Alzheimer’s Disease (AD) ravages the cognitive ability of more than 5 million Americans and creates an enormous strain on the health care system. Our research explores prediction of AD development without medical imaging, in hopes of earlier and cheaper diagnoses. We construct a classification pipeline which shows greater than 90% accuracy and recall in predicting AD with our best model. This model generalizes well to sub-studies of our main data set, ADNI, as well as another AD dataset, AIBL. We also find that we can get close to 80% accuracy with only one clinical visit of data. Finally, we produce a meta-classification algorithm which balances feature cost with prediction accuracy. This work can be adapted into a diagnostic tool for predicting the development of Alzheimer’s that maximizes accuracy while minimizing the number of necessary diagnostic tests and clinical visits.

### Results

**Figure 2: ROC Curve**

- **Model Performance**
  - Generalizes well across ADNI sub-studies: > 90% recall
  - Generalizes to AIBL data using only 5 features

<table>
<thead>
<tr>
<th>Data</th>
<th>Accuracy</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADNI</td>
<td>92.5%</td>
<td>91.7%</td>
</tr>
<tr>
<td>ADNI &amp; AIBL</td>
<td>90%</td>
<td>85%</td>
</tr>
<tr>
<td>ADNI, test on AIBL</td>
<td>93%</td>
<td>80%</td>
</tr>
</tbody>
</table>

### 3. Feature Cost Analysis

- Meta-classification approach (Pichara et al., 2016), where features are different models
- Meta-Decision Tree: balances entropy and time cost of features

![Figure 5: Example Meta-Classification Tree](image)

- **Application:** a practical, data-driven diagnostic tool that balances accuracy with cost of acquiring more features


### Conclusions

- Classification pipeline with > 90% accuracy and recall
- Model performance robust across different Alzheimer’s repositories (ADNI sub-studies and AIBL)
- Successful implementation of Meta-Classification and Longitudinal Data Analysis to obtain models that balance accuracy with cost
- Propose diagnostic protocol with only 3 tests and 4 clinical visits that can predict AD with 87% accuracy and 79% recall