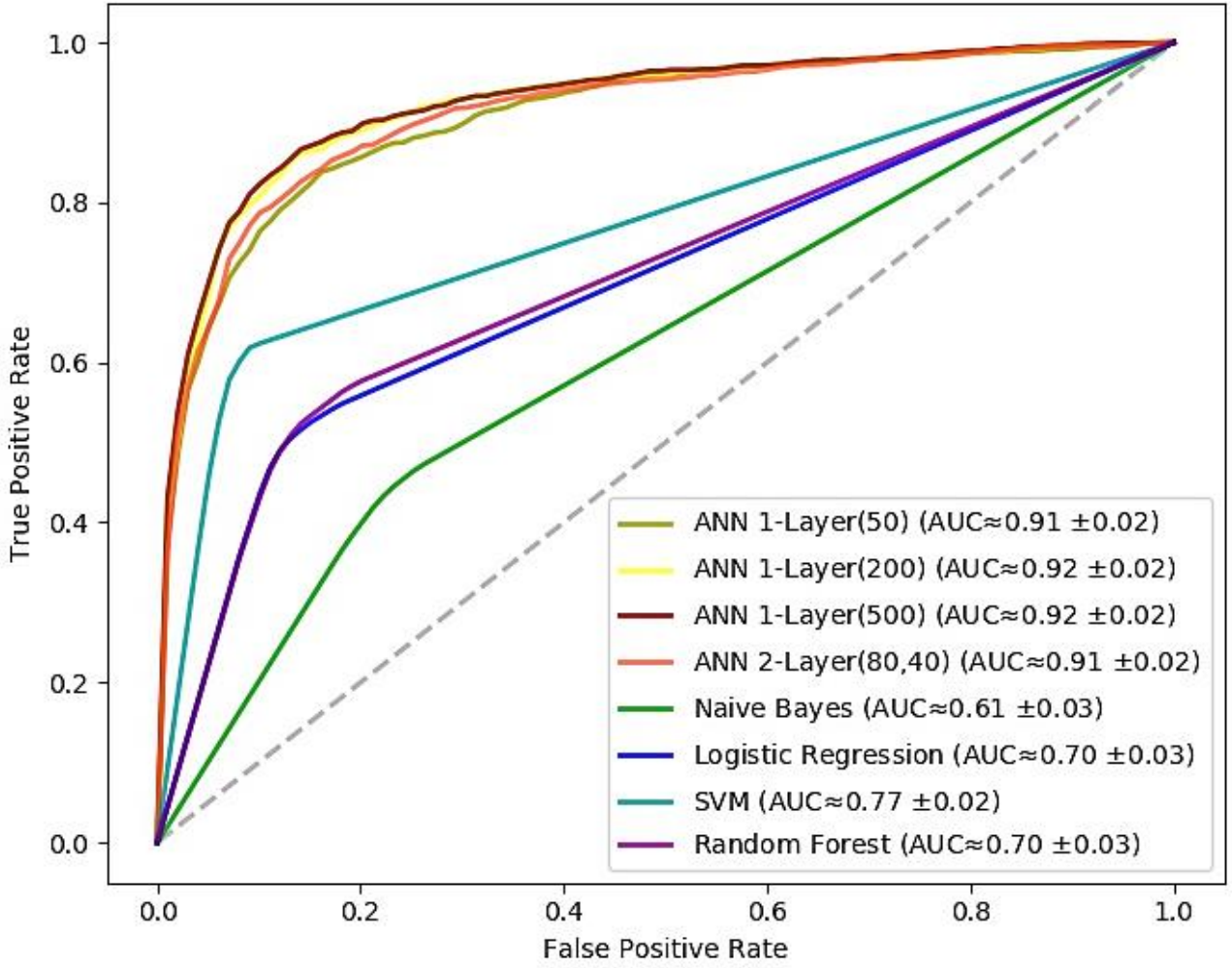
Results: Binary Classifier Accuracy (10-fold Cross-Validation)



