



PREDICTING MENTAL HEALTH ILLNESS OF WORKING PROFESSIONALS

MACHINE LEARNING PROJECT REPORT

TEAM ID || 594263

PRANJAY SEKSARIA || 21BCB0156

ESHA KASHYAP || 21BCE0875

ANIKET KAILAS KHAKRE || 21BCE2636

ANII SHAKYA || 21BCE3062

ACKNOWLEDGEMENTS

A successful project is a culmination of the efforts by many people, some directly and others who have encouraged and supported us from the background. We are deeply indebted to these people.

We would like to express our gratitude to VIT University and Smart Internz for this opportunity. We would also like to thank the Smart Internz counselors and teachers for their constant guidance and patient help.

Throughout this project, they have answered our queries and have been instrumental in its completion.

INDEX

1 1.1 1.2	INTRODUCTION Project Overview Purpose	
2. 2.1 2.2 2.3	LITERATURE SURVEY Existing problem References Problem Statement Definition	
3. 3.1 3.2	IDEATION & PROPOSED SOLUTION Empathy Map Canvas Ideation & Brainstorming	
4. 4.1 4.2	REQUIREMENT ANALYSIS Functional requirement Non-Functional requirements	
5. 5.1 5.2	PROJECT DESIGN Data Flow Diagrams & User Stories Solution Architecture	
6. 6.1 6.2 6.3	PROJECT PLANNING & SCHEDULING Technical Architecture Sprint Planning & Estimation Sprint Delivery Schedule	
7. 7.1 7.2 7.3	CODING & SOLUTIONING Feature 1 Feature 2	
8. 8.1	PERFORMANCE TESTING Performace Metrics	
9. 9.1	RESULTS Output Screenshots	
10.	ADVANTAGES & DISADVANTAGES	
11.	CONCLUSION	
12.	FUTURE SCOPE	
13.	APPENDIX	
`	Source Code GitHub & Project Demo Link	

INTRODUCTION

In a world that full of bright distractions and the deafening cacophony of notifications, our mental well-being often takes a back seat. But what if technology could be a bridge to a healthier mind? This is the driving force behind our journey—a mission to bring mental health to the forefront of our digital landscape.

Behind every virtual screen, there is a real person with a real story.

1.1| Project Overview:

The Corporate World and large Tech Giants are infamous for their treatment of employees that might be the leading cause of mental health degradation. The sudden surge in depression, alcoholism, eating disorders, etc cannot all be attributed to them, but a better workplace and more sensitive colleagues and management could definitely go a long way.

Our model uses Machine Learning Concepts such as supervised learning, classification, Decision Tree, KNN, etc and integrates this into a lucrative website that presents a questionnaire based on which a prediction is made.

1.2| Purpose:

The main purpose of the Mental Health Prediction system is to predict whether a person needs to seek Mental health treatment or not based on inputs provided by them.

Employers can offer robust benefits packages to support employees who go through mental health issues. That includes Employee Assistance Programs, Wellness programs that focus on mental and physical health, Health and Disability Insurance, or flexible working schedules or time off policies.

Organizations that incorporate mental health awareness help to create a healthy and productive work environment that reduces the stigma associated with mental illness, increase the organizations' mental health literacy, and teaches the skills to safely and responsibly respond to a co-worker's mental health concern.

LITERATURE SURVEY

2.1| Existing problem:

Mental health has become a forefront concern in contemporary society, with an increasing recognition of its impact on overall well-being. The ubiquity of smartphones and the growing role of technology in our lives offer an unprecedented opportunity to leverage digital tools for mental health support. However, despite the progress made in understanding and destigmatizing mental health issues, there remains a considerable gap in the timely and accurate prediction of these conditions. The significance of mental health prediction lies in its potential to revolutionize the way we approach mental well-being. Unlike traditional methods that often rely on self-reporting or clinical assessments, predictive technologies can offer early insights, allowing for proactive interventions and personalized support. By harnessing the power of machine learning and mobile applications, we aim to create a bridge between individuals and the mental health resources they need, fostering a culture of proactive mental health management.

In this digital age, where our smartphones are extensions of ourselves, the integration of technology into mental health care is not just logical but imperative. A mental health prediction app can act as a vigilant companion, leveraging advanced algorithms to analyze subtle patterns in user behavior, emotions, and habits. By transforming smartphones into personalized mental health monitors, we aspire to empower individuals to take an active role in their emotional well-being.

Despite the potential benefits, existing barriers hinder the seamless integration of technology into mental health care. Stigma, concerns about data privacy, and the need for robust and accurate predictive models are among the challenges that must be addressed. Through this project, we aim to contribute to the ongoing discourse surrounding mental health, emphasizing the importance of technology as an ally rather than a replacement for traditional care.

As we embark on this journey, we recognize the critical need to bridge the gap between technological innovation and mental health support. Our project seeks to go beyond the surface, delving into the complexities of mental well-being to offer not just predictions but personalized insights and resources. By fostering a holistic approach to mental health care, we aspire to contribute to a future where technology is seamlessly integrated into our lives, supporting our emotional resilience and well-being.

2.2| References

1. <https://www.ibm.com/topics/supervised-learning#:~:text=Supervised%20learning%2C%20also%20known%20as,data%20or%20predict%20outcomes%20accurately.>
2. <https://www.techtarget.com/searchenterpriseai/definition/unsupervised-learning#:~:text=Unsupervised%20learning%20is%20a%20type,are%20neither%20classified%20nor%20labeled.>
3. <https://www.javatpoint.com/regression-vs-classification-in-machine-learning#:~:text=The%20main%20difference%20between%20Regression,Spam%20or%20Not%20Spam%2C%20etc.>
4. <https://www.sciencedirect.com/topics/computer-science/logistic-regression#:~:text=Logistic%20regression%20is%20a%20process,%2Fno%2C%20and%20so%20on.>
5. <https://www.javatpoint.com/machine-learning-decision-tree-classification-algorithm>

6. <https://www.ibm.com/topics/random-forest#:~:text=Random%20forest%20is%20a%20commonly,both%20classification%20and%20regression%20problems.>
7. <https://www.javatpoint.com/k-nearest-neighbor-algorithm-for-machine-learning>
8. <https://www.nvidia.com/en-us/glossary/data-science/xgboost/#:~:text=XGBoost%20is%20a%20scalable%20and,model%20performance%20and%20computational%20speed.>
9. <https://www.almabetter.com/bytes/tutorials/data-science/adaboost-algorithm>
10. <https://www.analyticsvidhya.com/blog/2021/09/gradient-boosting-algorithm-a-complete-guide-for-beginners/#:~:text=Gradient%20boosting%20is%20a%20method,has%20produced%20the%20best%20results.>
11. <https://www.analyticsvidhya.com/blog/2021/05/know-the-best-evaluation-metrics-for-your-regression-model/>
12. https://www.youtube.com/watch?v=lj4I_CvBnt0
13. <https://www.mentalhealthfirstaid.org/>
14. <https://www.ncbi.nlm.nih.gov/books/NBK401817/>
15. <https://recruitinginnovation.com/front-end-technologies/#:~:text=HTML%20is%20the%20first%20layer,stand%20for%20Hypertext%20Markup%20Language.>

2.3] Problem Statement Definition

In the realm of mental health prediction, a critical void exists in the web-based landscape. Current solutions predominantly cater to mobile apps, leaving a significant portion of users untapped. This project addresses this gap by envisioning and developing a comprehensive web platform for predicting mental health conditions.

Our primary challenge involves adapting sophisticated supervised machine learning algorithms, including regression and classification models, to the unique constraints and features of web environments. One standout algorithm in our approach is the AdaBoost algorithm, chosen for its ability to enhance predictive accuracy by combining multiple weak learners.

To seamlessly integrate predictive models into the web, we leverage Flask mechanisms, ensuring a secure, responsive, and user-friendly interface. Flask enables the incorporation of advanced machine learning capabilities, empowering users to receive personalized mental health insights, resources, and support directly through their web browsers.

