

Is human face processing a feature- or pattern-based task? Evidence using a unified computational method driven by eye movements

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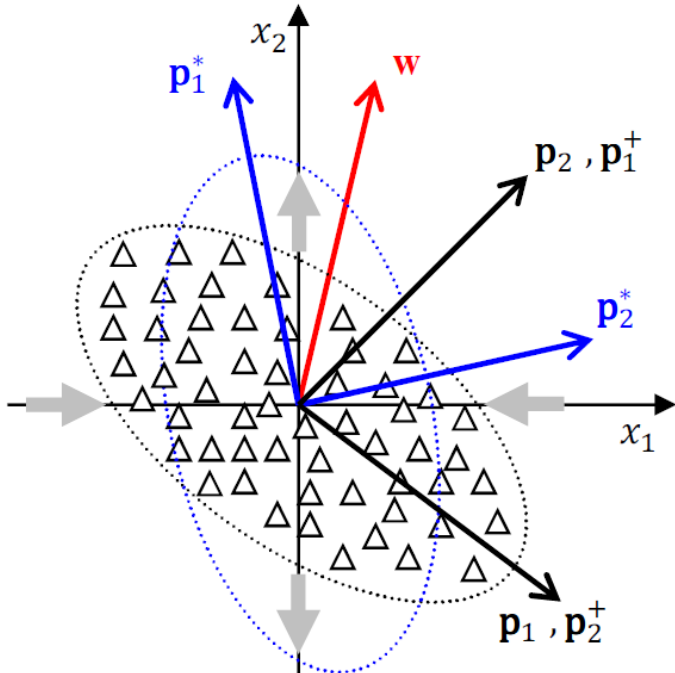
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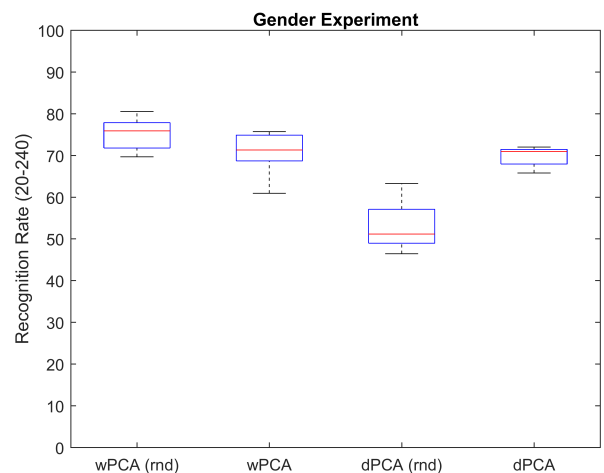
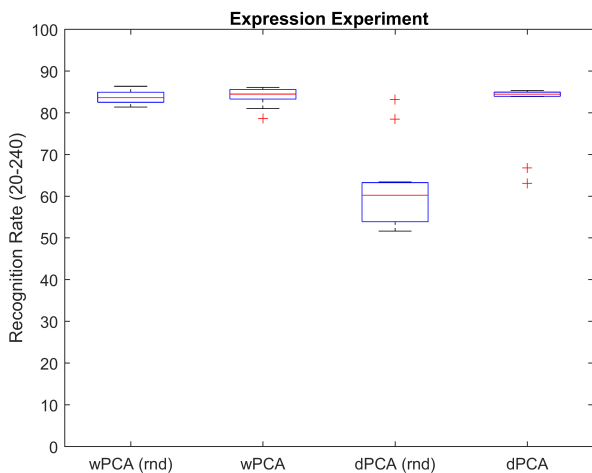
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Abstract: Research on human face processing using eye movements has provided evidence that we recognize face images successfully focusing our visual attention on a few inner facial regions, mainly on the eyes, nose and mouth. To understand how we accomplish this process of coding high-dimensional faces so efficiently, this work proposes and implements a multivariate extraction method that combines face images variance with human spatial attention maps modeled as feature- and pattern-based information sources. It is based on a unified computational representation of the well-known face-space concept (Valentine et al., 2015). The spatial attention maps are summary statistics of the eye-tracking fixations of a number of participants and trials to frontal and well-framed face images during separate gender and facial expression recognition tasks. Our experimental results carried out on publicly available face databases have indicated that we might emulate the face perception processing as a pattern-based coding scheme rather than a feature-based one to properly explain the proficiency of the human visual system in recognizing face information.



Method (geometric idea): The feature-based (*) approach (wPCA) magnifies or shrinks the deviation of each variable separately depending on the direction of w , whereas the pattern-based (+) one (dPCA) re-ranks the standard dimensions by how well such directions align with w as a whole.

Face perception: Spatial attention maps (left) and their randomly generated versions (right). The upper and lower panels describe the facial expression and gender classifications tasks, respectively, superimposed on the grand mean face of the training database used.



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