EST2024

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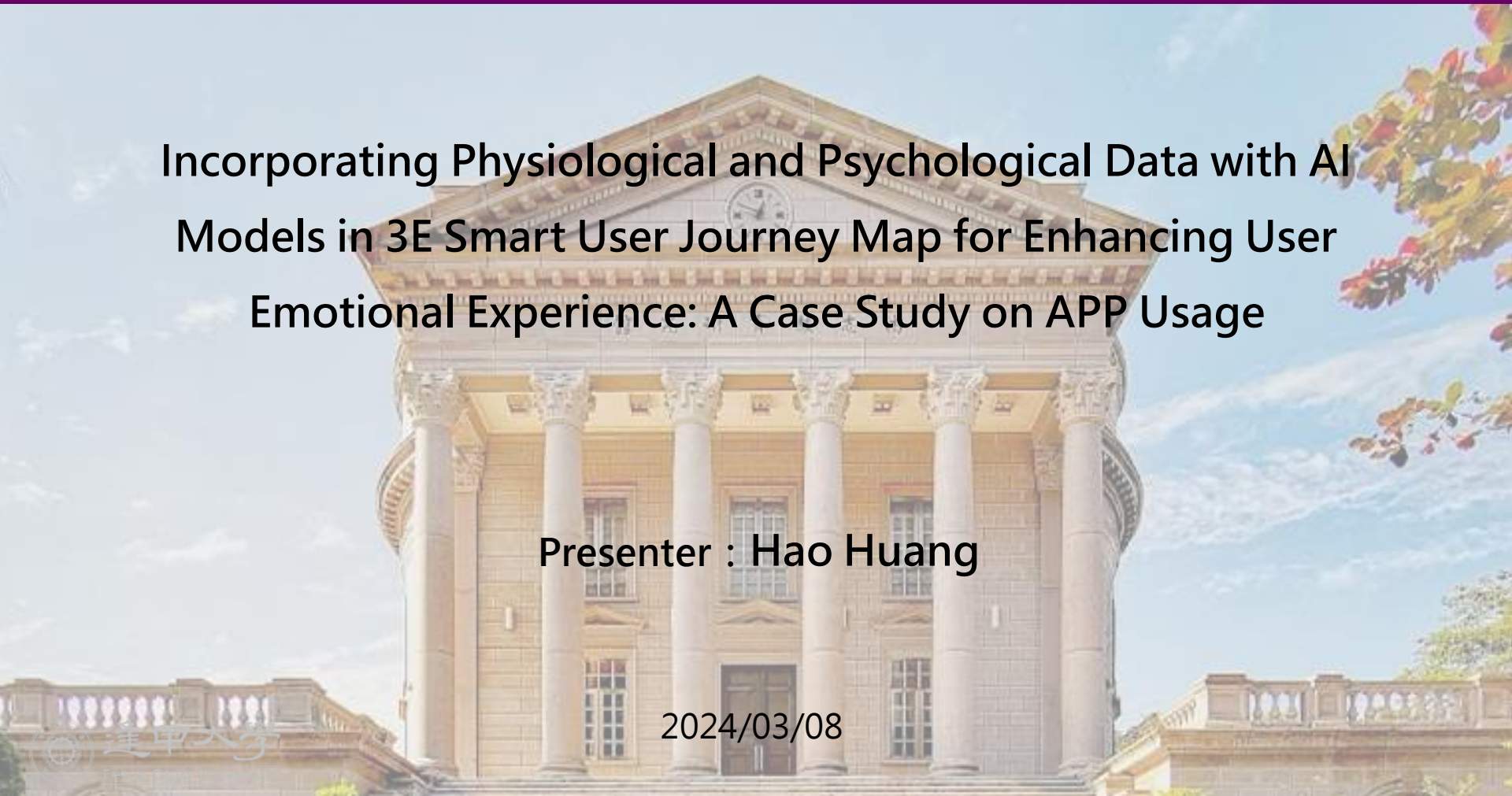

Incorporating Physiological and Psychological Data with AI Models in 3E Smart User Journey Map for Enhancing User Emotional Experience: A Case Study on APP Usage

