Digital Mental Health Service: Lessons Learned and Recommendations

6 Lessons Learned from Dmind : Challenges and Solutions

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2200

Number of over 15-year-old Thais with depression disorder per 100,000 citizens*

9

Number of psychiatric workers (doctors+nurses+Psychologists) per 100,000 citizens*

*Source: Department of Mental Health in 2021

DMIND Multimodal AI model for Depression

- Started in 2019 as a research project by Prof.Solapat and Prof.Peerapon

- Become part of Mohpromt service in Apr 2022

- Self-rating (adapted from HAMD-7), facial video, voice, text

- Dmind provides quick screening with accuracy and precision > 75%

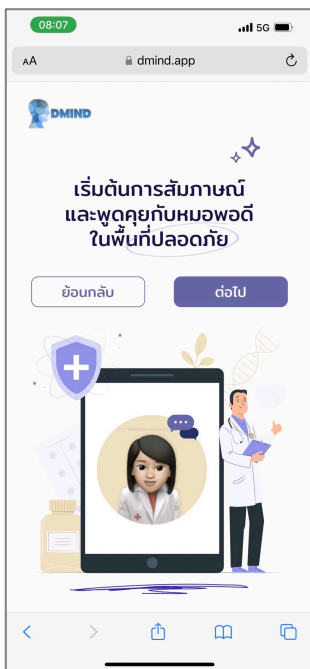- Our AI engine has been trained with > 7,000 labelled cases
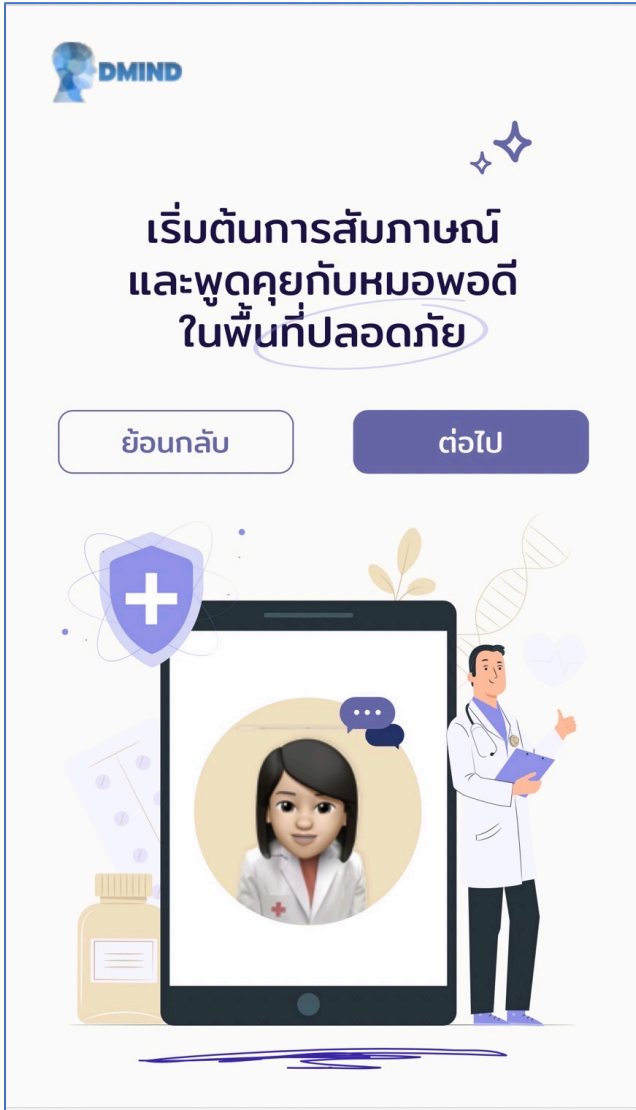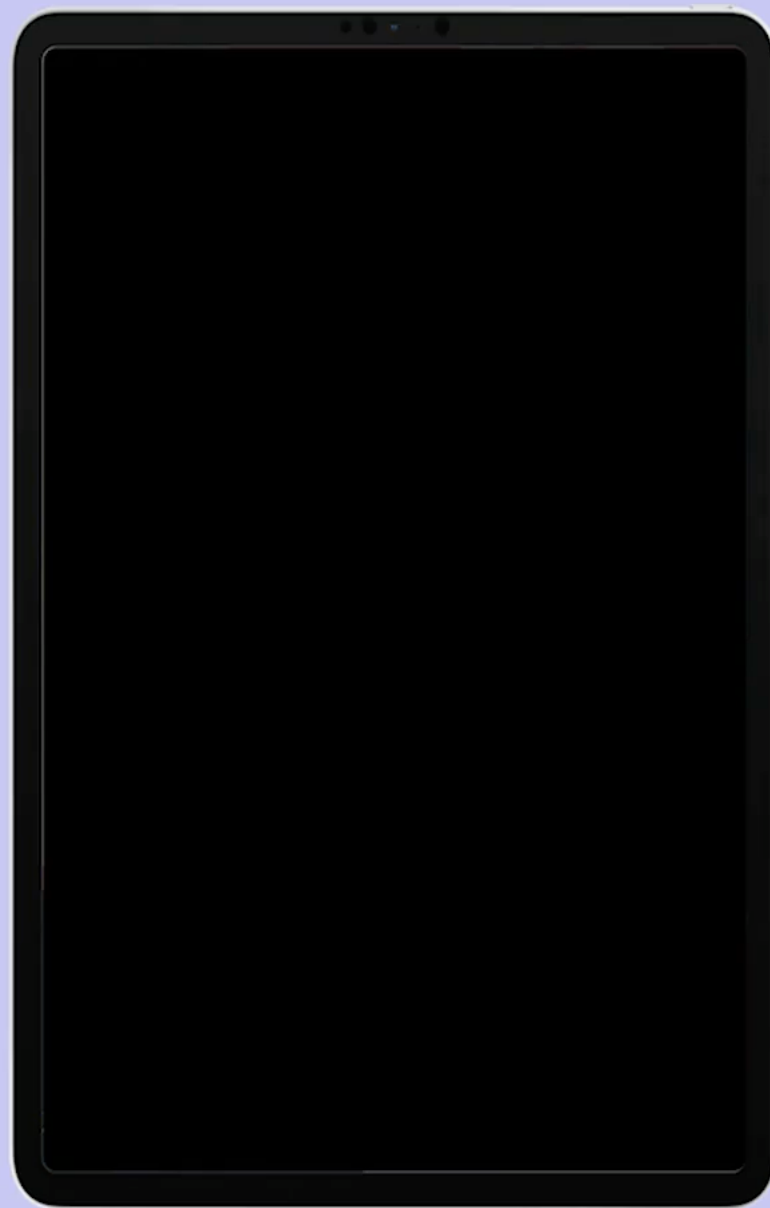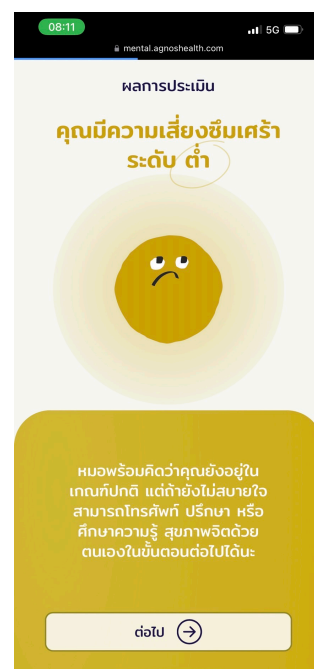
Mohpromt
Line OA

