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ENHANCED EARLY AUTISM SCREENING: ASSESSING DOMAIN ADAPTATION WITH DISTRIBUTED FACIAL IMAGE DATASETS AND DEEP FEDERATED LEARNING

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Abstract

This study offers a significant advancement in the area of early autism screening by offering diverse domain facial image datasets specifically designed for the detection of Autism Spectrum Disorder (ASD). It stands out as the pioneering effort to analyze two facial image datasets – Kaggle and YTUIA, using federated learning methods to adapt domain differences successfully. The federated learning scheme effectively addresses the integrity issue of sensitive medical information and guarantees a wide range of feature learning, leading to improved assessment performance across diverse datasets. By employing Xception as the backbone for federated learning, a remarkable accuracy rate of almost 90% is attained across all test sets, representing a significant enhancement of more than 30% for the different domain test sets. This work is a significant and remarkable contribution to early autism screening research due to its unique novel dataset, analytical methods, and focus on data confidentiality. This resource offers a comprehensive understanding of the challenges and opportunities in the field of ASD diagnosis, catering to both professionals and aspiring scholars. © (2025), (International Islamic University Malaysia). All rights reserved.

Author Keywords

Artificial Intelligence; Autism Spectrum Disorder (ASD); Data Federation; Deep Learning; Domain Adaptation

References

- (2023),
[1] Autism World Health Organization. Available
- Rashid, M. M., Alam, M. S.
Power of Alignment: Exploring the effect of face alignment on ASD diagnosis using facial images
(2024) *IJUM Engineering Journal*, 25 (1), pp. 317-327.
[2]
- Alam, M. S., Rashid, M. M., Roy, R., Faizabadi, A. R., Gupta, K. D., Ahsan, M. M.
Empirical Study of Autism Spectrum Disorder Diagnosis Using Facial Images by Improved Transfer Learning Approach
(2022) *Bioengineering*, 9 (11), pp. 1-18.
[3]
- Kojovic, N., Natraj, S., Mohanty, S. P., Maillart, T., Schaer, M.
Using 2D video-based pose estimation for automated prediction of autism spectrum disorders in young children
(2021) *Scientific Reports*, 11 (1), p. 15069.
[4]
- Khodatars, M., Shoeibi, A., Sadeghi, D., Ghaasemi, N., Jafari, M., Moridian, P., Khadem, A., Berk, M.
Deep learning for neuroimaging-based diagnosis and rehabilitation of Autism Spectrum Disorder: A review
(2021) *Computers in Biology and Medicine*, 139, p. 104949.
[5]