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2024/03/08

Outline

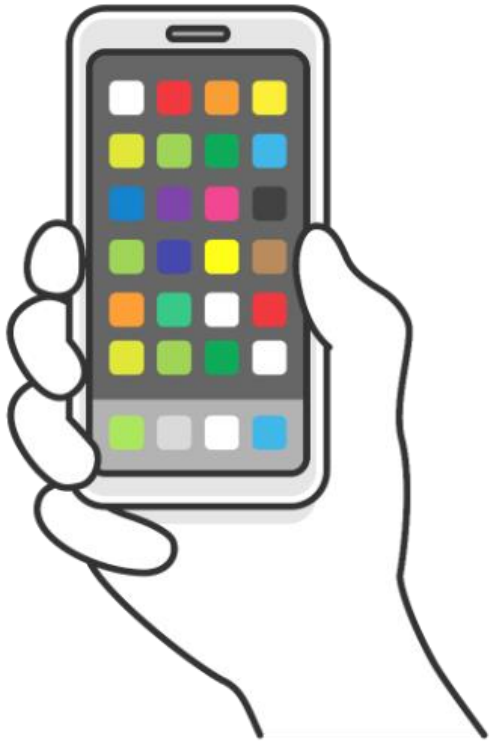
01 Background

02 Literature Review

03 Method

04 Case Study

05 Conclusion and future work



BACKGROUND

Background - User Journey Map

Describe and visualize the various steps, touchpoints, and emotions a user experiences throughout their entire interaction with a brand, product, or service.

Img by Appcues Blog

Questions

Traditional user journey maps rely on users' subjective feedback and designers' assumptions, lacking quantitative information for reference.

Determine users' emotions at different stages through physiological information and artificial intelligence.

Evaluate emotional user experiences at different stages and propose improvement plans

2

LITERATURE REVIEW

Literature Review - Emotional UX model

Author	Content
Saariluoma et al. (2014)	The relationship between emotional user experience and interactive events can be analyzed using the bipolar competence-frustration model, where the sense of competence stems from successfully completing tasks and users positively perceiving their own skills, while frustration represents the opposite.
Jokinen (2015)	The competence-frustration model is constructed for the field of human-technology interaction. Additionally, both competence and frustration are very suitable for primary and secondary assessment surveys.
Georges (2016)	Propose an emotional heatmap that can effectively highlight areas on the interface where users experience varying degrees of cognitive load.

Literature Review - Emotion Recognition

作者	內容
Watson et al. (1988)	Introduce the Positive and Negative Affect Schedule (PANAS) to obtain the emotional tendencies of the respondents in 20 items.
Veilleux et al. (2020)	Utilize data from eye trackers, EDA and facial recognition for conditional emotion Recognition, and create a web interface emotion journey map.
Vazquez-Rodriguez et al. (2022)	Use ECG data to train a transformer model to output arousal and valence , determine the subjects' emotions with an impact matrix.

