

**SUPPLEMENTARY MATERIAL FOR:**

**Machine Learning with Neuroimaging Data to Identify Autism Spectrum Disorder: A Systematic Review and Meta-Analysis.**

**Running Title:** ML with Neuroimaging data in ASD classification

**Authors:** Da-Yea Song<sup>1\*</sup>, Constantin-Cristian Topriceanu<sup>2\*</sup>, Denis C. Ilie-Ablachim<sup>3</sup>, Maria Kinali<sup>4</sup>, Sotirios Bisdas<sup>5,6</sup>

\*The two authors share co-first authorship.

**Author Affiliations:**

1. Institute of Neurology, University College London, London, UK
2. University College London Medical School, University College London, London, UK
3. Faculty of Automatic Control and Computers, University Politehnica of Bucharest, Bucharest, Romania
4. Department of Paediatric Neurology, The Portland Hospital, London, UK
5. Lysholm Department of Neuroradiology, The National Hospital for Neurology and Neurosurgery, University College London Hospitals NHS Foundation Trust, London, United Kingdom
6. Department of Brain Repair & Rehabilitation, Queen Square Institute of Neurology, University College London, London, UK

**Corresponding author:**

Sotirios Bisdas

Department of Neuroradiology, 8-11 Queen Square, Box 65, London WC1N 3BG, United Kingdom

Tel : 0044 20 344 83148

Email : [s.bisdas@ucl.ac.uk](mailto:s.bisdas@ucl.ac.uk)

**Supplementary Equation 1**

$$\text{DOR} = \frac{\text{True positive} \times \text{True negative}}{\text{False positive} \times \text{False negative}}$$

**Supplementary Equation 2**

$$\text{PLR} = \frac{\text{Sensitivity}}{1 - \text{Specificity}}$$

**Supplementary Equation 3**

$$\text{NLR} = \frac{1 - \text{Sensitivity}}{\text{Specificity}}$$

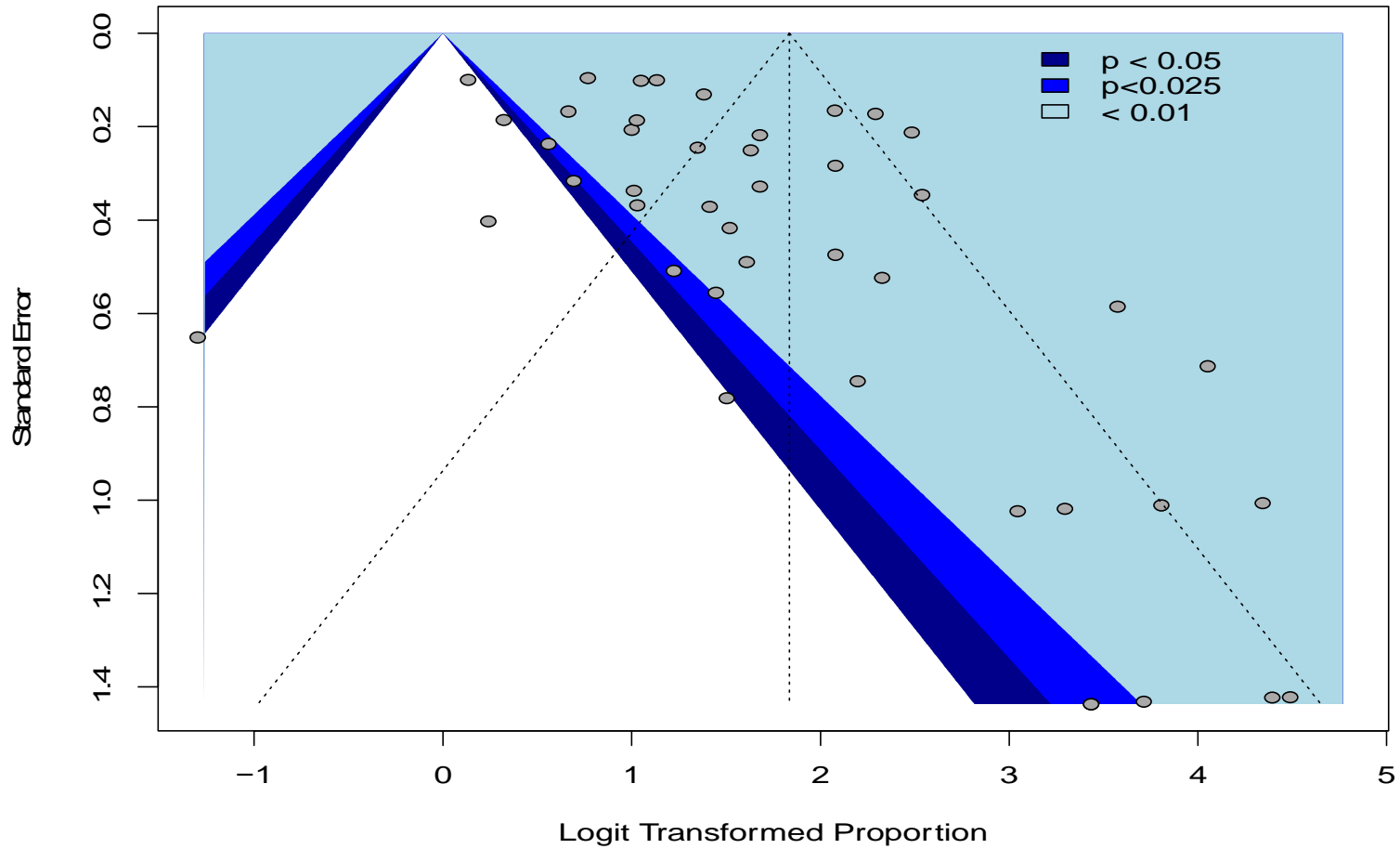
**Supplementary Table S1: Diagnostic performance of machine learning in differentiating Autistic Spectrum Disorder from Typical development: Meta-analysis results in the complete set**

