MULTI-MODALITY MACHINE LEARNING PREDICTION OF MENTAL HEALTH-ARCHETYPES IN A DEEP PHENOTYPED YOUNG AND REPRESENTATIVE SAMPLE.

MASTER THESIS IN BIOINFORMATICS

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October 2024

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This thesis explores the application of multi-modal machine learning in predicting mental health archetypes in a young and well-represented cohort. By integrating polygenic scores, plasma blood markers and braing imaging data we aimed to identify archetypal profiles associated with psychiatric risk and resilience. Using Random Forest models and feature selection techniques, we achieved significant predictive power in differentiating individuals at risk for mental disorders, particularly within the A1 archetype (associated with high neuroticism and emotional dysregulation) and A5 archetype (associated with emotional stability and resilience). Our results reveal distinct genetic and metabolic signatures that delineate risk and protective archetypes. This research is a first step in a broader European initiative to map psychiatric phenotypes using deep phenotyping techniques.

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PREFACE

The rise of mental health disorders across Europe, particularly among young populations, has prompted a renewed focus on understanding the underlying biological mechanisms that drive psychiatric risk. This master's thesis represents my contribution to this growing body of research. Building on archetypal models developed by previous studies, my research integrates genetic, blood markers, and brain imaging data to predict mental health archetypes, thereby providing new insights into psychiatric risk factors. This work was carried out at Aarhus University, Denmark, under the guidance of Associate Professor Per Qvist and Professor Jakob Grove, and is part of the EU COST Action CA18106 project. I hope that the findings of this thesis will contribute to the ongoing efforts to improve mental health screening and interventions.