Self-Rating
Questionnaire

AI Video
Interview

Depression Level
Classification

Severe Cases
(with consent)

Moderate Cases
(with consent)

Usages
165,629

Severe Cases
11,003

Successful Helps
968 + 300

Stats during Apr 2022 – July 2023

Lesson #1

Understand customer journey with data-driven insights

Challenge : Customer Journey Design

- To design customer journey, we usually observe user behaviors in actual environment / situation

- It is quite impossible to observe people with depression using our Dmind application
  e.g. need to be alone,

- Solution: understand our users by finding insights from usage data

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Complete Self-Rating

Start AI Interview

Complete Dmind App

78.61% Drop-off

33.07% Drop-off
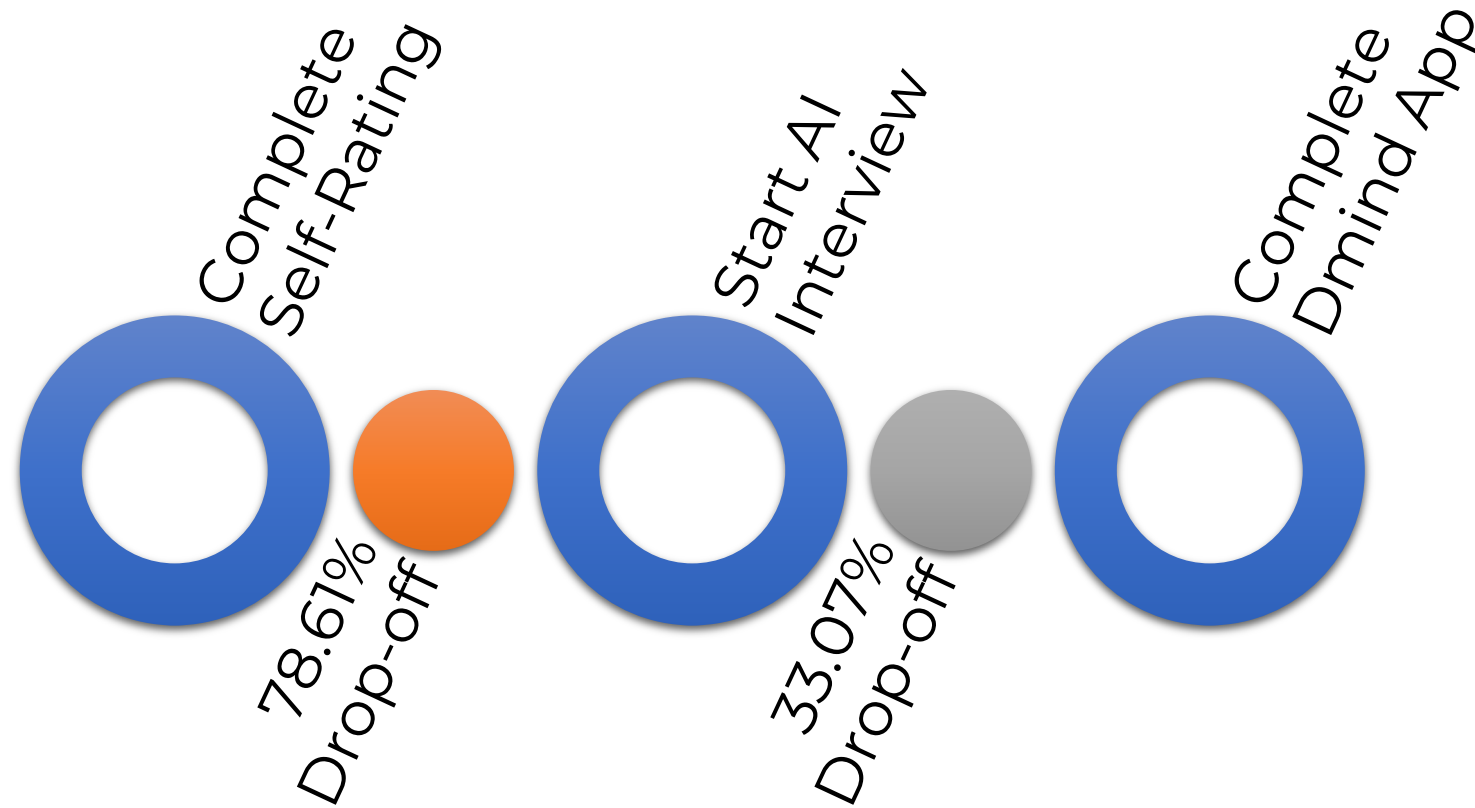
23,712 out of 165,629 cases complete Dmind app (14.32% completion rate)

