

# DrawBot

Final Presentation

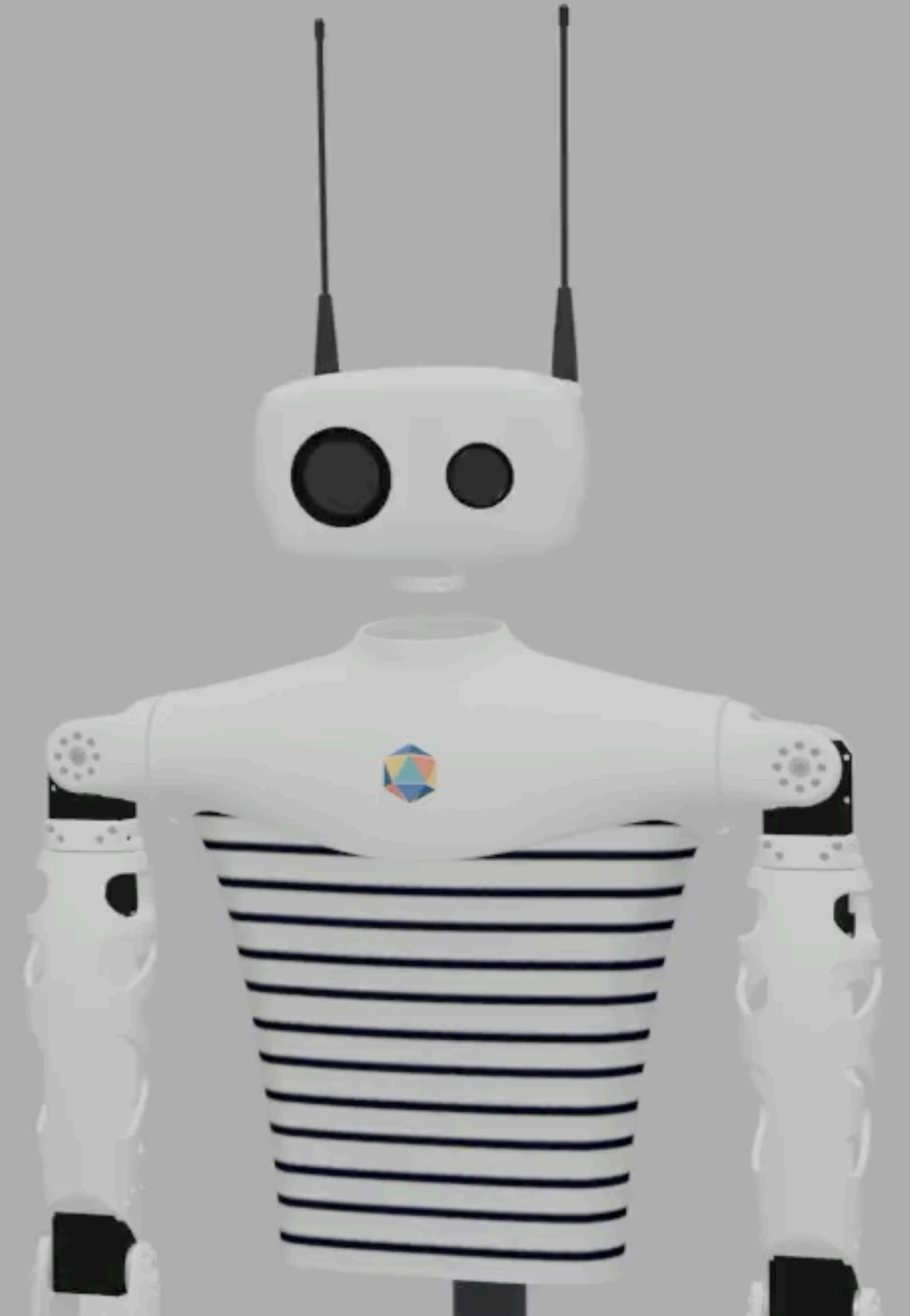
DS323 AI in Design

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Yuanning HAN

Tutor: 万芳 Fang Wan

2022.11.3

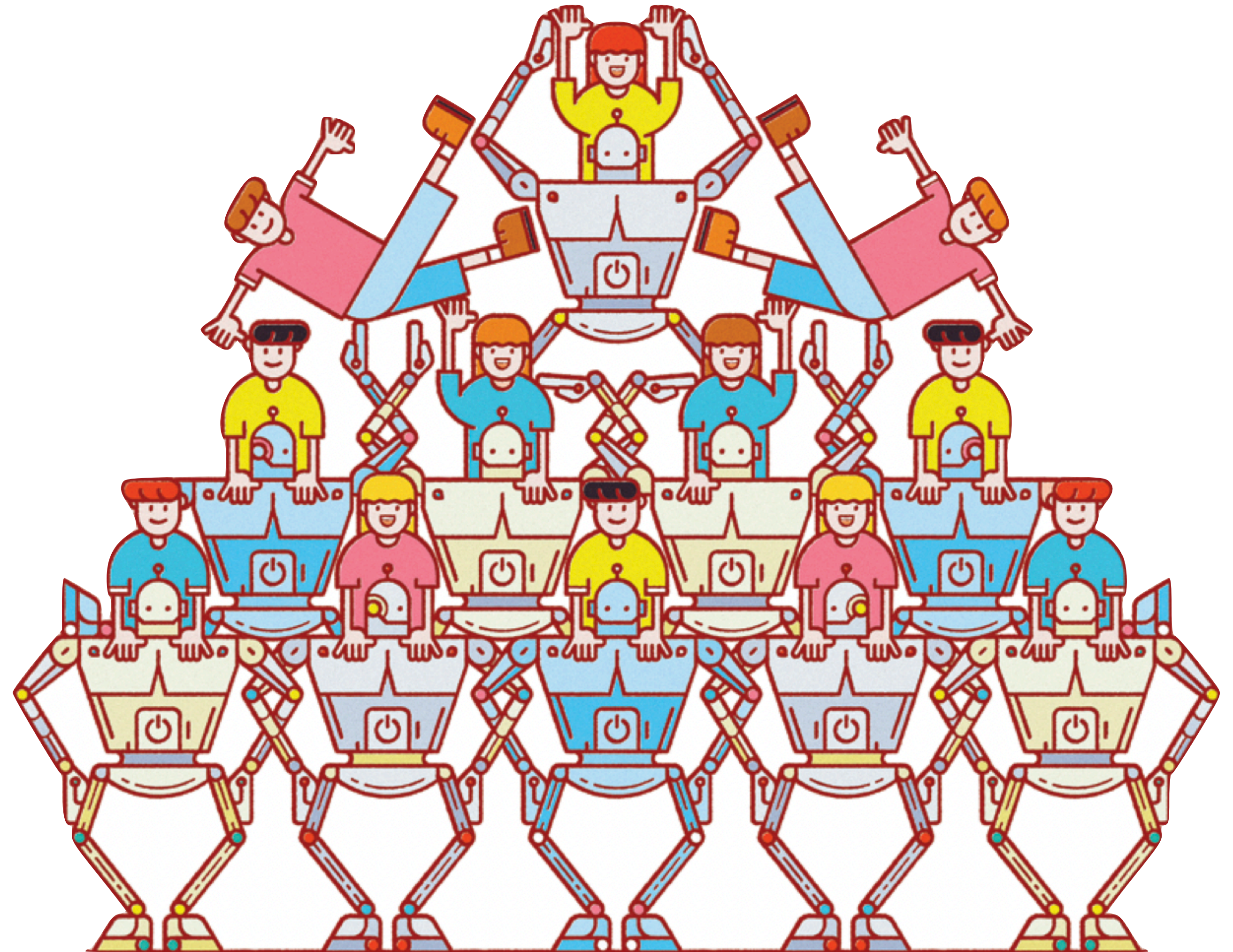


# Design Proposal

The project DrawBot apply neural network models on the robot Rechy to enable the robot could draw with kids.

Rechy can draw abstract sketches to inspire children when they get stuck, use emotional expressions to encourage children to enrich their drawing, and understand their drawings to provide suggestions and inspirations which unexpected by children.