Literature Review：Competence-Frustration Model

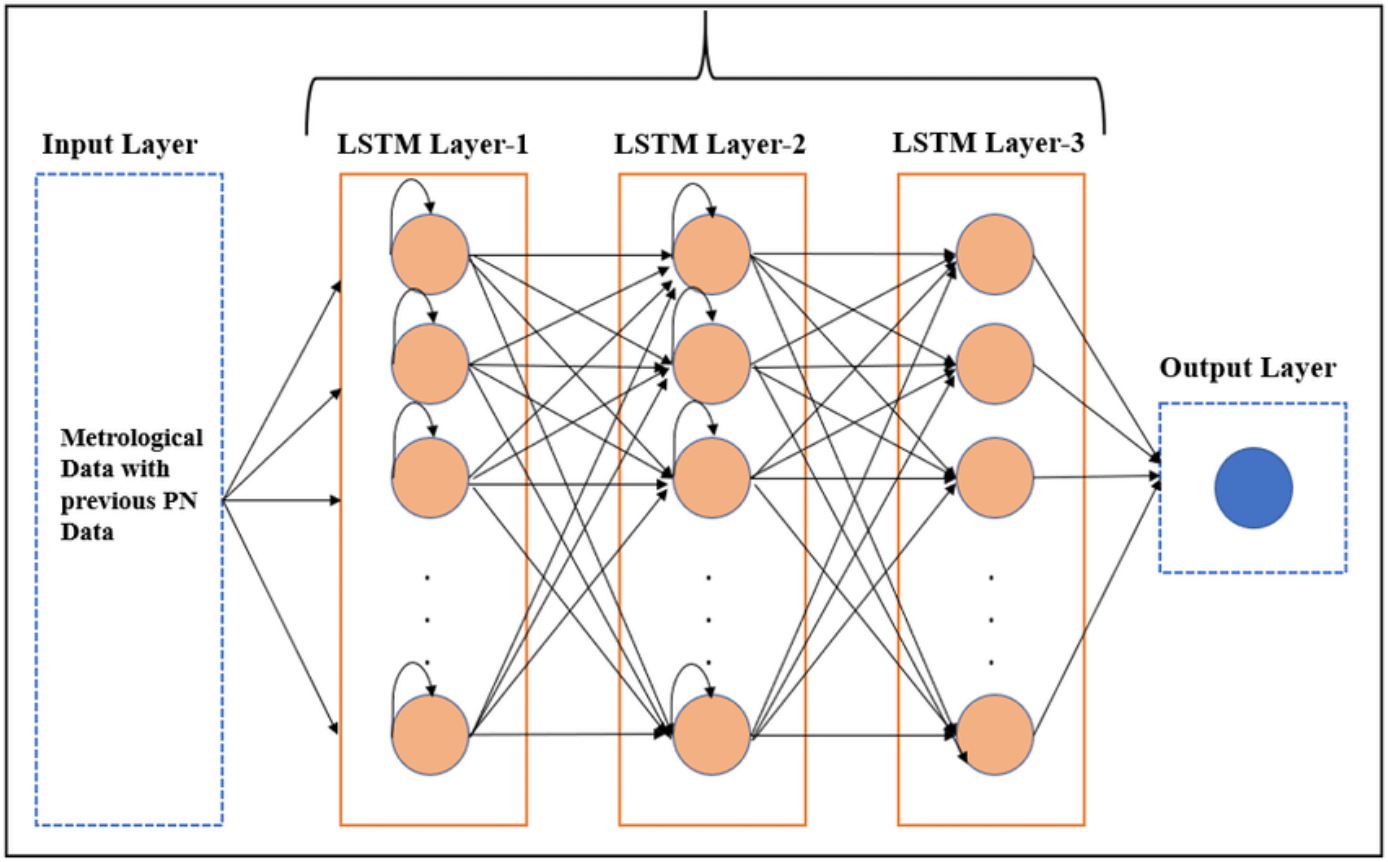
Competence – Frustration Model

- Valence (positive vs negative): Indicates whether the emotion is positive or negative.
- The two emotional dimensions of user experience (competence, frustration) can be distinguished by their **valence.**

Saariluoma, & Jokinen (2014)

➢ **Use valence to classify emotions into two categories: competence (+) and frustration (-) , and analyze the relationship between emotional user experience and interactive events.**

Literature Review –LSTM model



LSTM is particularly suited for predicting emotion from **electrocardiogram (ECG)** data due to its **strong capability in handling time series data**.

Research Question

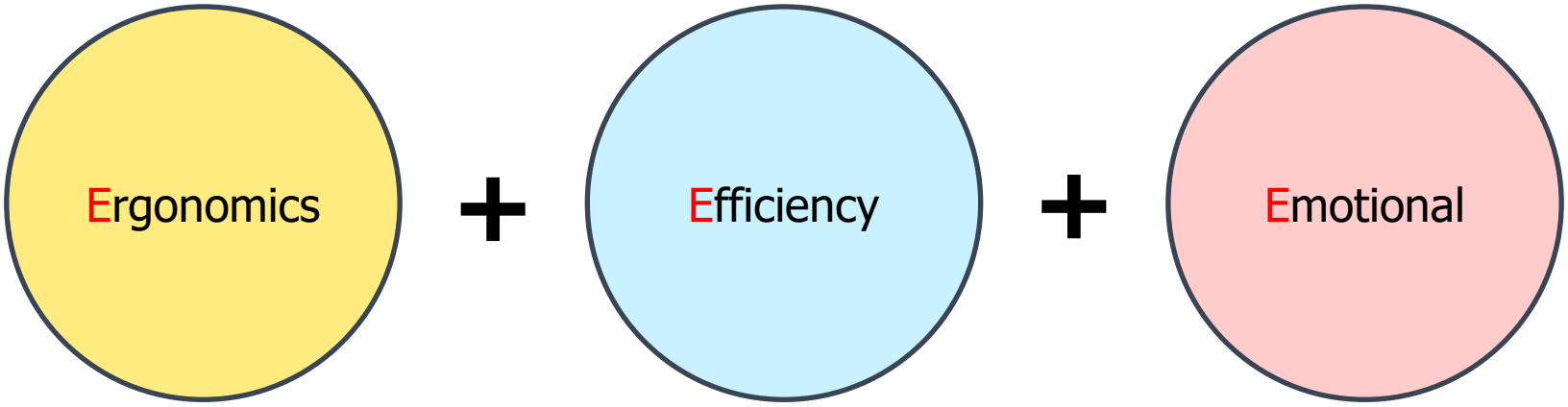
Research Gap

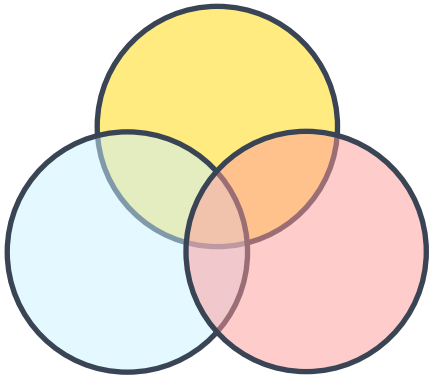
there are few research that utilize physiological information combined with artificial intelligence models to determine emotions and apply them in the evaluation of app user experience.