AI Interview Completion
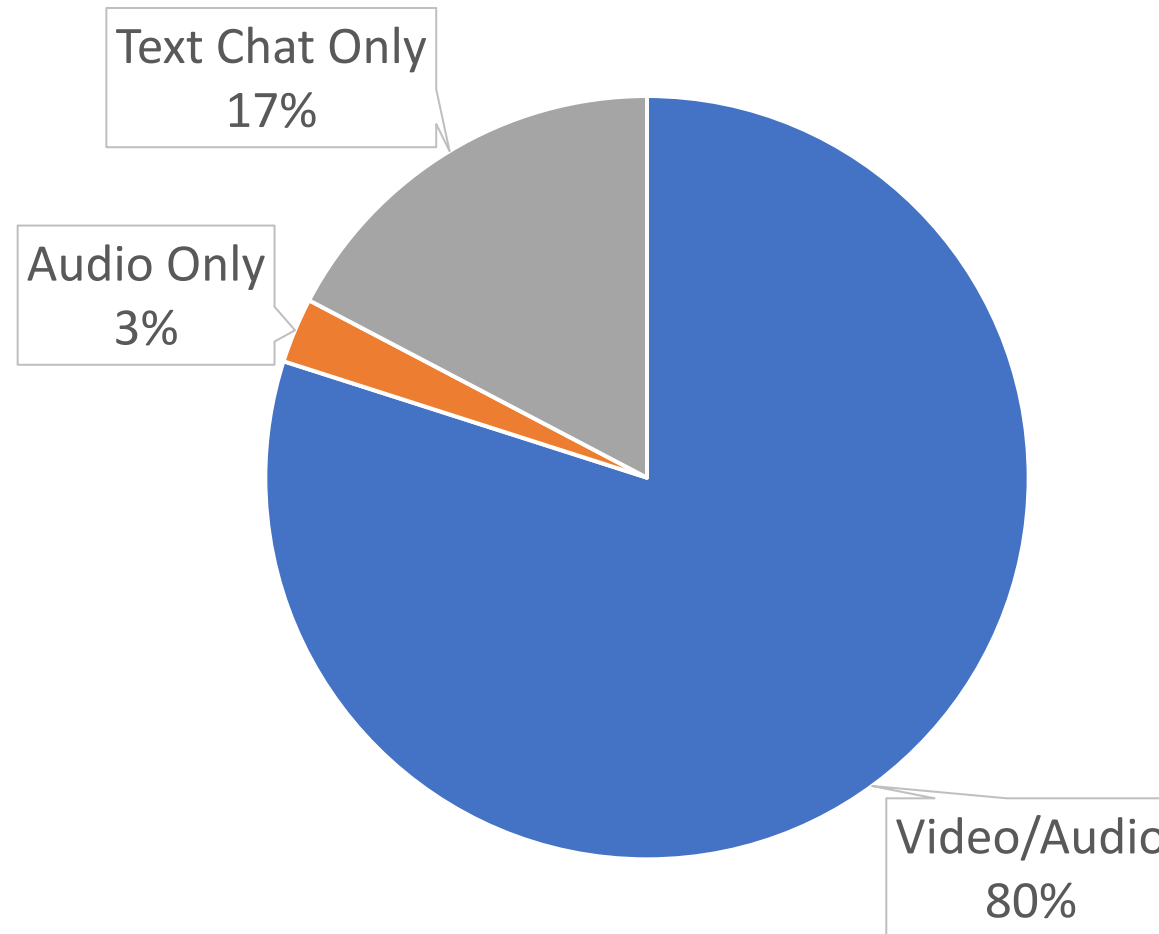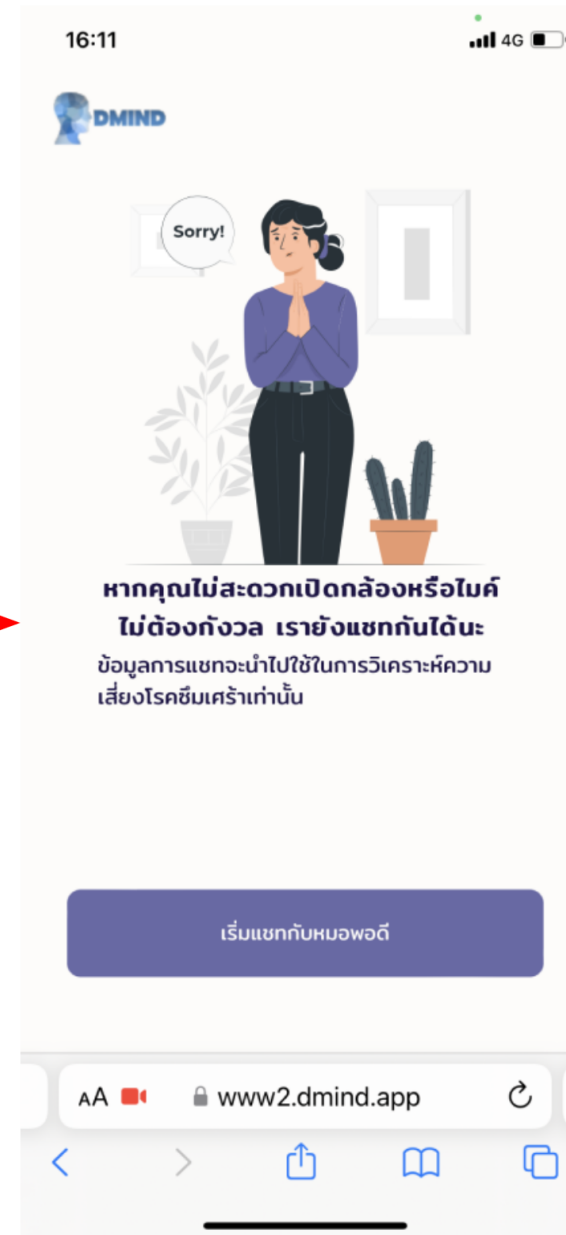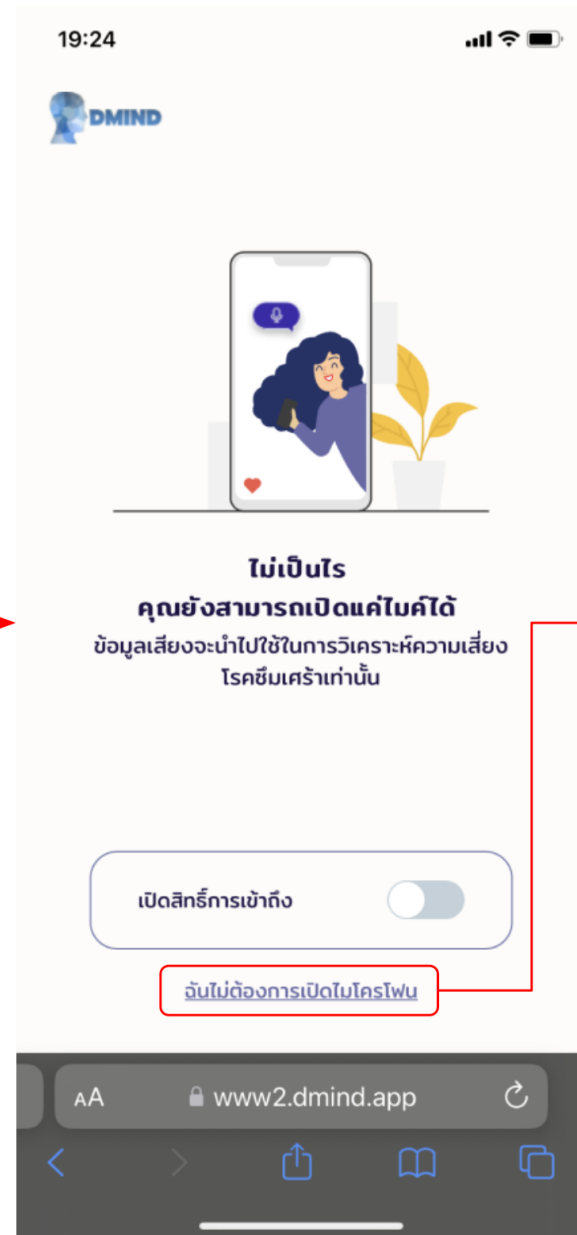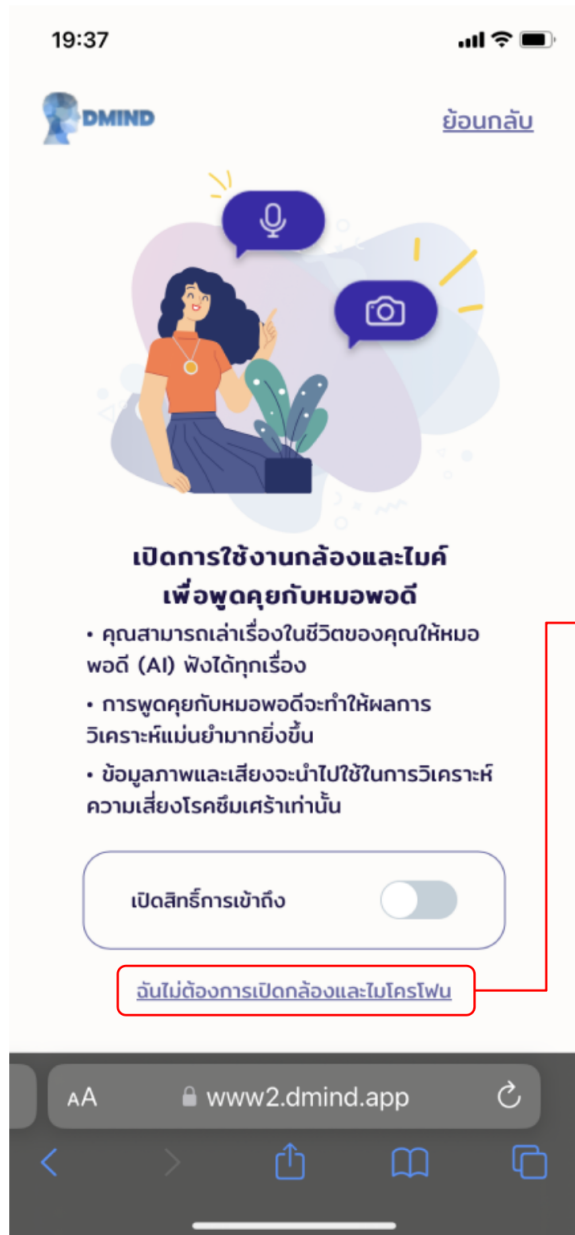
In original UX design, we ask permission from the user along with the mode of interview