The frontend is designed using HTML, offering an intuitive and inclusive user experience. We prioritize user-centric design, aligning with ethical standards to address privacy concerns and data security. The platform utilizes a basic dataset with 21 data columns, capturing a comprehensive range of factors influencing mental health. Through this initiative, we aim to revolutionize how individuals engage with mental health prediction, fostering a proactive and accessible approach to emotional well-being on the web.

Final Problem Statement: A model to predict the risk level (regression) of mental health problems in a colleague and provide subsequent solutions for each range.

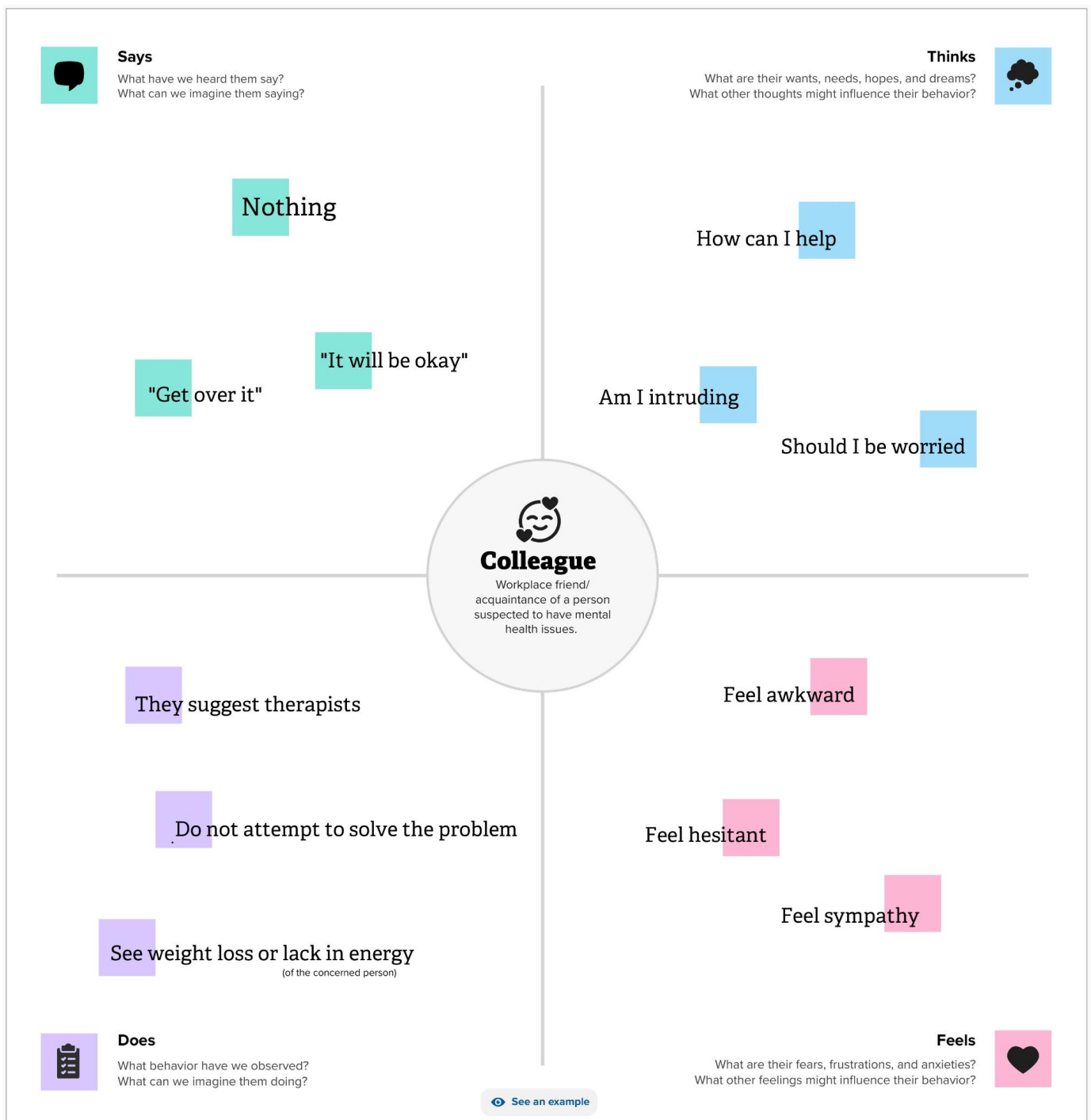
IDEATION & PROPOSED SOLUTION

3.1] Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to help teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2] Ideation & Brainstorming

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Problem Statement: Mental Health First Aid teaches participants how to notice and support an individual who may be experiencing a mental health or substance use concern or crisis and connect them with the appropriate employee resources. Employers can offer robust benefits packages to support employees who go through mental health issues. That includes Employee Assistance Programs, Wellness programs that focus on mental and physical health, Health and Disability Insurance, or flexible working schedules or time off policies. Organizations that incorporate mental health awareness help to create a healthy and productive work environment that reduces the stigma associated with mental illness, increase the organizations' mental health literacy, and teaches the skills to safely and responsibly respond to a co-worker's mental health concern. The main purpose of the Mental Health Prediction system is to predict whether a person needs to seek Mental health treatment or not based on inputs provided by them.

Step-2: Brainstorm, Idea Listing and Grouping

1. **Employee Mental Health Monitoring:** A machine learning system to continuously monitor and assess the mental health of employees within an organization, identifying early warning signs of stress or burnout.
2. **Mental Health Resource Recommendation:** A recommendation system that suggests relevant mental health resources (e.g., articles, self-help tools, or support groups) to employees based on their self-reported mental health status or specific concerns.
3. **Mental Health Chatbot:** A conversational AI chatbot that provides employees with a confidential and supportive platform to discuss their mental health concerns and receive guidance or referrals to appropriate resources.
4. **Mood Prediction for Workforce Scheduling:** Use of machine learning to predict employee mood and productivity based on factors like workload, work hours, and personal preferences, enabling optimized workforce scheduling to reduce stress.
5. **Mental Health Awareness Training:** A machine learning-enhanced training program that identifies employees who would benefit from mental health awareness training and tailors the training to their specific needs.
6. **Peer Support Matching:** A system that matches employees in need of mental health support with peer mentors or supporters based on compatibility, ensuring a network of emotional support within the organization.
7. **Anonymous Reporting System for Mental Health Issues:** A platform that allows employees to anonymously report mental health concerns and incidents to HR or management, with machine learning-based analytics to identify trends and patterns in reported issues.
8. **Mental Health Feedback Loops:** A system that collects feedback from employees about their experiences with mental health support programs and uses machine learning to iteratively improve and customize these programs.

Step-3: Idea Prioritization

Final Problem Statement: A model to predict the risk level (regression) of mental health problems in a colleague and provide subsequent solutions for each range.

REQUIREMENT ANALYSIS

4.1] Functional requirement

1. User Registration and Authentication: Users should be able to create accounts securely.
2. User Profile: Users should be able to create and update their profiles. The profile should include relevant information for mental health prediction.
3. Input Data Collection: The app must collect user input data related to emotions, behaviors, and habits. Data collection should be user-friendly and non-intrusive.
4. Machine Learning Model: Implement a machine learning algorithm to analyze user input. The model should predict potential mental health issues based on input data.Educational Resources.
5. Feedback Mechanism: Allow users to provide feedback on the accuracy of predictions. Use feedback to continually improve the machine learning model.

4.2] Non-Functional requirements

1. Security: Implement robust security measures to protect user data. Comply with data protection regulations.
2. Scalability: Design the app to handle a growing user base. Ensure scalability for increased data and user activity.
3. Performance: The app should respond promptly to user actions. Minimize latency in data processing and prediction.
4. Usability: Create an intuitive and user-friendly interface. Ensure accessibility for users with different abilities.
5. Reliability: The app should be available and reliable under normal operating conditions. Implement backup and recovery mechanisms.
6. Regulatory Compliance: Comply with relevant regulations and standards in the mental health and healthcare industry.
7. Data Privacy: Safeguard user privacy and ensure compliance with data protection laws.Clearly communicate the app's privacy policy to users.
8. Performance Monitoring: Implement tools for monitoring app performance. Track system usage and identify areas for improvement.
9. Documentation: Provide comprehensive documentation for developers, administrators, and users.

