Applying Artificial Neural Networks to fMRI Data

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An artificial neural network is a computational model used to classify patterns in large, complex datasets. The strengths of these networks make them particularly well suited to the classification of fMRI and phenotypic data; here a subset of the IMAGEN dataset is considered. IMAGEN is a multi-site, longitudinal study of adolescent neurodevelopment with a specific interest in understanding the development of adolescent drug and alcohol use. It contains genetic, neuroimaging and behavioral measures (personality, cognition, mental health etc) on a sample of 2,400 fourteen year olds. Using data collected at age 14, including 6 brain activation measures obtained using fMRI, neural networks were trained and evaluated. These networks attempted to predict whether or not subjects would become binge drinkers in the future, using data collected at age 16 to verify accuracy. The best networks had an AUC of .75 and an average accuracy of 69%. These initial results are promising in that they establish that the network was able to successfully detect patterns within the data with which it could successfully predict future binge drinking. Future testing with different feature sets and more varied network architectures will be investigated to optimize the prediction accuracy.