เลือกวิธีการพูดคุยกับคุณหมอ Avatar

หมอจินตนา

พูดคุยด้วยกล้องวิดีโอ

ประเมินภาวะซึมเศร้าผ่านกล้อง
คุณหมอจะสามารถวิเคราะห์
ได้ทั้งจากสีหน้าและน้ำเสียง
ช่วยให้ผลมีความแม่นยำมากขึ้น

ถัดไป

🔒 dmind.app

พูดคุยด้วยแชท

ประเมินภาวะซึมเศร้าผ่านข้อความ
คุณหมอจะวิเคราะห์จากเนื้อหา
ความแม่นยำขึ้นกับความชัดเจน
และรายละเอียดของข้อความ

พูดคุยด้วยกล้องวิดีโอ

ประเมินภาวะซึมเศร้าผ่านกล้อง
คุณหมอจะสามารถวิเคราะห์
ได้ทั้งจากสีหน้าและน้ำเสียง
ช่วยให้ผลมีความแม่นยำมากขึ้น

พูดคุยด้วยไมโครโฟน

ประเมินภาวะซึมเศร้าผ่านเสียงสนทนา
คุณหมอจะวิเคราะห์จากน้ำเสียงของคุณ
ความแม่นยำขึ้นกับคุณภาพน้ำเสียง

อนุญาตเปิดการใช้งานกล้องและไมค์

วิธีการประเมินที่คุณเลือกจำเป็นต้อง
เปิดการใช้งานอุปกรณ์กล้องและไมโครโฟนก่อน
จึงจะสามารถดำเนินการต่อได้

ปฏิเสธ   อนุญาต

อนุญาตเปิดการใช้งานไมค์

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ปฏิเสธ   อนุญาต

Insight from data analytic led to new UX design.

In new UX design, we let user choose method of interview first, then asking for permission

Lesson #2

Data quality and data labeling is always hard

Challenges: Input Data Quality

- AI Performance depends on input data quality
- In pilot tests, we can control testing environment
- In reality,
  - Video: Camera resolution, lighting, sharpness, head position
  - Audio: Background noise, sobbing, talking with others

Solutions: Data Cleansing

- Video:
  - Preprocessing
  - Facial detection
- Audio:
  - Noise cancellation
  - Loudness detection
  - Tonal mood classification (sad, happy, other)

Challenge: Data Labeling is a huge task

Legend: Labelled Interviews, Completed Interviews

Tooltip:
16 Jul 2023
Labelled Interviews: 7,253
Completed Interviews: 18,285

Pair-wise Accuracy

	1	2	3	4	5	6	7	8	9	10	11
1	1	0.6	0.4	0.43	0.3	0.6	0.5	0.5	0.6	0.5	0.5
2	0.6	1	0.75	0.62	0.75	0.7	0.7	0.8	0.8	0.7	0.4
3	0.4	0.75	1	0.75	0.65	0.55	0.65	0.85	0.7	0.85	0.5
4	0.43	0.62	0.75	1	0.5	0.38	0.88	0.75	0.38	0.88	0.62
5	0.3	0.75	0.65	0.5	1	0.5	0.55	0.65	0.6	0.55	0.5
6	0.6	0.7	0.55	0.38	0.5	1	0.55	0.6	0.55	0.5	0.45
7	0.5	0.7	0.65	0.88	0.55	0.55	1	0.7	0.5	0.7	0.35
8	0.5	0.8	0.85	0.75	0.65	0.6	0.7	1	0.6	0.8	0.35
9	0.6	0.8	0.7	0.38	0.6	0.55	0.5	0.6	1	0.6	0.45
10	0.5	0.7	0.85	0.88	0.55	0.5	0.7	0.8	0.6	1	0.45
11	0.5	0.4	0.5	0.62	0.5	0.45	0.35	0.35	0.45	0.45	1