PROJECT DESIGN

5.1] Data Flow Diagrams & User Stories

DATA FLOW DIAGRAMS:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right

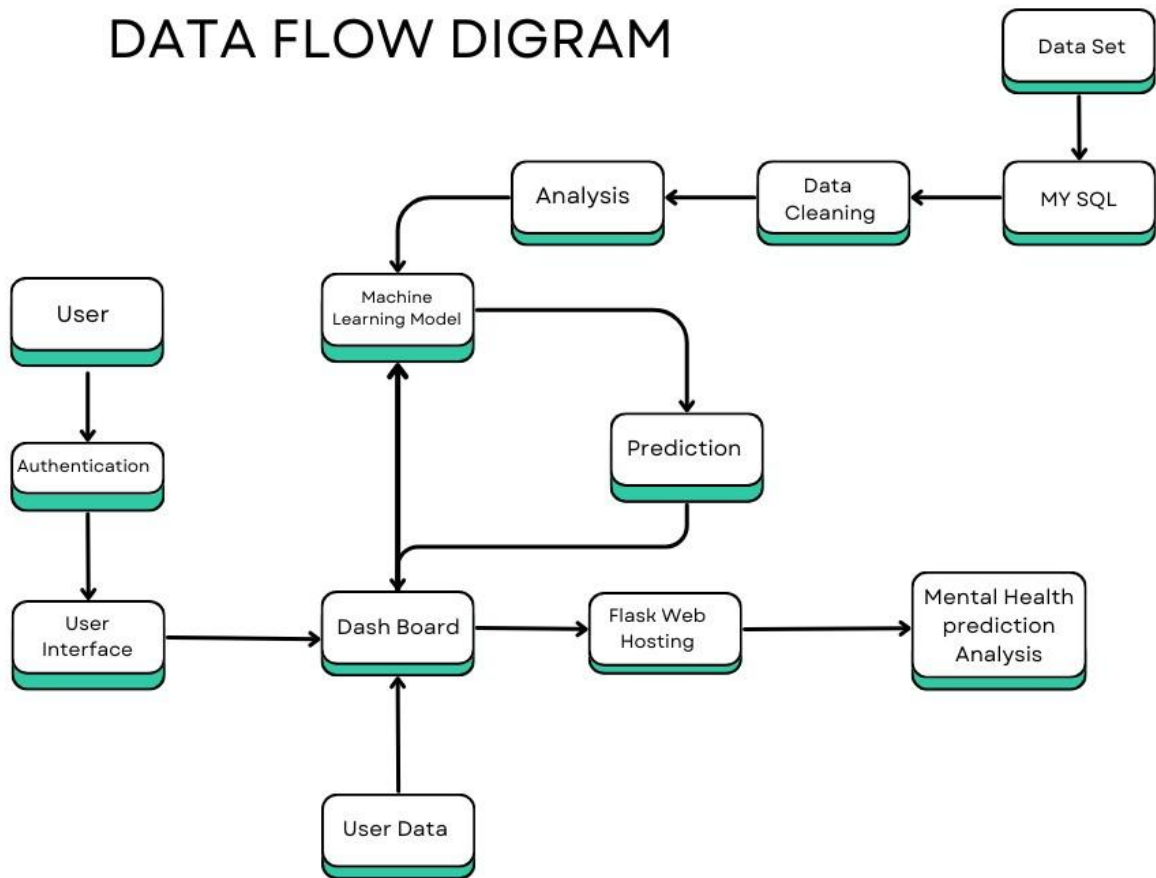
amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is

stored.

FLOW:

1. User configures credentials for login and starts the application.
2. On opening the app, our attractive user interface keeps the user engaged.
3. User inputs the data based on the questionnaire.
4. The predefined dataset is loaded into SQL.
5. Data cleaning and analysis is performed on the dataset and fed into the machine learning algorithm.
6. The trained algorithm receives new information inputted by the user.
7. The model makes a prediction based on previous learning
8. This prediction is displayed on the web application.

DATA FLOW DIGRAM



USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
	Dashboard	USN -1	As a user I can navigate through and provide input in the questionnaire.	I can successfully submit my answers	High	Sprint -1
		USN -2	As a user, I can see solutions for my mental health based on the level predicted by the application	I can view an accurate solution.	High	Sprint -1
Counselor	Dashboard	USN-1	As a counselor, I can see relevant user data and review their reports.	I can access verified user data.	High	Sprint -2
			As a counselor, I can provide solutions based on score predictions	I can input effective solutions into the application.	Medium	Sprint - 2

5.2] Solution Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

Find the best tech solution to solve existing business problems.

Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.

Define features, development phases, and solution requirements.

Provide specifications according to which the solution is defined, managed, and delivered.

