Welcome

"AI-Driven ADHD Prediction and Analysis at Early Age: A Novel Approach Integrating Machine Learning, Explainable AI, LLMs, and Dialogflow with a Virtual Therapy Chatbot"

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Group-3

Aim and Objective :

- Detection of ADHD at early age
- Identifying the key factors/features of ADHD
- Comparing the impact of Adverse Childhood experiences for ADHD
- Develop optimised web and mobile applications
- Primary therapy through virtual chatbot
- Apply unique approaches to challenge the existing works (Novelty add)
- Generalize and validate with domain expert
- A complete research work for publishing in journal

The Experiments (so far covered):

- Machine Learning experiments (Results, EDA, Research questions, Error Analysis, Evaluations, Ablation Study,Generalization)
- Explainable AI implementations (LIME & SHAP)
- LLMS initial testing
- Andriod and Webapp (Skeleton and Prototype)
- Dialogflow chatbot (version 1)
- Pycaret Tryouts
- Literature Review (with Comparison table)
- Other documentations (e.g : impacts, ethics)
- GitHub Repository and tracking
- Overleaf Latex tryouts (experiments and formatting)

Results :

Total used ML classifiers : 14

Hyper Parameter tuner : GridSearch & Optuna

Without Resampling:

Stacking	**0.9427 ± 0.0002**	**0.8700 ± 0.0015**	**0.8207 ± 0.0008**	**0.8430 ± 0.0003**

Result after undersampling (training values) :

LightGBM	**0.8824**	**0.74**	**0.91**	**0.78**

With Resampling SMOTE (Only Training Values):

XGBoost (Extreme Gradient Boosting)	**0.9292**	0.81	0.84	**0.83**

Results from Pycaret (SMOTE resampled):

CatBoost	**0.9354**	**0.93**	**0.93**	**0.93**

Stacking	**0.9430**	**0.8732**	0.8176	**0.8424**	{'rf_n_estimators': 200, 'lgbm_n_estimators': 250, 'xgb_n_estimators': 500, 'xgb_learning_rate': 0.04823461189593865, 'xgb_max_depth': 5, 'meta_C': 0.03571529406374313}

Total used LLMs BERT classifiers : 5

Model Performance Comparison *(LLMs)*

Model	eval_loss	eval_accuracy	eval_precision	eval_recall	eval_f1	eval_auc	eval_runtime (s)	eval_samples/sec	eval_steps/sec	epoch
BERT	0.2474	0.8715	0.9152	0.8715	0.8862	0.9109	36.47	365.58	5.73	3.0
DistilBERT	0.1422	0.9345	0.9323	0.9345	0.9332	0.9683	19.25	692.74	10.86	3.0
ClinicalBERT	0.3428	0.8927	0.9042	0.8927	0.8428	0.2912	36.04	369.95	5.80	3.0
BioBERT	0.3444	0.8919	0.7955	0.8919	0.8410	0.7311	42.17	316.23	4.96	3.0
ALBERT	0.1829	0.9270	0.9221	0.9270	0.9238	0.9501	46.25	288.32	4.52	3.0

Existing current state-of-the-art accuracy : accuracy of 85.5%, sensitivity of 84.4%, specificity of 86.4%,

ABLATION STUDY:(USING STACKING)

Removed_feature	Accuracy	F1_score
SC_AGE_YEARS	0.9320 ± 0.0018	0.8053 ± 0.0063
sex_2122	0.9329 ± 0.0018	0.8106 ± 0.0056
allergies_2122	0.9299 ± 0.0010	0.7940 ± 0.0036
asthma_2122	0.9293 ± 0.0011	0.7957 ± 0.0043
headache_2122	0.9327 ± 0.0019	0.8079 ± 0.0063
anxiety_2122	0.9316 ± 0.0017	0.8022 ± 0.0061
depress_2122	0.9326 ± 0.0020	0.8073 ± 0.0066
behavior_2122	0.9278 ± 0.0018	0.7902 ± 0.0068
GeneticScr_2122	0.9327 ± 0.0019	0.8074 ± 0.0061
BrainInjTold_2122	0.9342 ± 0.0014	0.8125 ± 0.0048
ACE2more6HH_2122	0.9343 ± 0.0013	0.8126 ± 0.0049
famstruct5_2122	0.9335 ± 0.0017	0.8121 ± 0.0054
fruit_2122	0.9343 ± 0.0012	0.8134 ± 0.0049
vegetables_2122	0.9343 ± 0.0016	0.8131 ± 0.0058
Cond2more_2122	0.9257 ± 0.0012	0.7744 ± 0.0037
CSHCNtype_2122	0.9282 ± 0.0016	0.7952 ± 0.0064
ChHlthSt_2122	0.9337 ± 0.0022	0.8111 ± 0.0066
ExBrstFd_2122	0.9341 ± 0.0015	0.8129 ± 0.0054
DevDelay_2122	0.9335 ± 0.0007	0.8108 ± 0.0028
learning_2122	0.9324 ± 0.0012	0.8057 ± 0.0047
autism_2122	0.9335 ± 0.0017	0.8109 ± 0.0062
BedTime_2122	0.9338 ± 0.0017	0.8118 ± 0.0054
ACE1more4Com_2122	0.9339 ± 0.0014	0.8115 ± 0.0050
ACEincome_2122	0.9334 ± 0.0015	0.8108 ± 0.0052
ACE2more11_2122	0.9340 ± 0.0020	0.8120 ± 0.0071