# Challenge: Labeling consistency

Inter-ratings are performed regularly

Lesson #3

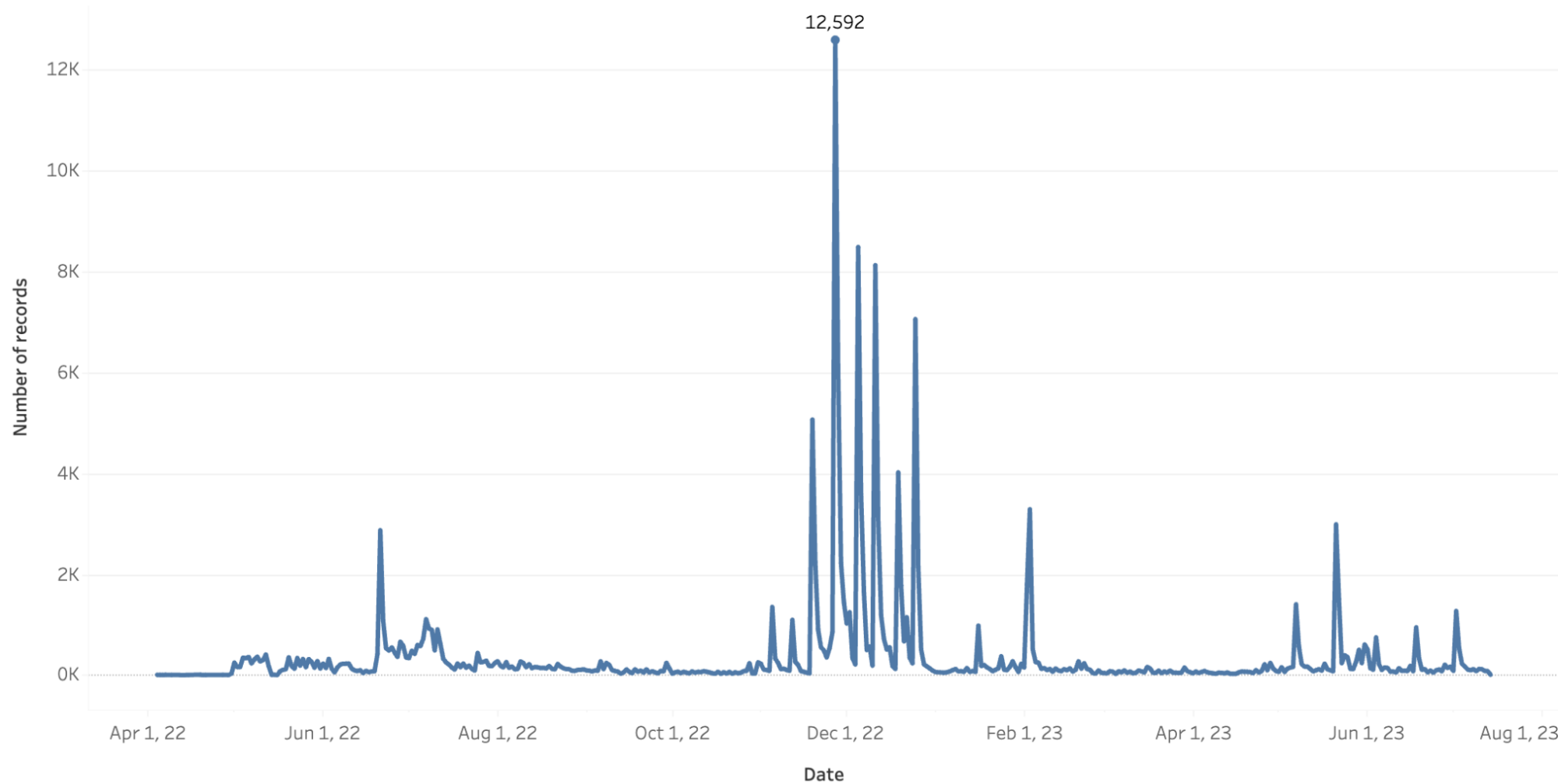Balancing theory with practice

Challenge: Class Imbalance

- Class imbalance can degrade performance of rare classes prediction

- If our AI model ignores rare classes, rare classes' sensitivity will be bad, but overall accuracy is still good

- Solution: we utilize rule-based method to help improve sensitivity

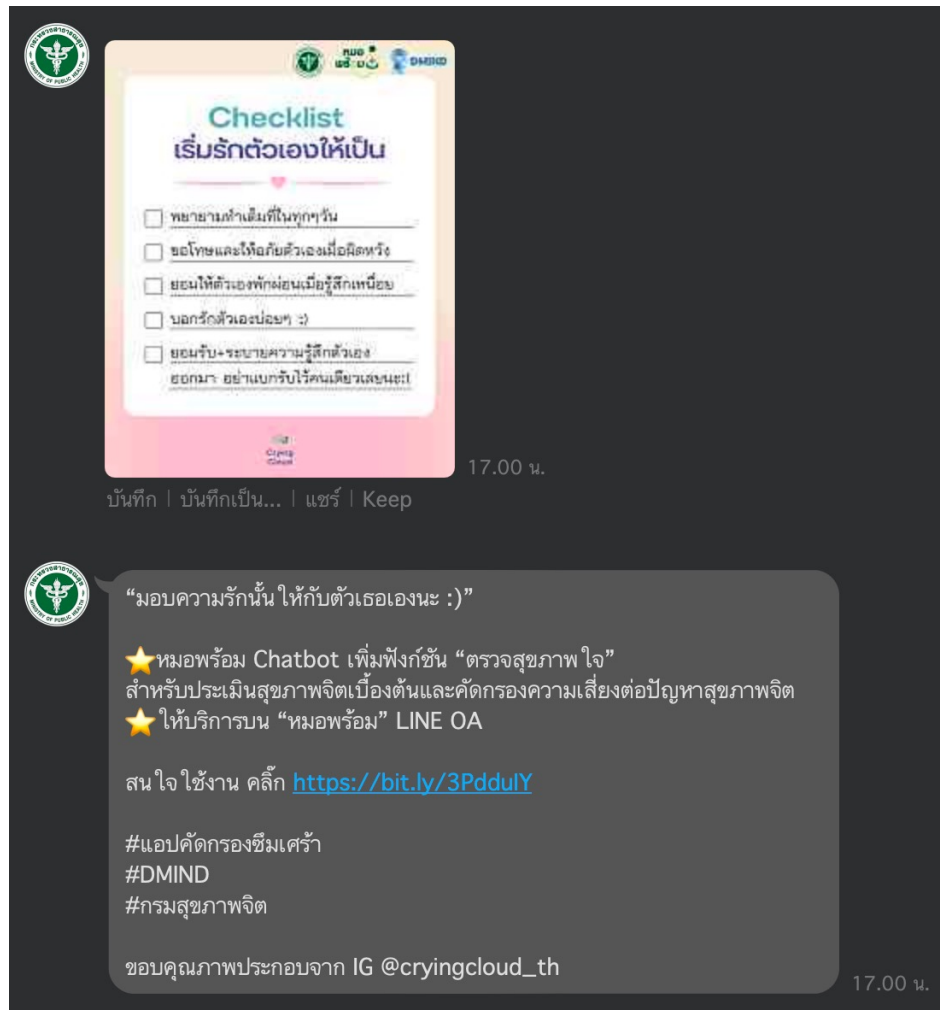 - If users indicate tendency to suicide, we assign them with severe class