Research Goal

Propose a methodology that involves an **artificial intelligence model based on physiological information**, used to recognize **user emotional experiences** at different stages and propose corresponding solutions.

Research Question

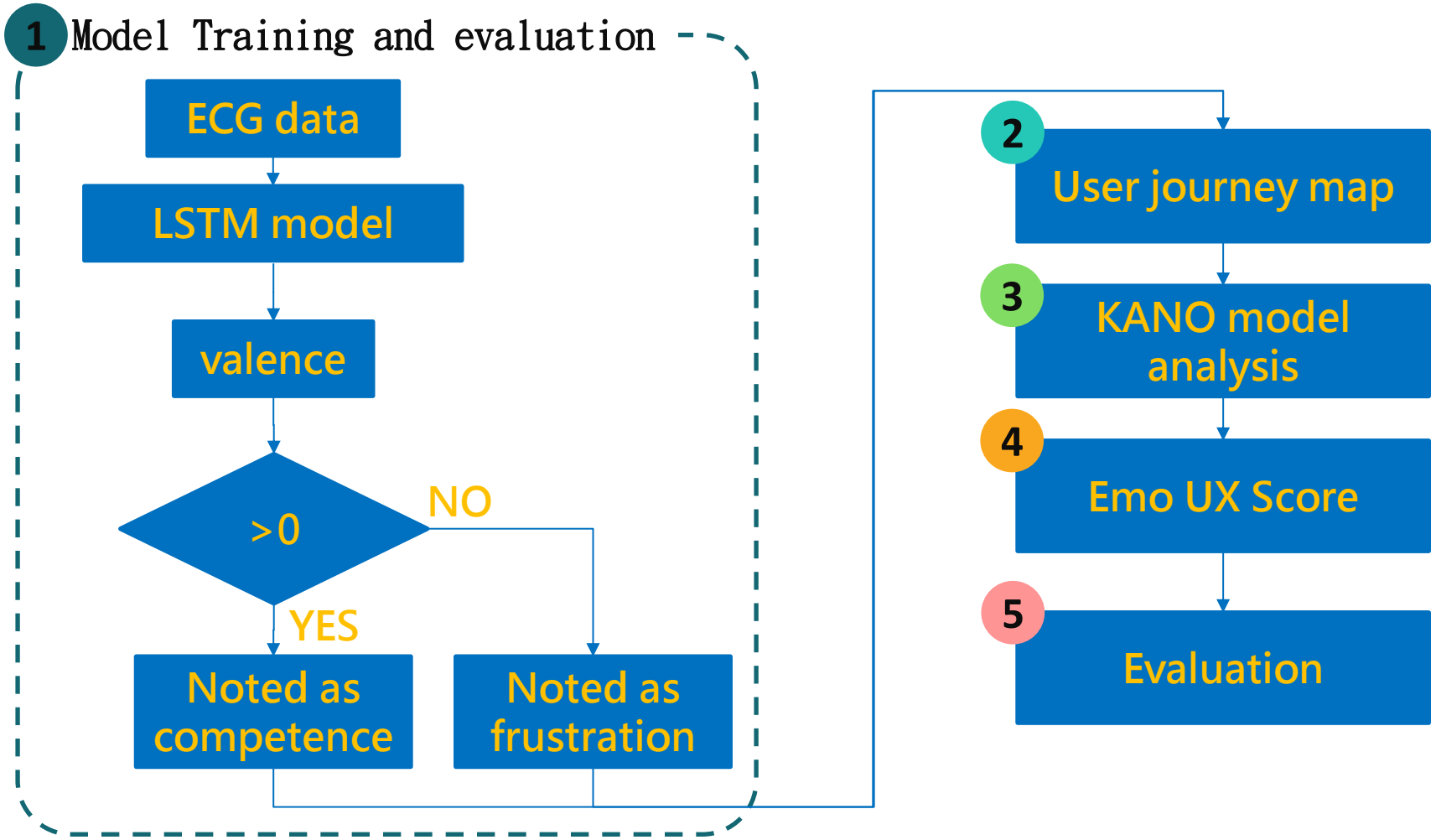




3E smart user journey map