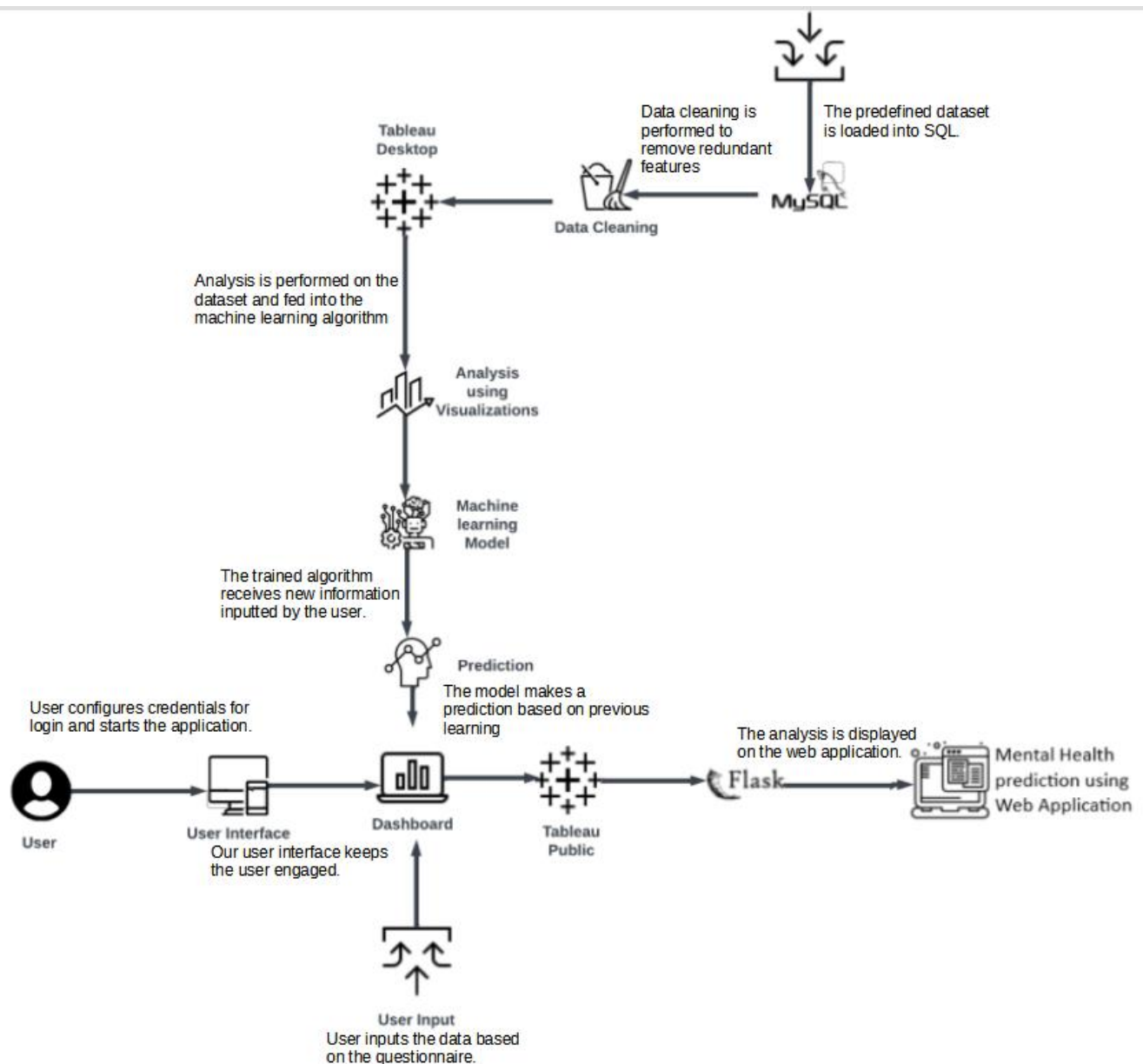


Figure 1: Architecture and data flow of the psycare sample web application

PROJECT PLANNING & SCHEDULING

6.3] Technical Architecture

Technical architecture is a foundational and systematic approach to designing and organizing complex systems, including software applications and network infrastructures, with the primary objective of achieving specific technical goals. It is a crucial component in the realm of information technology, playing a pivotal role in ensuring the successful implementation of projects. Technical architects, often serving as the guiding visionaries, are responsible for overseeing the design and construction of these systems, ensuring they operate efficiently, maintain a high level of security, and are in perfect alignment with the broader objectives of the project.

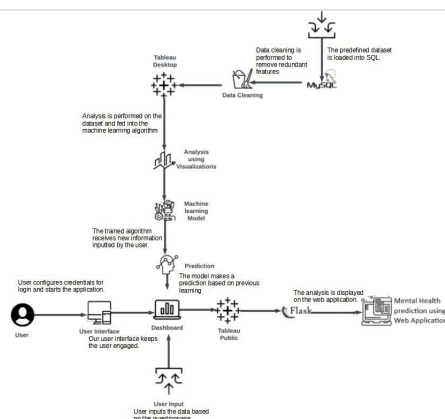


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How the user interacts with web application.	HTML, CSS, JavaScript, React Js etc.
2.	User Authentication	Authentication and security	Firebase, OAuth2
3.	Database	Data Type, Configurations etc.	MySQL
4.	Infrastructure (Server)	Application Deployment on Local System	Local, Cloud Foundry, Kubernetes, etc.
5.	Data collection	Gather a diverse dataset of 1200 employees from different regions of the country across various age groups.	Dataset collection
6.	Data preprocessing	Cleaning, visualization, removal of nulls and redundant data. Removing stop words, tokenizing data and handling special characters.	NumPy, seaborn, etc.
7.	Model Architecture	Utilize word embeddings to convert words into numerical representations suitable for deep learning. Implement an RNN-based model which can capture sequential information in the text.	Word2Vec, GloVe, PyTorch
8.	Training	Train the model on the preprocessed dataset, utilizing GPU/CPU resources, and fine-tune model weights to minimize classification errors.	GPU/CPU, Deep Learning Frameworks
9.	Evaluation	Assess the model's performance and accuracy through metrics.	Metrics such as F1 score/ correlation
10.	Deployment	Integrate the trained model into applications for solutions, involving web app development for user accessibility.	Flask, python

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	React JS, Node JS, flask
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	Firebase, OAuth2
3.	Scalable Architecture	Designing the app's architecture for scalability, easy maintenance, and future updates.	Model-View-ViewModel (MVVM) architecture: Separation of concerns for easier scalability. Repository pattern: Isolating data access for flexibility and testability. Dependency Injection: Dagger Hilt for managing dependencies and scalability
4.	Availability	Ensuring the web app is available to users with minimal downtime	Load Balancing: Distributing incoming network traffic to maintain availability. Server redundancy: Multiple server instances to ensure availability in case of server failures.
5.	Performance	Optimizing the web app's speed and responsiveness	Caching: Use of local caching to reduce network requests. Image Compression: Compressing and optimizing images for faster loading. Background Tasks: Implementing background processing to keep the app responsive. Profiling and optimization tools: Android Profiler and tools for performance analysis and improvement

6.4] Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password	4	High	Anii Shakya
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	4	High	Aniket Khakre
Sprint-2	Dashboard	USN-3	As a user I can navigate through and provide input in the questionnaire.	6	High	Esha Kashyap
Sprint-2		USN-4	As a user, I can see solutions for my mental health based on the level predicted by the application through Gmail	10	High	Pranjoy Seksaria
Sprint-3	Dashboard	USN-5	As a counselor, I can see relevant user data and review their reports.	4	Medium	Pranjoy Seksaria
Sprint-3			As a counselor, I can provide solutions based on score predictions	4	Medium	Anii Shakya

6.5] Sprint Delivery Schedule

Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	8	4 Days	24 Oct 2023	27 Oct 2023		
Sprint-2	16	8 Days	28 Oct 2023	04 Nov 2023		
Sprint-3	8	2 Days	05 Nov 2023	06 Nov 2023		

Velocity:

$$AV = 32/14 = 2.3$$

Burndown Chart:

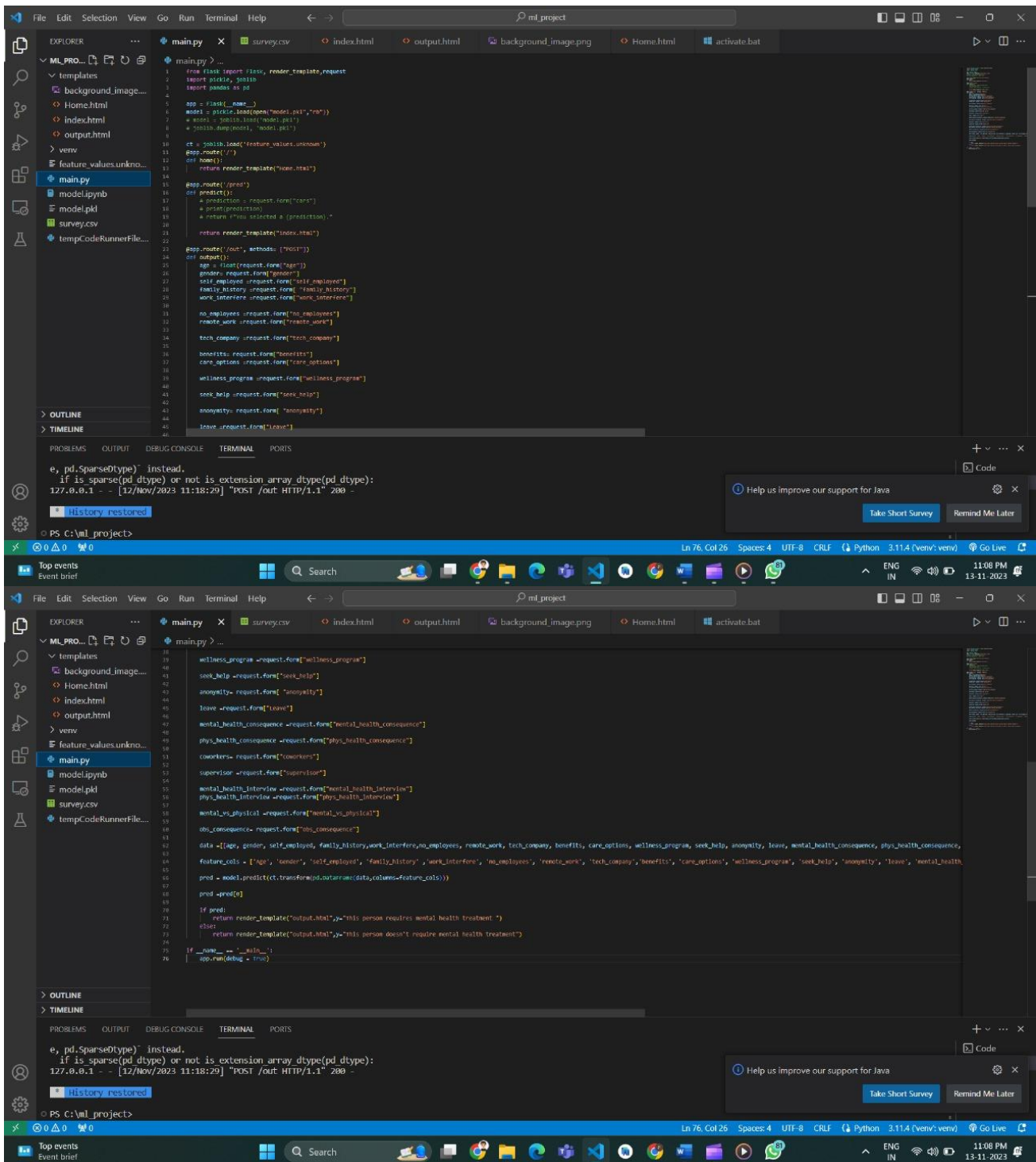
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such