Severe 2%

Normal 19%

Moderate 22%

Mild 57%
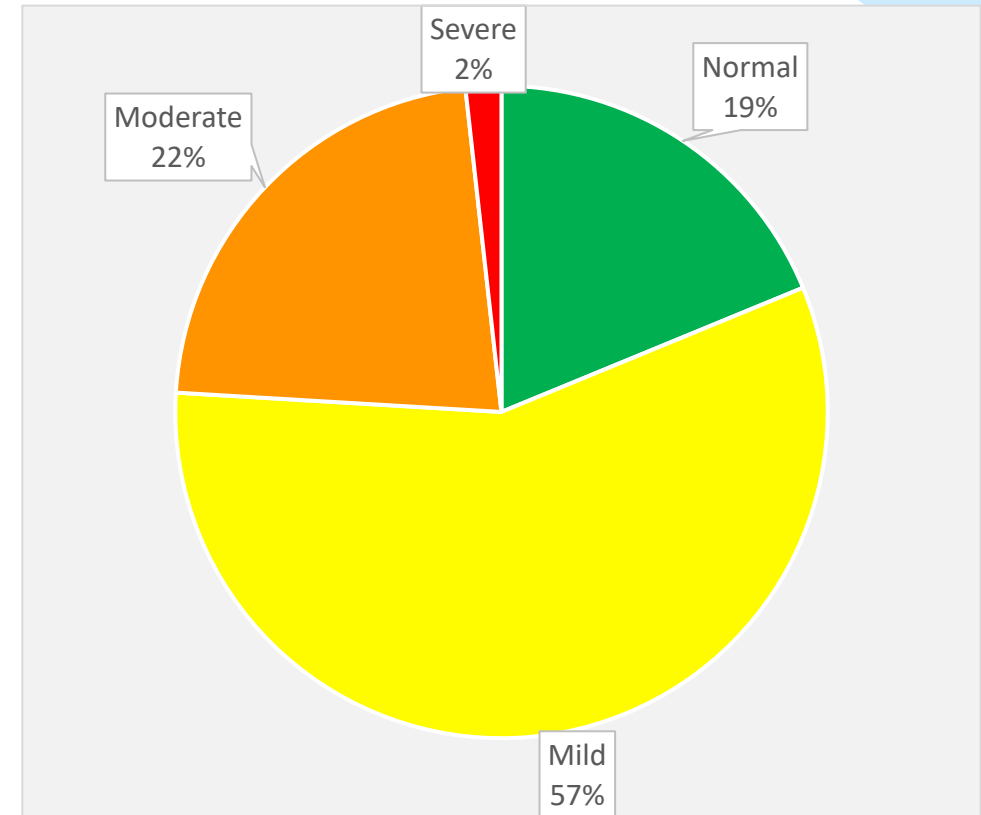
Lesson #4

Simple (but right timing) promotions can go a long way

Challenge: Traffics fluctuated over time

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Solution: Increase Traffic with Promotion in Mohpromt Line OA

Effective Promotions require Right Timings
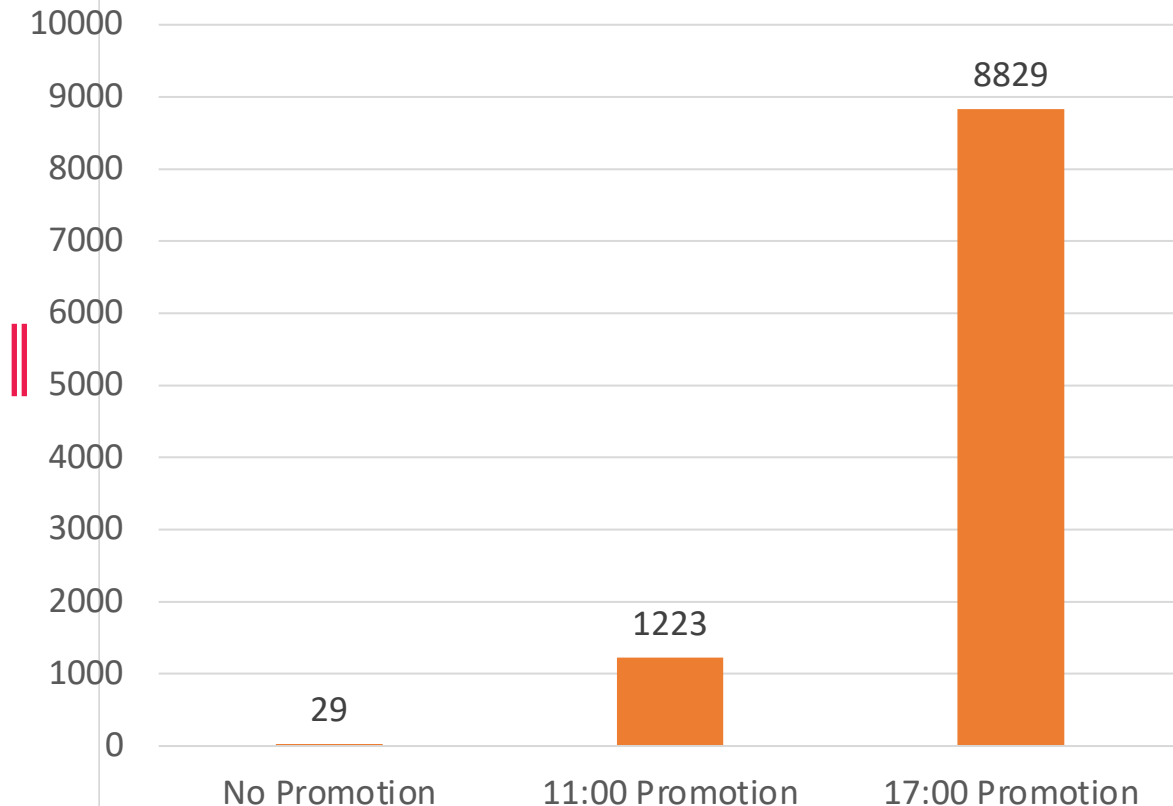
- Average daily users without promotion and with promotion at different time
  - No promotion: 22 and 29 Oct 2022
  - 11:00 promotion: 5 and 12 Nov 2022
  - 17:00 promotion: 19 and 27 Nov 2022
- Daily users increase for 42 and 304 times
- Note that we have not studied interaction from other effects