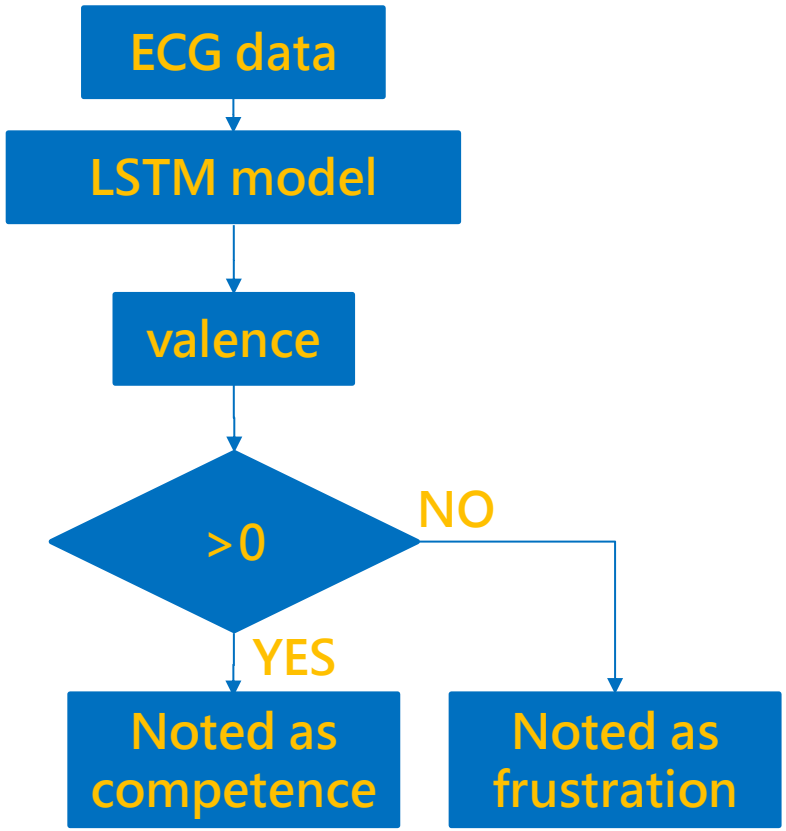
METHOD

Research Framework



Method

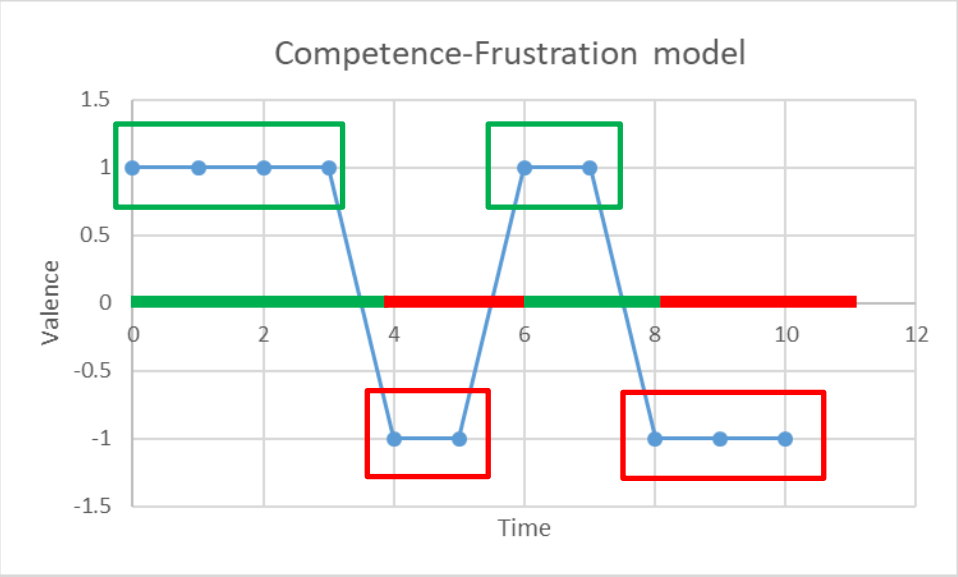
1 Model Training and Evaluation



evaluation
Accuracy
F1 score

Method

2 user journey map



Competence time(能力)

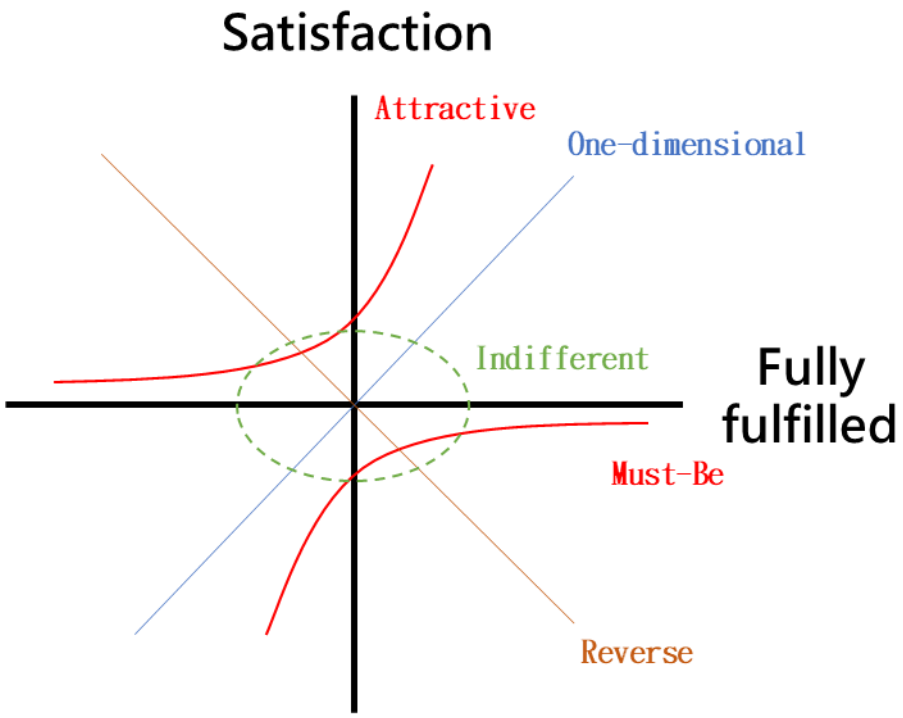
Frustration time(挫折)