Generalization Result :

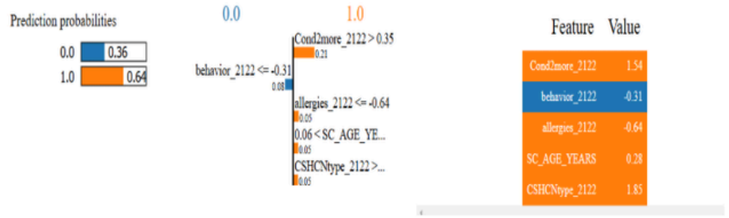
Dataset : 2018-2019e NSCH_Topical_CSV_CAHMI_DRC_v3

Blending (ML models)	0.9344 ± 0.0008	0.8429 ± 0.0016	0.7613 ± 0.0032	0.7949 ± 0.0020
Stacking (ML models)	**0.9427 ± 0.0008**	**0.8608 ± 0.0040**	0.8016 ± 0.0072	0.8278 ± 0.0038

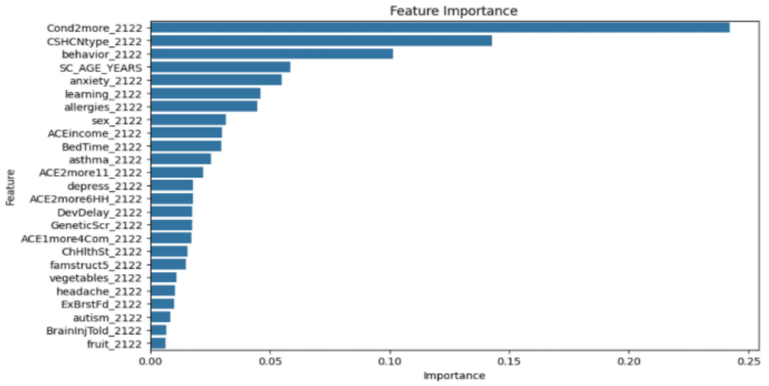
Results (2):

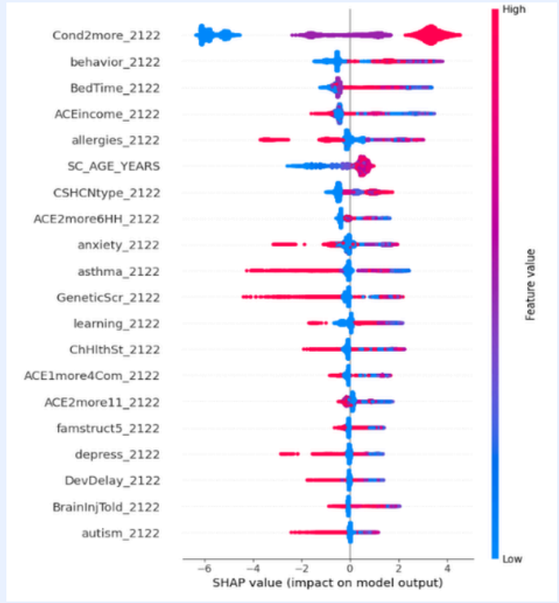
Explainable AI Results:

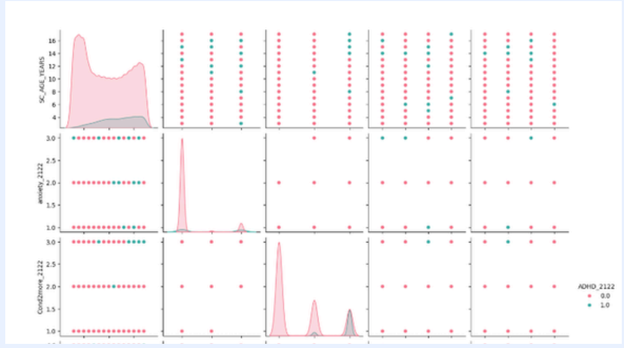
****LIME****

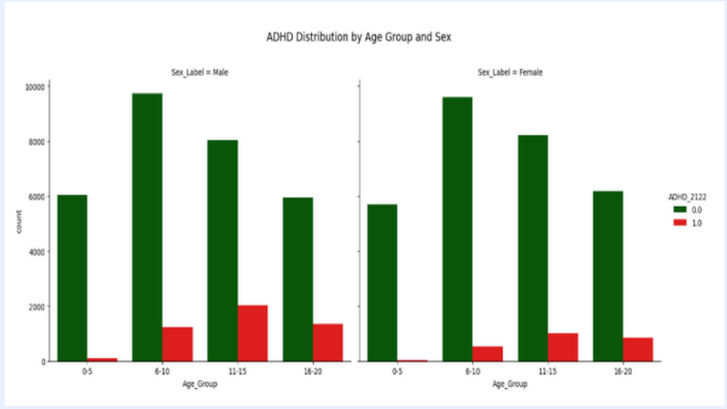


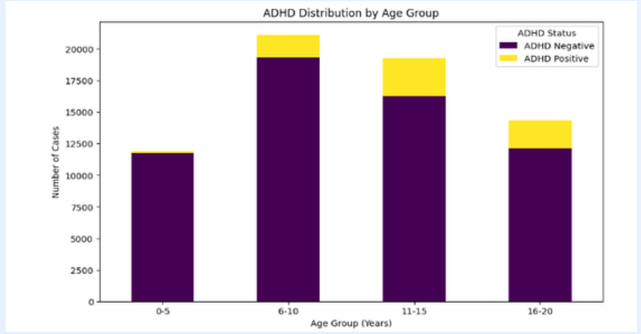
Feature Contributions:

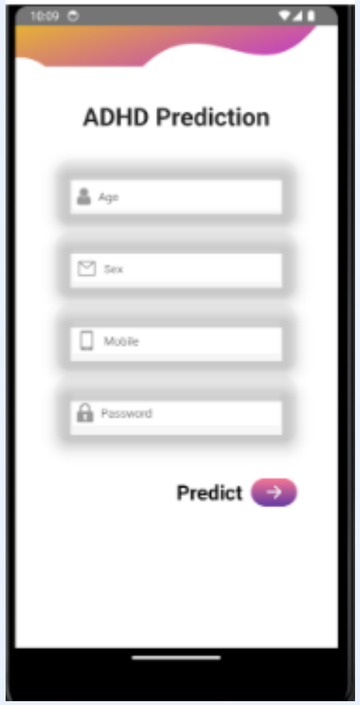






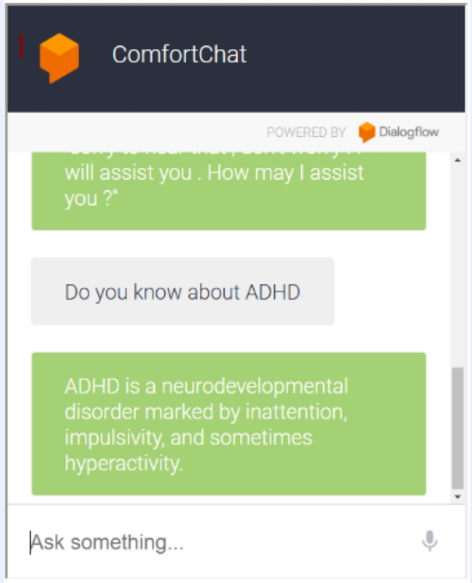






Dialogflow Chatbot :

Version 1 chatbot demo :



ADHD Predictions and Analysis at Early age

Please enter the details below to predict ADHD:

Age in Years: 12

Sex of child: Male

Allergies status: Currently has condition

Asthma status: Does not have condition

Headache status: Ever told, does not currently have

Anxiety status: Does not have condition

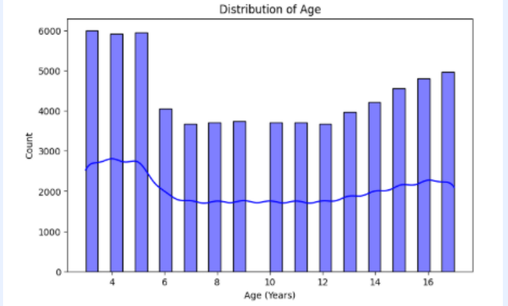
Depression status: Currently has condition

Behavioral issues status: Currently has condition

Genetic screening status: Never had condition

Brain injury status: Never thought child has injury

Household challenges: 2 or more ACEs



Yet to cover tasks:

- Error analysis
- LLMs tuning and optimization
- Full optimised app deployments (Android and Webapp)
- Gen AI implementation and Synthetic data
- Generalization with more Datasets (2-3 versions)
- Finish the final report and submit a full journal
- Consult with Domain Expert (Psychiatrist/Therapist)

Final Objective(Capstone Plans):

- A complete app (Deployed Optimised and Fine Tuned Model)
- A complete Paper (abstract to conclusion)
- A complete well-detailed poster (abstract to conclusion)
- A complete understanding and novelty (Dataset,Research analysis,Own approaches in ML and NLP) of the work
- Innovation Challenge attempt

“Those who can imagine anything, can create the impossible.”

— Alan Turing

Thanks