Number of Users by Hours

We usually promote our app on Sunday 17:00
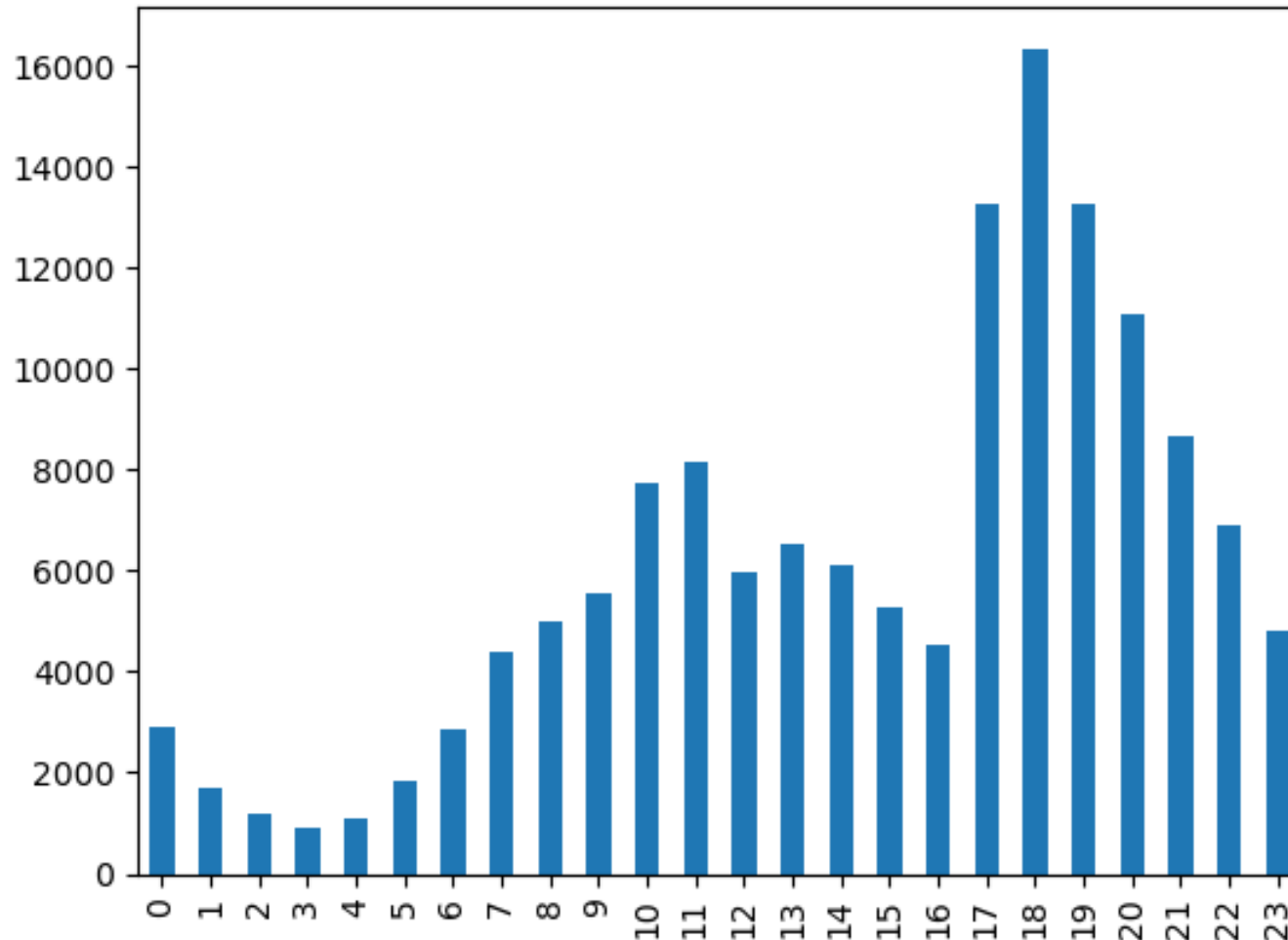
Usage Peak Time

18:00-18:59	16,361
17:00-17:59	13,276
19:00-19:59	13,262
20:00-20:59	11,067
21:00-21:59	8,649

Low Volume of Usages

01:00-01:59	1,680
02:00-02:59	1,166
04:00-04:59	1,072
03:00-03:59	900

Impacts of Promotions

hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
dayofweek_name																								
Sunday	362	218	200	120	129	188	337	457	527	542	723	611	533	499	483	537	400	9149	9267	6379	5035	3604	2468	1475
Monday	833	458	272	223	313	661	1094	1354	1761	1893	1977	1752	1309	1471	1475	1225	1020	2127	4684	4035	3166	2274	1484	841
Tuesday	451	296	258	180	253	425	688	958	1083	1327	1548	1234	950	1699	1606	1223	891	889	901	1016	1117	1080	774	514
Wednesday	332	234	159	113	107	166	246	747	833	915	1219	1218	953	1025	755	695	925	677	721	816	816	864	736	433
Thursday	255	179	113	99	103	166	237	442	517	717	901	1249	823	977	768	749	629	538	650	636	764	700	1314	1313
Friday	643	264	191	139	172	266	367	632	662	597	1237	1570	1063	935	981	825	694	578	521	633	655	646	625	502
Saturday	378	308	147	141	98	148	181	258	330	391	1137	1336	843	705	658	577	483	2243	1519	1272	1098	982	678	470