+ Total time(全)

Method

3 KANO model analysis

- **Pain point**
  - Problems encountered by users.
- **Need**
  - The corresponding need
- **Feasible solution**
  - The solution that can satisfy the need
- **Need category**
  - Attractive
  - One-dimensional
  - Must-Be…



Method

4 Emotional User Experience Score

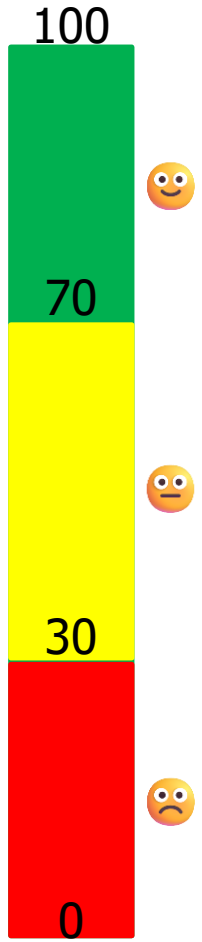
$$emo\ UX\ \text{Score} = \frac{Competence\ time}{Total\ time} * 100, \qquad emo\ UX\ score \in \{0, 100\}$$

Scores will range between 0 and 100, addressing negative values and scale issues.

$Good\ Experience$: $emo\ UX\ score \in \{70, 100\}$

$Normal\ Experience$: $emo\ UX\ score \in \{30, 70\}$

$Bad\ Experience$: $emo\ UX\ score \in \{0, 30\}$



5 Evaluation

Evaluation item	Questionnaire	Reference
System Usability	SUS	Brook · 1996
Mental Workload	NASA-TLX	Hart et al · 1988
Subjective emotional feedback	PANAS	Watson · 1988

4 CASE STUDY

Case Study-- Dataset

- Dataset : AMIGOS
- Participants : 40
- Data type : ECG
- Data : 227,800s
- Label : Valence

Case Study

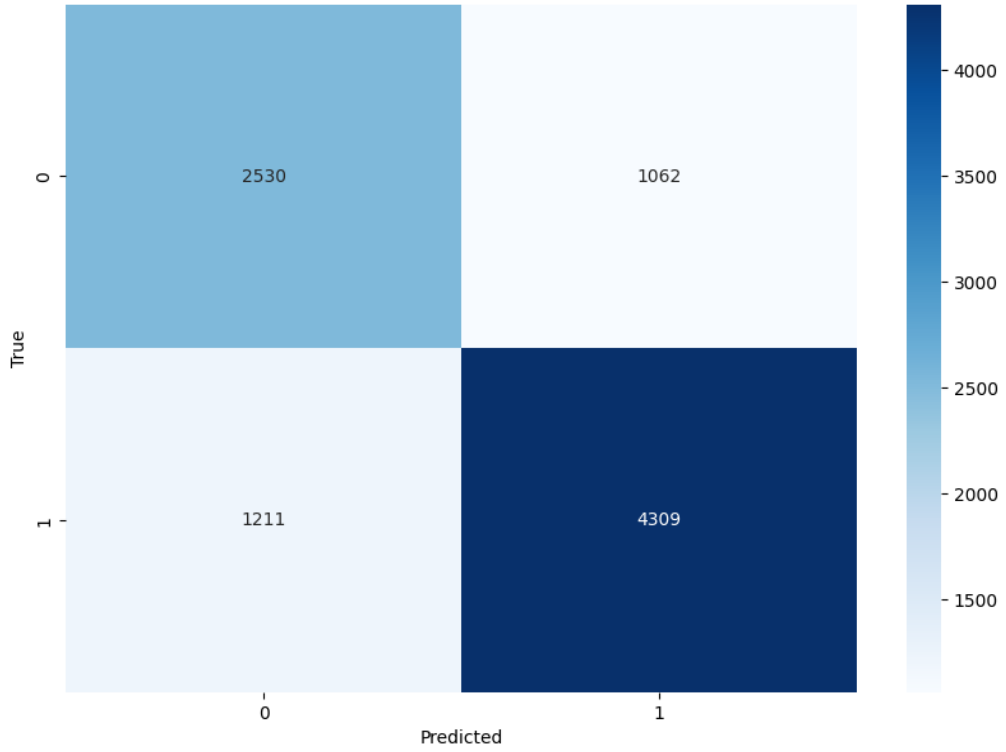
- Taguchi method — 4 factors at 3 levels

After weight transfer, the model's accuracy reached 0.762.