as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



CODING & SOLUTIONING

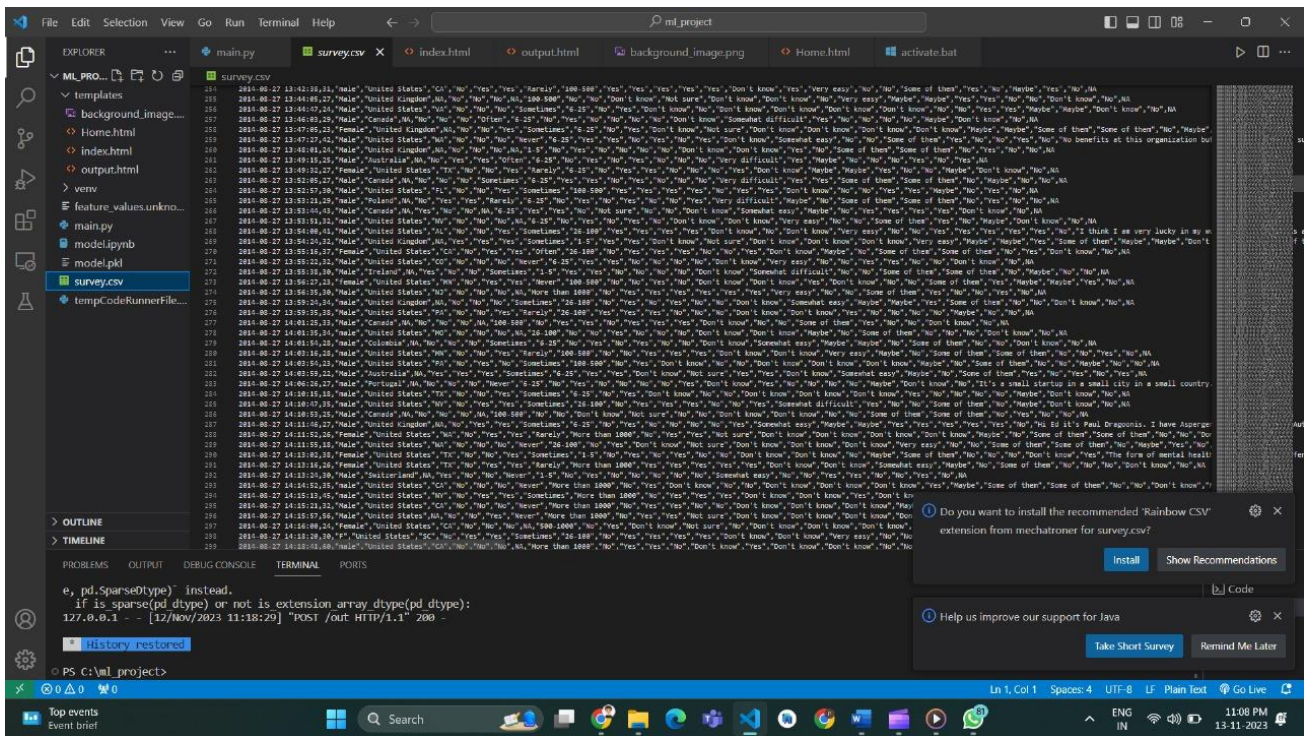
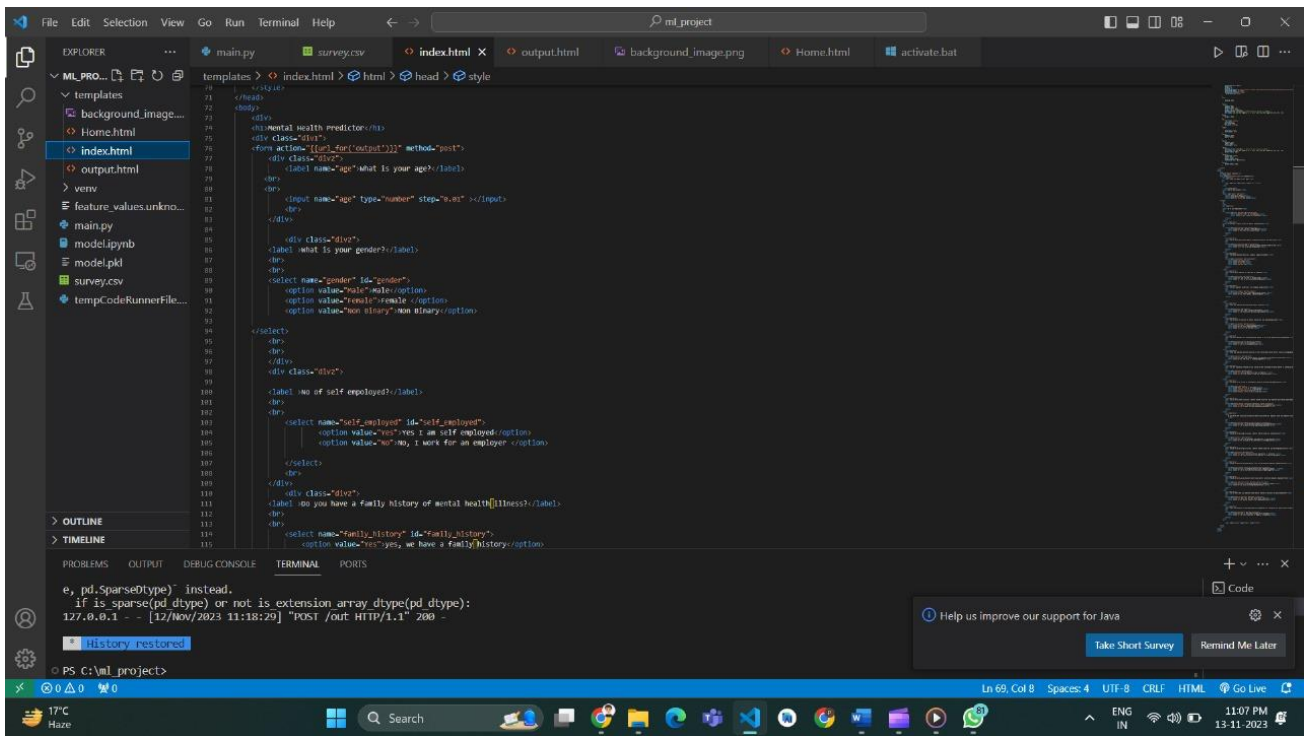
7.1| Feature 1:



7.2] Feature 2:

```
File Edit Selection View Go Run Terminal Help ml_project
EXPLORER
  ML_PRO...
  templates
    background_image...
    Home.html
    index.html
    output.html
  venv
  feature_values_unkno...
  main.py
  model.ipynb
  model.pkl
  survey.csv
  tempCodeRunnerFile...

templates > Home.html > html > head > title
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200
2201
2202
2203
2204
2205
2206
2207
2208
2209
2210
2211
2212
2213
2214
2215
2216
2217
2218
2219
2220
2221
2222
2223
2224
2225
2226
2227
2228
2229
2230
2231
2232
2233
2234
2235
2236
2237
2238
2239
2240
2241
2242
2243
2244
2245
2246
2247
2248
2249
2250
2251
2252
2253
2254
2255
2256
2257
2258
2259
2260
2261
2262
2263
2264
2265
2266
2267
2268
2269
2270
2271
2272
2273
2274
2275
2276
2277
2278
2279
2280
2281
2282
2283
2284
2285
2286
2287
2288
2289
2290
2291
2292
2293
2294
2295
2296
2297
2298
2299
2300
2301
2302
2303
2304
2305
2306
2307
2308
2309
2310
2311
2312
2313
2314
2315
2316
2317
2318
2319
2320
2321
2322
2323
2324
2325
2326
2327
2328
2329
2330
2331
2332
2333
2334
2335
2336
2337
2338
2339
2340
2341
2342
2343
2344
2345
2346
2347
2348
2349
2350
2351
2352
2353
2354
2355
2356
2357
2358
2359
2360
2361
2362
2363
2364
2365
2366
2367
2368
2369
2370
2371
2372
2373
2374
2375
2376
2377
2378
2379
2380
2381
2382
2383
2384
2385
2386
2387
2388
2389
2390
2391
2392
2393
2394
2395
2396
2397
2398
2399
2400
2401
2402
2403
2404
2405
2406
2407
2408
2409
2410
2411
2412
2413
2414
2415
2416
2417
2418
2419
2420
2421
2422
2423
2424
2425
2426
2427
2428
2429
2430
2431
2432
2433
2434
2435
2436
2437
2438
2439
2440
2441
2442
2443
2444
2445
2446
2447
2448
2449
2450
2451
2452
2453
2454
2455
2456
2457
2458
2459
2460
2461
2462
2463
2464
2465
2466
2467
2468
2469
2470
2471
2472
2473
2474
2475
2476
2477
2478
2479
2480
2481
2482
2483
2484
2485
2486
2487
2488
2489
2490
2491
2492
2493
2494
2495
2496
2497
2498
2499
2500
2501
2502
2503
2504
2505
2506
2507
2508
2509
2510
2511
2512
2513
2514
2515
2516
2517
2518
2519
2520
2521
2522
2523
2524
2525
2526
2527
2528
2529
2530
2531
2532
2533
2534
2535
2536
2537
2538
2539
2540
2541
2542
2543
2544
2545
2546
2547
2548
2549
2550
2551
2552
2553
2554
2555
2556
2557
2558
2559
2560
2561
2562
2563
2564
2565
2566
2567
2568
2569
2570
2571
2572
2573
2574
2575
2576
2577
2578
2579
2580
2581
2582
2583
2584
2585
2586
2587
2588
2589
2590
2591
2592
2593
2594
2595
2596
2597
2598
2599
2600
2601
2602
2603
2604
2605
2606
2607
2608
2609
2610
2611
2612
2613
2614
2615
2616
2617
2618
2619
2620
2621
2622
2623
2624
2625
2626
2627
2628
2629
2630
2631
2632
2633
2634
2635
2636
2637
2638
2639
2640
2641
2642
2643
2644
2645
2646
2647
2648
2649
2650
2651
2652
2653
2654
2655
2656
2657
2658
2659
2660
2661
2662
2663
2664
2665
2666
2667
2668
266
```

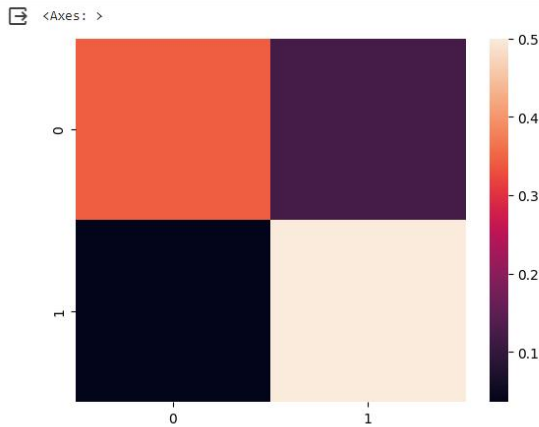


PERFORMANCE TESTING

8.1] Performace Metrics:

S.No.	Parameter	Values	Screenshot
1.	Metrics	Classification Model: Confusion Matrix - , Accuray Score- & Classification Report -	
1.	Tune the Model	Hyperparameter Tuning - Validation Method -	86.8% accuracy

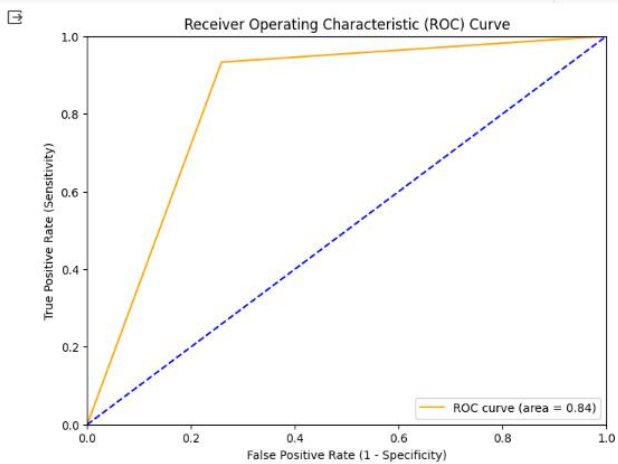
```
import seaborn as sns
cf_matrix= confusion_matrix(y_test, pred_abc)
sns.heatmap(cf_matrix/np.sum(cf_matrix))
```



```
from sklearn.metrics import roc_curve, auc
import matplotlib.pyplot as plt

fpr_abc, tpr_abc, thresholds_abc = roc_curve(y_test, pred_abc)
roc_auc_abc = auc(fpr_abc, tpr_abc)

plt.figure(figsize=(8, 6))
plt.plot(fpr_abc, tpr_abc, color='orange', label='ROC curve (area = {:.2f})'.format(roc_auc_abc))
plt.plot([0, 1], [0, 1], color='blue', linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.0])
plt.title('Receiver Operating Characteristic (ROC) Curve')
plt.xlabel('False Positive Rate (1 - Specificity)')
plt.ylabel('True Positive Rate (Sensitivity)')
plt.legend(loc='lower right')
plt.show()
```



```

[64] from sklearn.model_selection import RandomizedSearchCV
import numpy as np

params_abc = {
    'n_estimators': [int(x) for x in np.linspace(start=1, stop=50, num=15)],
    'learning_rate': [(0.97 + x/100) for x in range(0, 8)],
}

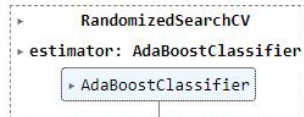
abc_random = RandomizedSearchCV(estimator=abc, param_distributions=params_abc, n_iter=50, cv=5, n_jobs=-1, random_state=49)

```

```

[65] abc_random.fit(x_train, y_train)

```



```

abc_random.best_params_
{'n_estimators': 4, 'learning_rate': 1.0}

```

```

[67] from sklearn.ensemble import AdaBoostClassifier
from sklearn.metrics import accuracy_score
abc_tuned = AdaBoostClassifier(random_state=49, n_estimators=11, learning_rate=1.02)
abc_tuned.fit(x_train, y_train)
pred_abc_tuned = abc_tuned.predict(x_test)
print('Accuracy of AdaBoost (tuned) =', accuracy_score(y_test, pred_abc_tuned))

```

Accuracy of AdaBoost (tuned) = 0.868

```

[77] print(classification_report(y_test, pred_abc))

```

	precision	recall	f1-score	support
0	0.91	0.74	0.82	116
1	0.81	0.93	0.87	134
accuracy			0.84	250
macro avg	0.86	0.84	0.84	250
weighted avg	0.85	0.84	0.84	250

