

SUPPLEMENTARY MATERIAL

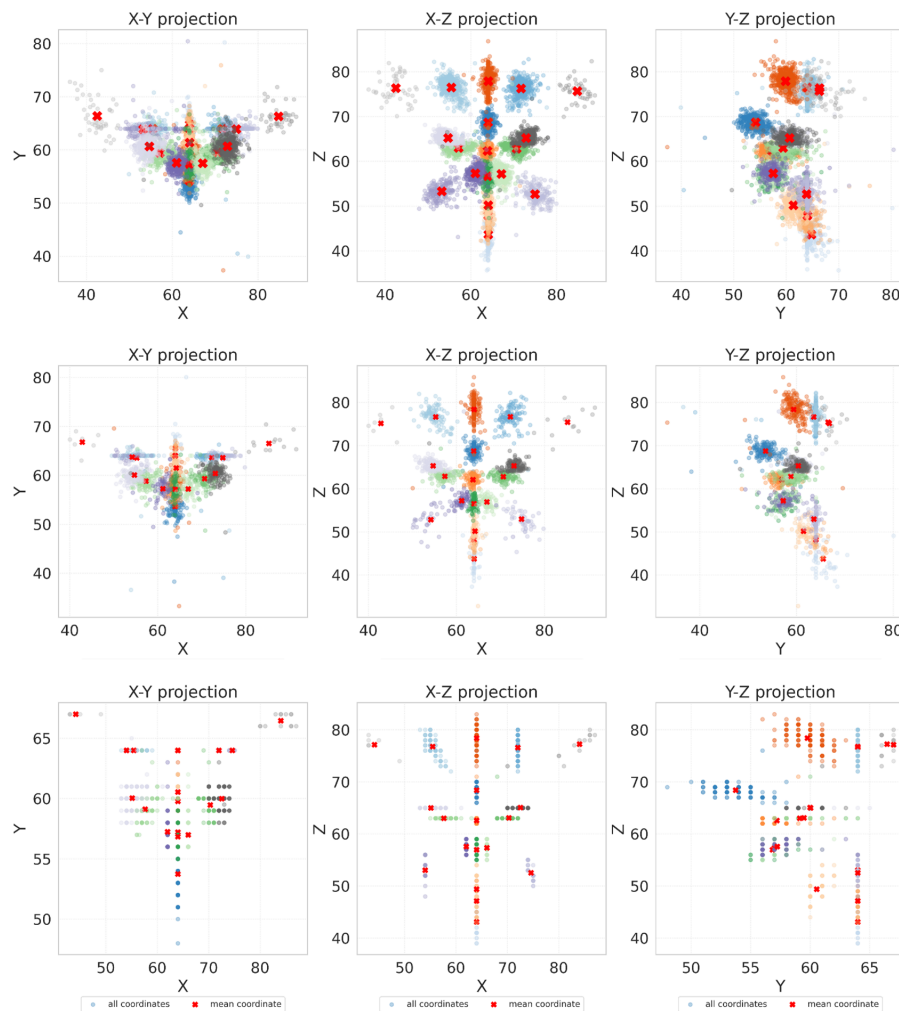
EMD-Regularized Heatmap Regression for 3D Ultrasound Prenatal Facial Landmark Detection

Yusuf Baran Tanriverdi¹, [0000-0002-6030-6904], Antonia Alomar¹, [0000-0003-3658-5832], Ricardo Rubio², [0000-0003-0025-2614], Federico Sukno¹, [0000-0002-2029-1576], and Gemma Piella¹, [0000-0001-5236-5819]