Y1	Learning Rate	Hidden Size	Batch Size	Dropout prop	y1
1	0.001	50	16	0.3	0.64
2	0.001	100	32	0.5	0.66
3	0.001	150	64	0.7	0.65
4	0.005	50	32	0.7	0.60
5	0.005	100	64	0.3	0.62
6	0.005	150	16	0.5	0.62
7	0.01	50	64	0.5	0.60
8	0.01	100	16	0.7	0.60
9	0.01	150	32	0.3	0.62

Case Study

1 Model Training and Evaluation



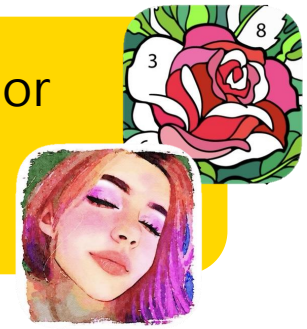
evaluation	
Accuracy	0.76
F1 score	0.79

Case Study--Validation

- Experiment setting:
  - Participants
    - People : 10
    - Age : 23.6

  - ECG sensor
    - Polar h10

  - APP
    - Happy Color
    - 數字填色



  - Questionnaires
    - SUS
    - NASA-TLX
    - PANAS

Case Study--Experiments Design

Step1. wear ECG sensor

↓

Step2. APP1 Tasks

↓

Step3. APP1 Questionnaires

↓

Step4. Rest

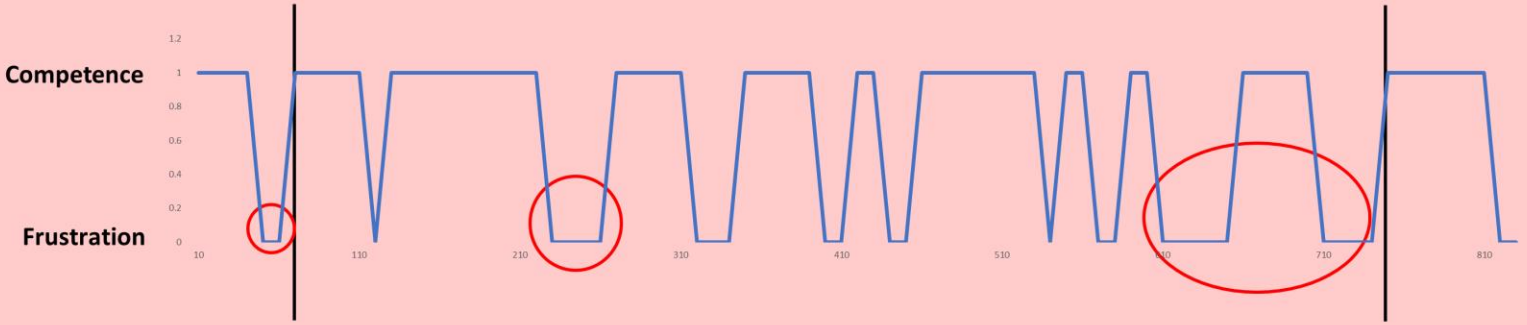
↓

Step5. APP2 Tasks

↓

Step6. APP2 Questionnaires

Case Study--Experiments Result

User Action	Select Picture	Start Drawing	Watch ending animation
Touch point	Homepage	Drawing page	Ending page
Emotion Curve			
	Pain point : Can't find the desired picture	Pain point: Realizing the image might take a long time to complete	Pain point: Require constant scrolling through the number column
	Need : Find the picture user want to complete	Need : Knowing the time it will be taken to draw an image	Need : Easily complete the selection of number colors
Feasible Solutions	Feasible solution : 1. Provide AI recommendations 2. Add a category for popular picture	Feasible solution : 1. Add the average completion time for each image on the homepage	Feasible solution : 1. Add color hint function
KANO Analysis	Attractive	One-dimension	Indifferent