S.No.	Parameter	Screenshot / Values
1.	Dashboard design	No of Visualizations - 4
2.	Data Responsiveness	High
3.	Amount Data to Rendered (DB2 Metrics)	21
4.	Utilization of Data Filters	4 columns were filtered
5.	Effective User Story	3 pages

6.	Descriptive Reports	Data visualizations, bivariate, univariate and multivariate analysis were performed
----	---------------------	---

S.No.	Parameter	Values	Screenshot
1.	Model Summary	AdaBoost classifier	
2.	Accuracy	Training Accuracy - Validation Accuracy -	84.66 86.7

```
[63] from sklearn.ensemble import AdaBoostClassifier
      from sklearn.metrics import accuracy_score

      # Assuming you have X_train and y_train for training and x_test and y_test for testing
      abc = AdaBoostClassifier(random_state=99)
      abc.fit(x_train, y_train)
      pred_abc = abc.predict(x_test)
      print(f'Accuracy of AdaBoost = {accuracy_score(y_test, pred_abc) * 100}%', )
```

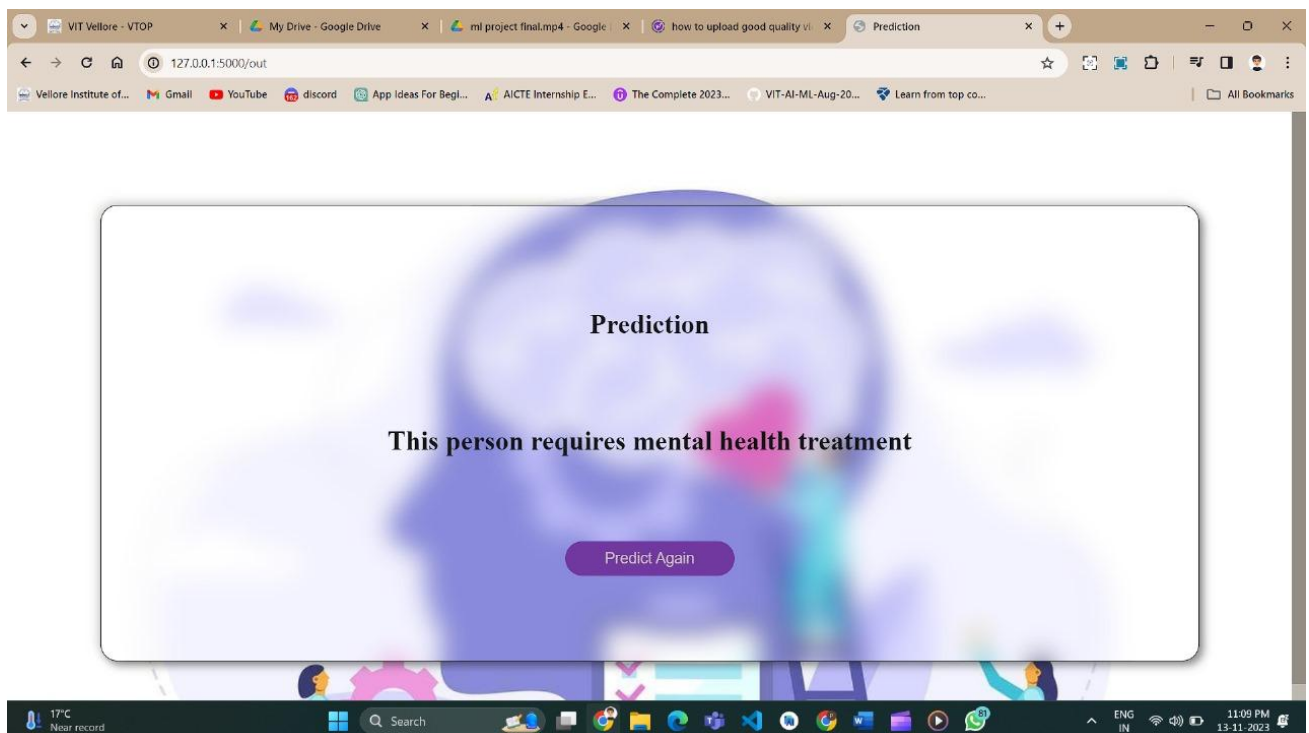
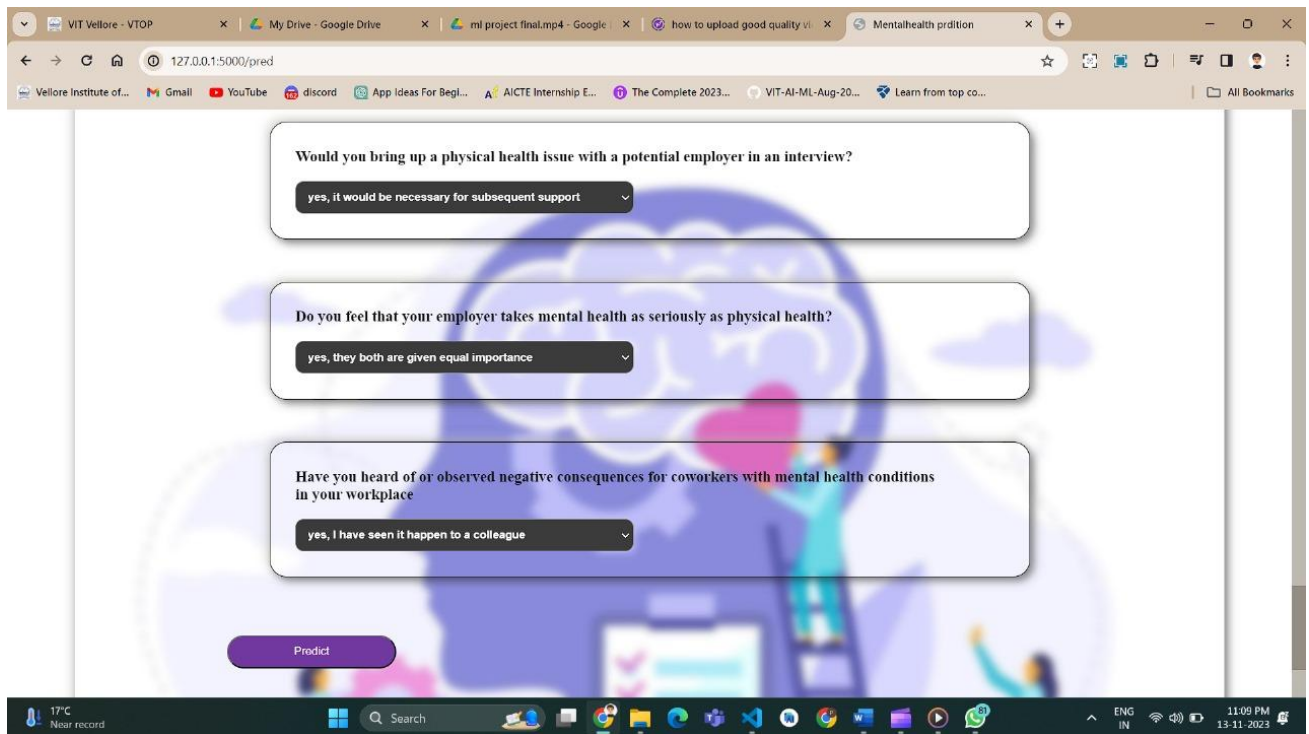
Accuracy of AdaBoost = 84.39999999999999%

RESULTS

9.1] Output Screenshots:

The screenshot shows a web browser window with the URL `127.0.0.1:5000`. The page has a light purple background with a large, stylized illustration of a human head profile. Inside the head, there's a smaller illustration of a person sitting at a desk with a laptop. The word "Welcome" is centered at the top. Below it, a white rectangular box contains a "Register" form. The form has the title "Register" and the instruction "Please fill in this form for Registration". It includes three input fields: "Name" (with a placeholder "Name"), "Email" (with a placeholder "Enter Email"), and "Mobile Number" (with a placeholder "Number"). Below these fields, there's a line of text: "By creating an account you agree to our [Terms & Privacy](#)." At the bottom of the form is a purple button labeled "Register". The browser's taskbar at the bottom shows the system clock as 11:09 PM on 13-11-2023.

