

# ***CogniPredictAD project proposal***

# Slide 1/3: Problem Description

- **Predict the baseline diagnosis (DX)** of **ADNI** participants using only the attributes detected at baseline. The objective is to build a classifier that, starting from clinical, neuropsychological, and genetic variables, assigns the diagnostic class of **Alzheimer Disease**.
- **ML techniques** enable the analysis of complex links between biomarkers and symptoms, **automating preliminary diagnoses** and supporting clinical decisions, accelerating screening and research on progression and risk factors.
- **Preprocessing:** only baseline visits per subject → removal of columns > 50% missing → KNN imputation → categorical encoding → feature selection → and more ...
- **Outlier Detection** to remove errors and discover rare clinical profiles.
- **Explainability** with *SHAP* to interpret feature contributions to individual predictions, highlighting which biomarkers or clinical measures most influence the diagnosis.
- **Technique: Multiclass Classification.**



# Slide 2/3: Dataset Description

- **Source:** <https://adni.loni.usc.edu/>
- **Raw (ADNIMERGE.csv):** 16421 rows  $\times$  116 columns (all visits).
- **Final (preprocessed):** 2419 rows  $\times$  36 columns (of which 1 target = DX).
- **Input:** vector of clinical, cognitive, genetic and volumetric features (e.g. ADAS13, MMSE, CDRSB, RAVLT, APOE4, brain volumes, age, sex, education).
- **Output:** ordinal-encoded diagnostic label (DX: 0...3):
  - CN (Cognitively Normal): 0
  - EMCI (Early Mild Cognitive Impairment): 1
  - LMCI (Late Mild Cognitive Impairment): 2
  - AD (Alzheimer's Disease): 3



# Slide 3/3: References

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- *ADNI LONI Official Website:* <https://adni.loni.usc.edu/>
- *ADNI Introduction (Mueller et al., 2005):* <https://alz-journals.onlinelibrary.wiley.com/doi/abs/10.1016/j.jalz.2005.06.003>
- *Use of ADNIMERGE dataset for Machine Learning:* <https://peerj.com/articles/cs-2437/>
- *Using the ADNIMERGE dataset for Machine Learning prognosis:* [https://www.researchgate.net/publication/371729203 A Machine Learning Approach for Predicting Deterioration in Alzheimer's Disease](https://www.researchgate.net/publication/371729203_A_Machine_Learning_Approach_for_Predicting_Deterioration_in_Alzheimer's_Disease)

