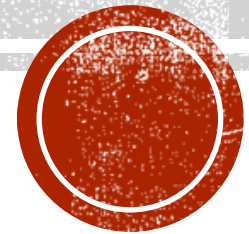


RESEARCH QUESTION, HYPOTHESIS AND PRELIMINARY DESIGN

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DOMAIN AND SCOPE – ACM 2012

- Computing Methodologies => Machine Learning => Machine Learning Approaches => Learning Linear Models (UYSAL, L et al. 1999) (Lee, K.-Y et al. 2017) (Singh Suri et al. 2021)
- Computing methodologies => Machine Learning => Machine Learning Approaches (Sadeghi, D et al. 2021)
- Computing Methodologies => Modeling and Simulation => Model Development and Analysis => Modeling Methodologies (Castanon, J. 2019, March 19) (Lin E et al. 2021)
- Computing Methodologies => Modeling and Simulation => Model Development and Analysis => Modeling Verification and Validation (Wang, H et al. 2013) (Colyer, A. 2019, June 5) (Vadavalasa, Rammohan et al. 2021)
- Computing Methodologies => Machine Learning => Machine Learning Algorithms => Feature Selection (Chen, R. 2020, July 23) (Hasan, M. A et al. 2015) (Miao, J et al. 2016)
- **SCOPE:** Investigate the difference in performance of regression techniques on fMRI and sMRI modalities presented in a HDLSS dataset
- **ASSUMPTIONS:** Distance weight discrimination will outperform SVM because it doesn't depend on feature selection
- **LIMITATIONS:** The complexity of the dataset used or unknown knowledge gaps can be limiting factors
- **DELIMITATIONS:** There are many different approaches to schizophrenia classification that are out of scope for regression techniques that proved to be effective such as clustering, deep learning among ensemble approaches



GAPS IN THE LITERATURE REVIEW AND RESEARCH QUESTION

- There is an application gap because of a limited amount of data making it even more difficult when working with an already complex and elusive condition. Deep learning models seem to attain the best performance, however its short lived as it plummets by ~ 0.25 on an AUC when used to classify new datasets especially from younger cohorts with less extreme or early symptoms. This routes back to the issue of overfitting due to a lack of data, deep learning is prone to overfitting when used on HDLSS data. GANs and CADs could be investigated to see the effectiveness of synthesized data. Required literature exists, most techniques used for HDLSS datasets are in microbiology where researchers work on gene arrays, I think these methodologies could be leveraged for rare mental health disorders, this sparked the investigation to use more traditional approaches such as SVM. (Sadeghi, D et al. 2021) (Cortes-Briones, J. A. et al. 2021) (Oh, J. et al. 2020)

Research Question

- What are the differences in classification accuracy between different implementations of regression techniques when classifying Schizophrenia using HDLSS data through sMRI and fMRI modalities?



HYPOTHESIS

Null Hypothesis

- There is no statistically significant difference between SVM and DWD classification accuracy

Alternate Hypothesis

- There is statistically significant difference between SVM and DWD classification accuracy



FEASIBILITY OF THE STUDY

- Select regression methods (SVM, Partial Least Square Regression, Distance Weighted Discrimination, LASSO Regression, Multivariate Regression)
- Construct baseline for each machine learning algorithm used
- Apply each regression method to available dataset/s
- Tune models appropriately to each HDLSS method document and explore feature selection techniques for tuning
- Record and compare results based on MSE, RMSE, MAE
- Document potential for future work



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DATASET

- **Name:** Mind Research Network's Schizophrenia Dataset
- **Source:** <https://www.kaggle.com/c/mlsp-2014-mri> & <http://schizconnect.org/>
- This dataset consists of functional connectivity values and source based morphometry loadings, the latter is a collection of similar datasets (request for access pending)
- Data format is numeric with column names mapping to each loading in the format of SBM_xx or FNC_xx
- These neuroimaging modalities are extracted from fMRI and sMRI images and are very difficult and time consuming to parse, data like this has to undergo an 8 step cleaning process by an expert before being made available in the format above