The screenshot shows a web browser window with the URL `127.0.0.1:5000/pred`. The page has a light purple background with a large, stylized illustration of a human head profile. Inside the head, there's a smaller illustration of a person sitting at a desk with a laptop. The title "Mental Health Predictor" is centered at the top. Below it, there are two white rectangular boxes for user input. The first box is titled "What is your age?" and contains a black input field. The second box is titled "What is your gender?" and contains a dropdown menu with "Male" selected. The browser's taskbar at the bottom shows the system clock as 11:09 PM on 13-11-2023.



ADVANTAGES & DISADVANTAGES

10.1] Advantages:

1. Accessibility: Advantage: Web-based platforms are accessible from various devices with internet connectivity, allowing users to engage with mental health support using their preferred devices, including computers and tablets.
2. Inclusivity: Advantage: A web-based approach caters to a broader audience, reaching individuals who may not use or have access to mobile applications, thereby promoting inclusivity in mental health care.
3. User Engagement: Advantage: Web platforms, with their larger screens and interactive interfaces, can facilitate a more immersive and engaging user experience, potentially enhancing user engagement with mental health features.
4. Scalability: Advantage: Web-based solutions are often easier to scale and update, allowing for continuous improvements in predictive models, user interfaces, and additional features.
5. Integration with Existing Services: Advantage: Integration with existing web-based services and platforms becomes more seamless, enabling collaboration with other healthcare providers, telehealth services, and support networks.
6. Flexible User Interface: Advantage: HTML-based frontend allows for a flexible and customizable user interface, ensuring adaptability to different user preferences and needs.
7. Global Reach: Advantage: Web platforms have the potential for a global reach, transcending geographical boundaries and making mental health prediction accessible to a diverse international audience.

10.2]Disadvantages:

1. Limited Offline Functionality: Disadvantage: Web platforms may have limited functionality in offline environments, potentially restricting user access in areas with poor or no internet connectivity.
2. Device Compatibility: Disadvantage: While web platforms are versatile, ensuring compatibility across various devices and web browsers can be challenging, potentially leading to inconsistencies in user experience.
3. Security Concerns: Disadvantage: Web-based platforms may face security challenges, necessitating robust measures to protect sensitive mental health data and maintain user confidentiality.
4. Learning Curve: Disadvantage: Users who are not familiar with web-based technologies may experience a learning curve, potentially impacting their ability to navigate and utilize the platform effectively.
5. Dependence on Internet Connectivity: Disadvantage: The effectiveness of the platform relies heavily on consistent internet connectivity, limiting its usability in areas with unreliable or no internet access.
6. Potential for Information Overload: Disadvantage: The web environment may present the risk of information overload, where users may be overwhelmed by the volume of data and insights provided, affecting the overall user experience.
7. Ethical and Privacy Concerns: Disadvantage: The collection and storage of sensitive mental health data raise ethical and privacy concerns. Ensuring compliance with privacy regulations and maintaining user

trust is paramount.

8. **Technical Challenges: Disadvantage:** Developing and maintaining a robust web-based platform with advanced machine learning capabilities can pose technical challenges, requiring ongoing updates and technical support.

CONCLUSION

In the culmination of our project, we've charted new territory in the intersection of mental health care and digital innovation. By pioneering a web-based mental health prediction platform, we've addressed the critical gap in the accessibility of predictive tools for a diverse audience.

Harnessing the power of supervised machine learning, including regression and classification models, and deploying the potent AdaBoost algorithm, we've elevated predictive accuracy and personalized insights. The integration of Flask mechanisms ensures a secure, responsive, and user-friendly interface, seamlessly delivering advanced machine learning capabilities through web browsers.

Our commitment to user-centric design, as embodied in the HTML frontend, ensures an inclusive and intuitive experience. Throughout development, we've adhered to ethical standards, prioritizing user privacy and data security. The utilization of a basic dataset with 21 data columns allows for a comprehensive understanding of the myriad factors influencing mental health.

As we conclude, this project signifies not just a technological evolution but a paradigm shift in mental health care. It marks the inception of a platform that empowers individuals to proactively manage their emotional well-being in the digital age. We anticipate that our web-based solution will not only redefine how users engage with mental health prediction but also set a precedent for the ethical, secure, and user-centric development of digital mental health solutions. In the journey ahead, we remain dedicated to refining and expanding our platform, contributing to a future where mental health support is as accessible and personalized as the click of a button.

FUTURE SCOPE

The future scope of a machine learning or data analysis project can be quite extensive, offering opportunities for scaling and diverse applications.

1. **Scalability for Big Data:** As data volumes grow, adapting the project to handle big data scenarios becomes crucial. Employing distributed computing frameworks like Apache Spark or integrating with big data platforms can enhance scalability.
2. **Advanced Machine Learning Models:** Explore more sophisticated machine learning models and algorithms. As new methods and techniques emerge, integrating them into your project can improve prediction accuracy and robustness.
3. **Real-Time Analytics:** Extend the project to provide real-time analytics. This could involve implementing stream processing systems to analyze and derive insights from data as it arrives.
4. **Integration with IoT Devices:** If applicable, consider integrating with Internet of Things (IoT) devices. This can provide real-time data from sensors and devices, enhancing the project's capabilities and use cases.
5. **Multi-Modal Data Analysis:** Expand the project to analyze multiple types of data, such as text, images, and audio. This could involve implementing multi-modal machine learning models for a more comprehensive understanding.
6. **Enhanced User Interaction:** Improve the project's user interface and interaction features. Consider implementing features like interactive visualizations, natural language processing for user queries, or incorporating virtual/augmented reality elements.
7. **Cross-Platform Compatibility:** Make the project more versatile by ensuring compatibility across different platforms (web, mobile, desktop). This allows users to access and interact with the project seamlessly from various devices.

8. Collaboration with Other Systems: Explore opportunities for collaboration with other systems or platforms. This could involve integrating with existing enterprise solutions, databases, or other analytics tools.

APPENDIX

13.1| Glossary

ML: Machine Learning

HTML: Hypertext Markup Language

CSS: Cascading Style Sheets

13.2| Data Dictionary

The dataset used in this project consists of 21 columns capturing various aspects related to mental health. The data dictionary provides a detailed description of each column, including data type and potential values.

Column Name	Description	Data Type
User_ID	Unique identifier for each user	Integer
Age	Age of the user	Integer
Gender	Gender of the user	String (Male/Female/Other)

13.3| Machine Learning Model Details

1. Supervised Learning:

- I. AdaBoost Algorithm
- II. KNN Classifier
- III. Random Forest
- IV. Decision Tree
- V. Gradient Boosting Classifier

Models Used:

Regression model for continuous prediction.

Classification model for categorical prediction.

Training Data: Dataset with labeled examples for supervised training.

2. Flask Integration

Endpoints:

/predict: Endpoint for making predictions.

/feedback: Endpoint for user feedback.

Security Measures:

HTTPS encryption for secure data transmission.
User authentication mechanisms.

13.4| Frontend Design

1. HTML Structure

Homepage: Overview of platform features and navigation.

Prediction Interface: User interface for input and displaying predictions.

Community Section: Forum, discussion groups, and community events.

2. CSS Styling

Color Palette: Calming and inclusive color scheme. - purples and light pastels

Responsive Design: Ensures usability across different screen sizes - drop down boxes and prewritten answers for ease of use.

Source Code:

** attached in the GitHub repository for this project

GitHub & Project Demo Link:

GitHub Link: <https://github.com/smartinternz02/SI-GuidedProject-591336-1697650886.git>

Project Demo Link (video explanation):

<https://drive.google.com/file/d/1k9hFug87KLGTVcXKQBk5l-W5wbk6I7-Z/view?usp=sharing>