- Alam, Mohammad Shafiul, Tasneem, Zabina, Khan, Sher Afghan, Rashid, Muhammad Mahbubur
Effect of Different Modalities of Facial Images on ASD Diagnosis using Deep Learning-Based Neural Network
(2023) *Journal of Advanced Research in Applied Sciences and Engineering Technology*, 32 (3), pp. 59-74.
[6]
- Uddin, M. Z., Shahriar, M. A., Mahamood, M. N., Alnajjar, F., Pramanik, M. I., Ahad, M. A. R.
Deep learning with image-based autism spectrum disorder analysis: A systematic review
(2024) *Engineering Applications of Artificial Intelligence*, 127, p. 107185.
[7]
- Alam, M. S., Rashid, M. M., Faizabadi, A. R., Mohd Zaki, H. F., Alam, T. E., Ali, M. S., Gupta, K. D., Ahsan, M. M.
Efficient Deep Learning-Based Data-Centric Approach for Autism Spectrum Disorder Diagnosis from Facial Images Using Explainable AI
(2023) *Technologies*, 11 (5), p. 115.
[8]
- Vuilleumier, P., Pourtois, G.
Distributed and interactive brain mechanisms during emotion face perception: Evidence from functional neuroimaging
(2007) *Neuropsychologia*, 45 (1), pp. 174-194.
[9]
- Vizitiu, A., Nita, C. I., Puiu, A., Suciu, C., Itu, L. M.
Towards Privacy-Preserving Deep Learning based Medical Imaging Applications
(2019) *2019 IEEE International Symposium on Medical Measurements and Applications (MeMeA)*, pp. 1-6.
[10]
- Feki, I., Ammar, S., Kessentini, Y., Muhammad, K.
Federated learning for COVID-19 screening from Chest X-ray images
(2021) *Applied Soft Computing*, 106, p. 107330.
[11]
- Li, X., Gu, Y., Dvornek, N., Staib, L. H., Ventola, P., Duncan, J. S.
Multi-site fMRI analysis using privacy-preserving federated learning and domain adaptation: ABIDE results
(2020) *Medical Image Analysis*, 65, p. 101765.
[12]
- Li, Y., Huang, W.-C., Song, P.-H.
A face image classification method of autistic children based on the two-phase transfer learning
(2023) *Frontiers in Psychology*, 14.
[13]
- Rabbi, M. F., Zohra, F. T., Hossain, F., Akhi, N. N., Khan, S., Mahbub, K., Biswas, M.
Autism Spectrum Disorder Detection Using Transfer Learning with VGG 19, Inception V3 and DenseNet 201
(2023) *Communications in Computer and Information Science*, 1704, pp. 190-204.
[14] Springer, Cham
- Kang, H., Yang, M., Kim, G.-H., Lee, T.-S., Park, S.
DeepASD: Facial Image Analysis for Autism Spectrum Diagnosis via Explainable Artificial Intelligence
(2023) *2023 Fourteenth International Conference on Ubiquitous and Future Networks*

(ICUFN), 2023, pp. 625-630.

[15]

- Ghazal, M., Munir, S., Abbas, S., Athar, A., Alrababah, H., Adnan Khan, M.
Early Detection of Autism in Children Using Transfer Learning
(2023) *Intelligent Automation & Soft Computing*, 36 (1), pp. 11-22.
T [16]
- Musser, M.
Detecting Autism Spectrum Disorder in Children With Computer Vision
(2020) *Towards Data Science*,
[17] Available
- Rajagopalan, S. S., Goecke, R.
Detecting self-stimulatory behaviours for autism diagnosis
(2014) *2014 IEEE International Conference on Image Processing (ICIP)*, 2014, pp. 1470-1474.
[18]
- Shamseddine, H., Otoum, S., Mourad, A.
On the Feasibility of Federated Learning for Neurodevelopmental Disorders: ASD Detection Use-Case
(2022) *GLOBECOM 2022 - 2022 IEEE Global Communications Conference*, pp. 1121-1127.
[19]
- Farooq, M. S., Tehseen, R., Sabir, M., Atal, Z.
Detection of autism spectrum disorder (ASD) in children and adults using machine learning
(2023) *Scientific Reports*, 13 (1), p. 9605.
[20]
- Lakhan, A., Mohammed, M. A., Abdulkareem, K. H., Hamouda, H., Alyahya, S.
Autism Spectrum Disorder detection framework for children based on federated learning integrated CNN-LSTM
(2023) *Computers in Biology and Medicine*, 166, p. 107539.
[21]
- Fan, Z., Su, J., Gao, K., Hu, D., Zeng, L.-L.
A Federated Deep Learning Framework for 3D Brain MRI Images
(2021) *2021 International Joint Conference on Neural Networks (IJCNN)*, pp. 1-6.
[22]
- Wang, J., Zhang, L., Wang, Q., Chen, L., Shi, J., Chen, X., Li, Z., Shen, D.
Multi-Class ASD Classification Based on Functional Connectivity and Functional Correlation Tensor via Multi-Source Domain Adaptation and Multi-View Sparse Representation
(2020) *IEEE Transactions on Medical Imaging*, 39 (10), pp. 3137-3147.
[23]

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