Analysis type	Parameter	Heterogeneity		Effect size	AUC	Egger's test
		I <sup>2</sup>	p-value	Pooled Estimate (95% CI)		
Complete set analysis (n=267)	Sensitivity	96.80%	< <b>0.0001</b>	71.31 (68.72, 73.77)	0.723	< <b>0.0001</b>
	Specificity	94.20%	< <b>0.0001</b>	72.92 (71.09, 74.67)		
	Diagnostic Odds Ratio	52.37%	< <b>0.0001</b>	5.40 (4.87, 5.98)		
	Positive Likelihood Ratio	45.54%	< <b>0.0001</b>	2.21 (2.11, 2.31)		
	Negative Likelihood Ratio	55.59%	< <b>0.0001</b>	0.46 (0.44, 0.49)		
Best set analysis (n=39)	Sensitivity	95.80 %	< <b>0.0001</b>	86.28 (80.88, 90.34)	0.889	< <b>0.001</b>
	Specificity	95.10%	< <b>0.0001</b>	83.78 (78.22, 87.82)		
	Diagnostic Odds Ratio	45.97%	<b>0.001</b>	20.46 (13.74, 30.46)		
	Positive Likelihood Ratio	43.16%	<b>0.003</b>	3.78 (3.17, 4.51)		
	Negative Likelihood Ratio	45.47%	<b>0.001</b>	0.24 (0.19, 0.29)		

CI, confidence interval; AUC, under the hierarchical summary receiver operating characteristic curve.

**Supplementary Figure 1. Color-enhanced Funnel Plot for the univariate random-effects model sensitivity meta-analysis of the studies using machine learning to distinguish Autistic Spectrum Disorder from Typical Development**

*Colors represent the significance level into which the effect size of each corresponding studies falls.*



**Supplementary Figure 2. Color-enhanced Funnel Plot for the univariate random-effects model specificity meta-analysis of the studies using machine learning to distinguish Autistic Spectrum Disorder from Typical Development**  
*Colors represent the significance level into which the effect size of each corresponding studies falls.*