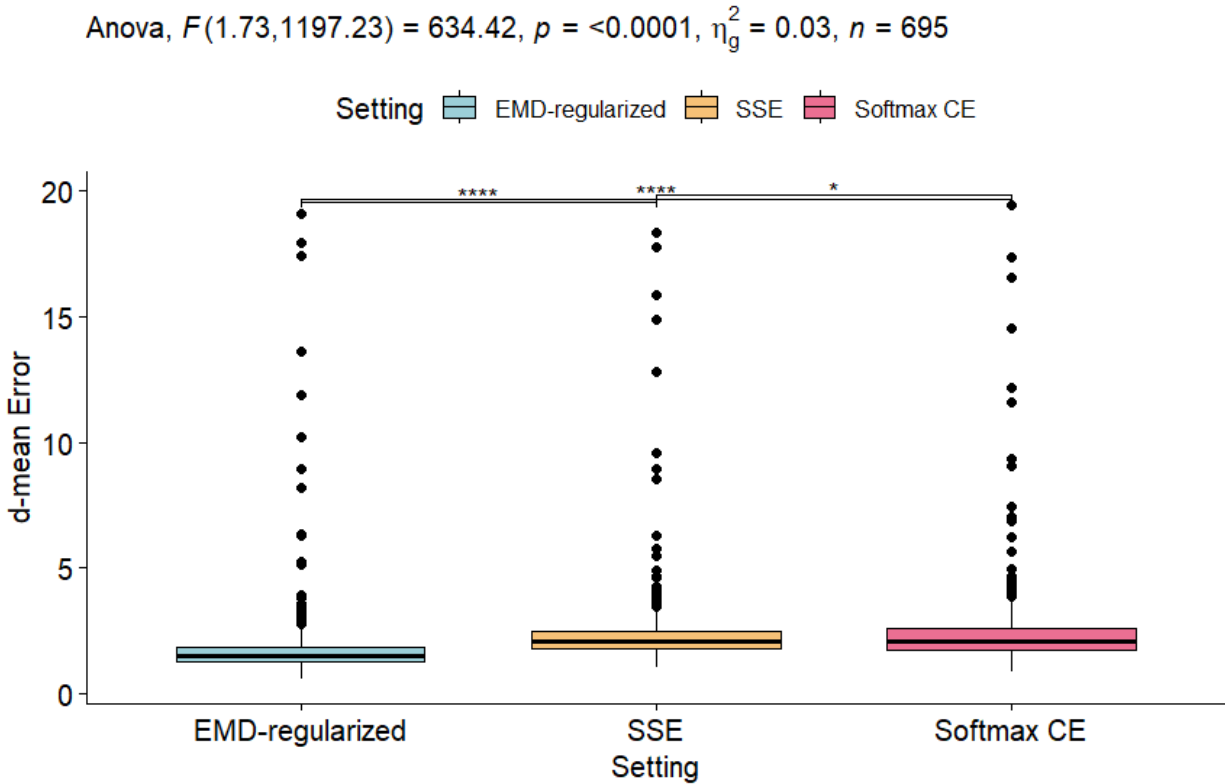
¹ Pompeu Fabra University, Barcelona, Spain

² Hospital del Mar, Barcelona, Spain

yusufbaran.tanriverdi@upf.edu



Supplementary Figure 1. Landmark point distributions in 2D projections of the training ($n = 548$; top) and validation ($n = 177$; middle) subsets of a dataset fold, and corresponding model predictions (bottom). This further visualizes quantization error, which will be addressed in future work.



Supplementary Figure 2. Repeated-measures ANOVA followed by paired post hoc t-tests for the three main settings. EMD regularization improves landmark localization accuracy relative to both conventional SSE and Softmax CE objectives. Significant differences are observed consistently in the paired comparisons, although the overall effect size is modest ($\eta_g^2 = 0.03$). Statistical analyses were performed in *R* using the *rstatix* package [1], following the repeated-measures ANOVA workflow described in [2].

Acknowledgments. This work is supported by Grant PID2024-161292OB-I00 funded by MICIU/AEI/10.13039/50110 0011033 and by "ERDF A way of making Europe", and also by the Joan Oró FI Predoctoral Program of the Department of Research and Universities of the Government of Catalonia (file number: 2025 FI-3 00065) and co-financed by the European Social Fund Plus. G.P. is supported by ICREA under the ICREA Academia programme.

[1]

Datanovia, "Repeated measures ANOVA in R: Compare means across time." Accessed: Aug. 10, 2026. [Online]. Available: <https://www.datanovia.com/learn/biostatistics/anova/repeated-measures-anova-in-r>

[2]

A. Kassambara, "rstatix: Pipe-friendly framework for basic statistical tests," manual, 2026. [Online]. Available: <https://rpkgs.datanovia.com/rstatix/>