Case Study--Experiments Result

APP1

Emo UX score : 63

PANAS

0.64

SUS

87.5

Mental Load

5

Downloaders

34k

APP2

Emo UX score : 47

PANAS

0.52

SUS

55.7

Mental Load

7

Downloaders

1k↓

Case Study--Experiments Result

Satisfaction

	Mean 1~10	Std
Your satisfaction level with the **user journey map**.	**8.8**	0.84
Your satisfaction level with the **electrocardiogram (ECG) assisted recognize** feature.	**8.8**	1.30
Your satisfaction level with the **KANO model** assisted analysis feature of this system.	**7.2**	1.30
Your overall satisfaction level with the **3E Smart User Journey Map**.	**9**	0.71
How do you feel after using the 3E Smart User Journey Map?	**9.4**	0.90

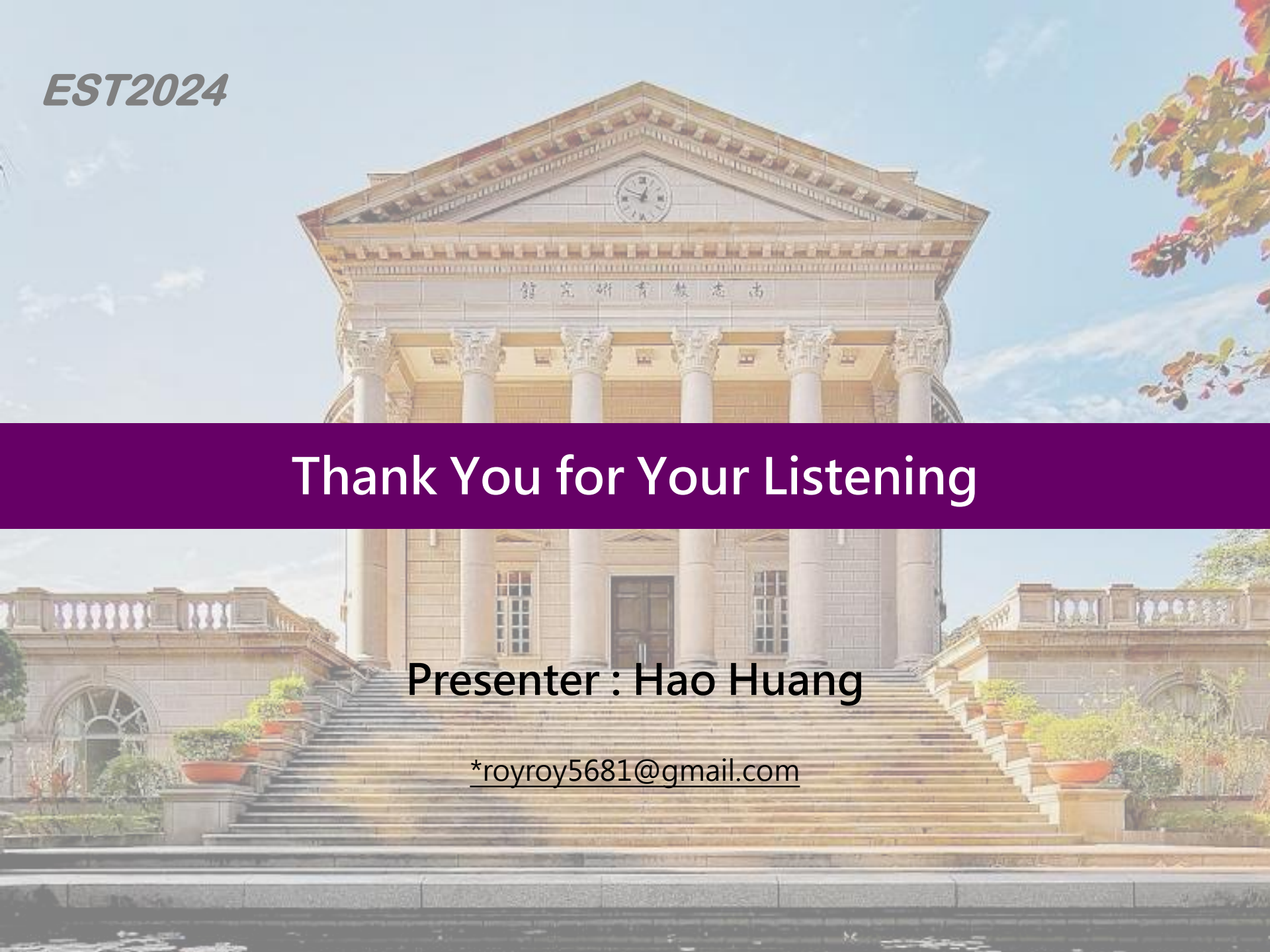
Conclusion

Propose a methodology based on ECG data and LSTM model to evaluate the user experience of mobile app users.

Quantify emotional user experience.

Quickly and easily applied to product testing and evaluation.

Enhance product emotional user experience based on demand analysis.



Thank You for Your Listening

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