We usually promote our app on Sunday 17:00

Lesson #5

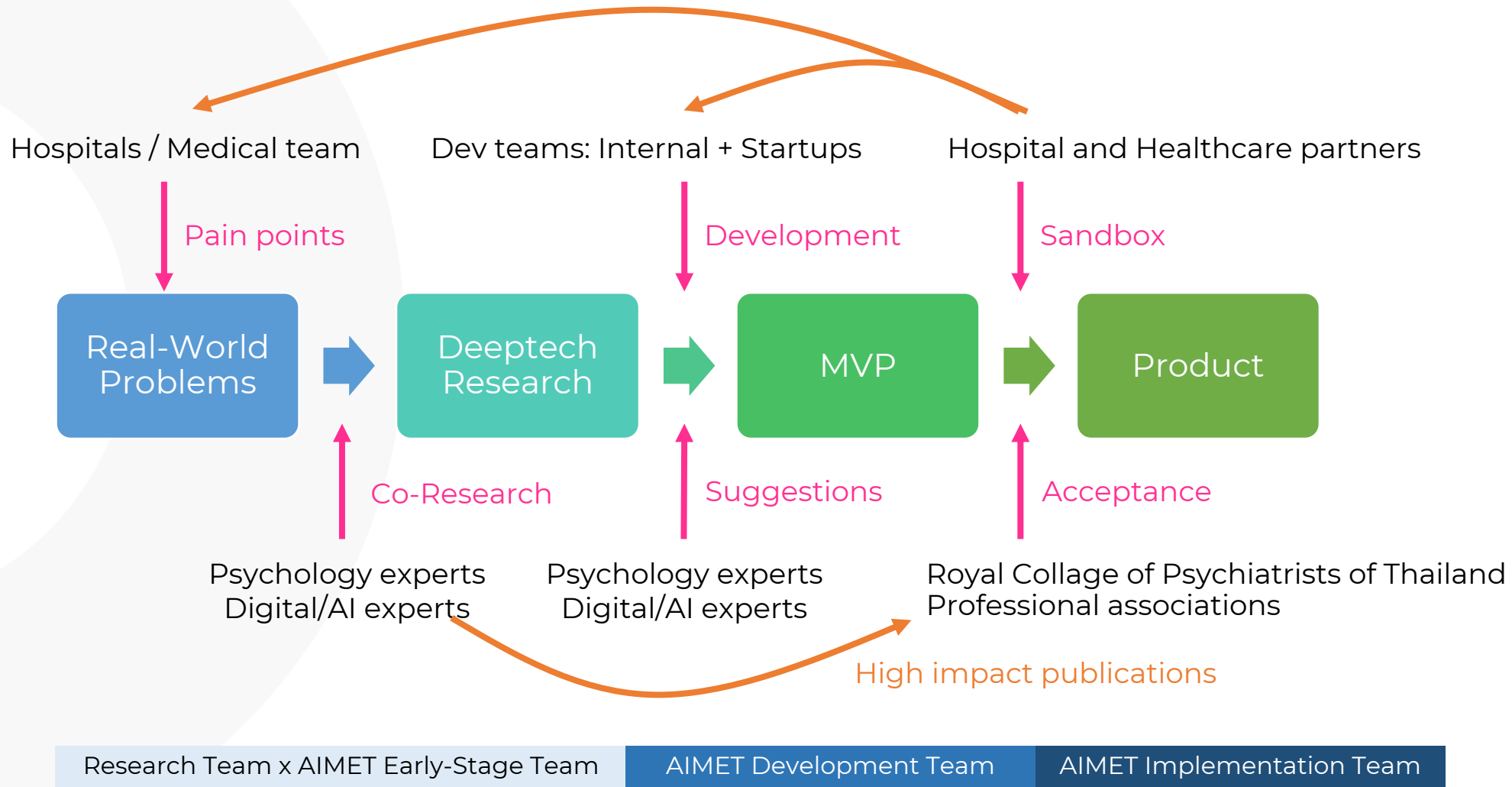End-to-end deeptech innovation lifecycle management

Challenge: Deeptech Innovation Lifecycle

- Deeptech innovation usually starts from deeptech research
  - Prototypes are usually good enough for publishing papers
  - Innovations require more development and refinement, especially with feedbacks and insights from actual usages
- Solution: end-to-end innovation lifecycle management with responsible teams
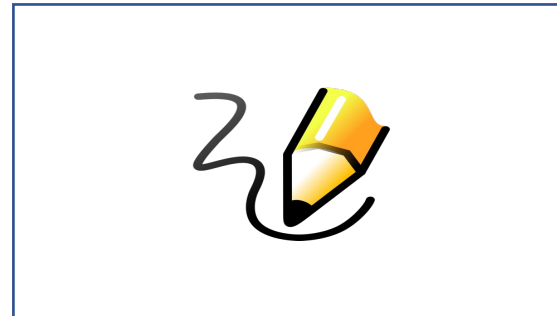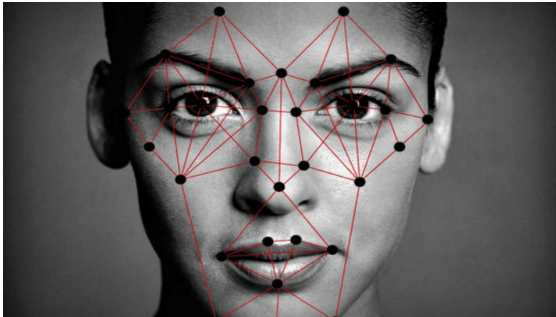
Introducing AIMET

- 4-year government-funded innovation development program

- Develop innovations using digital and AI technology to enhance efficiency of mental health and psychiatric care

- 2 Executives and 21 Full-time staffs
  (4 PMs, 7 developers, 4 data scientists, and 6 support staffs)

- Collaboration

  - 14 Professors and 15 students from 4 Faculties and 2 Universities involve in several sub-projects

  - 11 Medical staffs perform data labeling

  - External partners: department of mental health, hospitals (government / university / private), research teams, tech startups, and international organizations

Our Innovation Development Process

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Hospitals / Medical team   Dev teams: Internal + Startups   Hospital and Healthcare partners

Pain points   Development   Sandbox

Real-World Problems → **Deeptech Research** → **MVP** → **Product**

Co-Research   Suggestions   Acceptance

Psychology experts
Digital/AI experts

Psychology experts
Digital/AI experts

Royal Collage of Psychiatrists of Thailand
Professional associations

High impact publications

| Research Team x AIMET Early-Stage Team | AIMET Development Team | AIMET Implementation Team |

Opportunities of Digital and AI for Mental Health

- Screening

- Prioritization

- Monitoring

- Behavioral and alternative

  data-driven analytics

- Virtual Therapist

Lesson #6

Working together,
we create bigger impacts

Key Takeaway – 6 Lessons Learned

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01 Understand customer journey with data-driven insights

02 Data quality and data labeling is always hard

03 Balancing theory with practice

04 Simple (but right timing) promotions can go a long way

05 End-to-end deeptech innovation lifecycle management

06 Working together, we create bigger impacts

We welcome collaboration

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https://aimet.tech

Better Mental Health For Society