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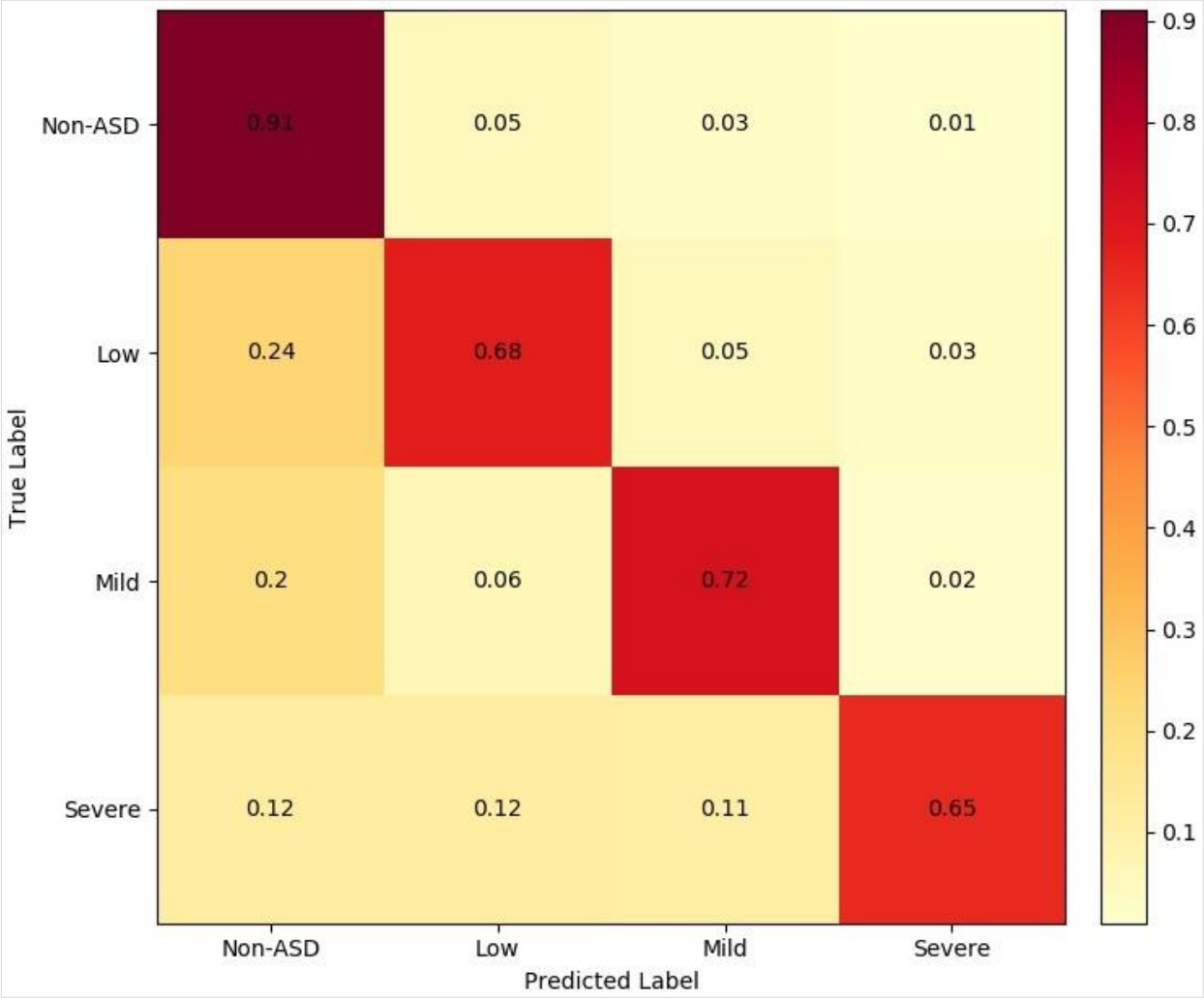
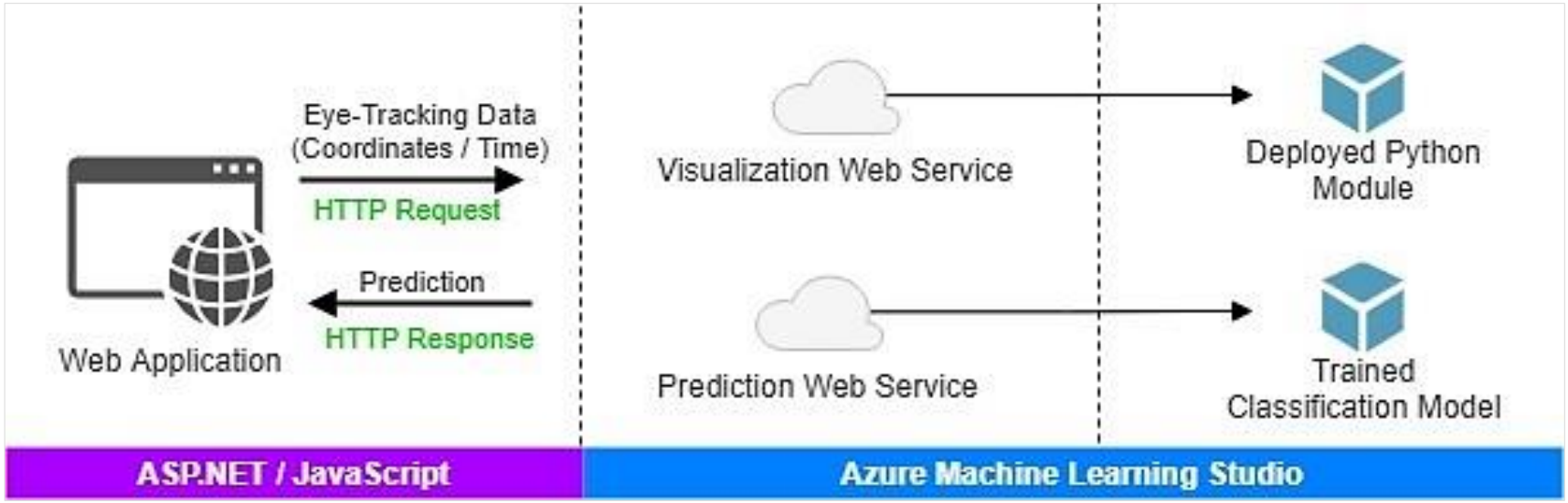
Results: Multi-Label Classifier Accuracy (10-fold Cross-Validation)



https://github.com/Mahmoud-Elbattah/Predicting_ASD

Demo Application: https://goo.gl/i4N7Zj



THANK YOU!

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Find the original publication on:

- https://www.researchgate.net/publication/331784416_Learning_to_Predict_Autism_Spectrum_Disorder_based_on_the_Visual_Patterns_of_Eye-tracking_Scanpaths
- http://www.insticc.org/Primoris/Resources/PaperPdf.ashx?idPaper=74026