As a result, this project proposes a new way to assist drawing and inspire the users in their creative process, as well as explore the possibility of children-Robot(and AI) interaction in drawing activities



[https://www.accenture.com/\\_acnmedia/pdf-84/accenture-collaborative-intelligence-2018.pdf](https://www.accenture.com/_acnmedia/pdf-84/accenture-collaborative-intelligence-2018.pdf)

# Literature Research

The design opportunity of make a real robot to carry out the co-create drawing with children

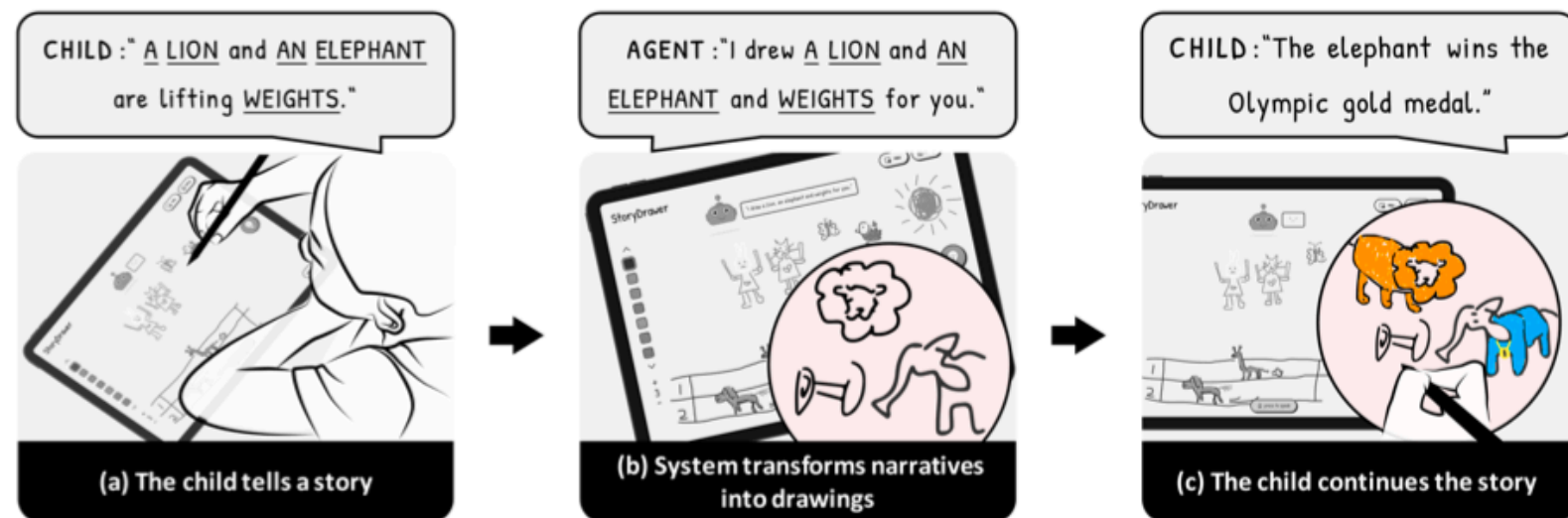
## StroyDrawer

Strategy 1: transform kids real-time speech into drawings

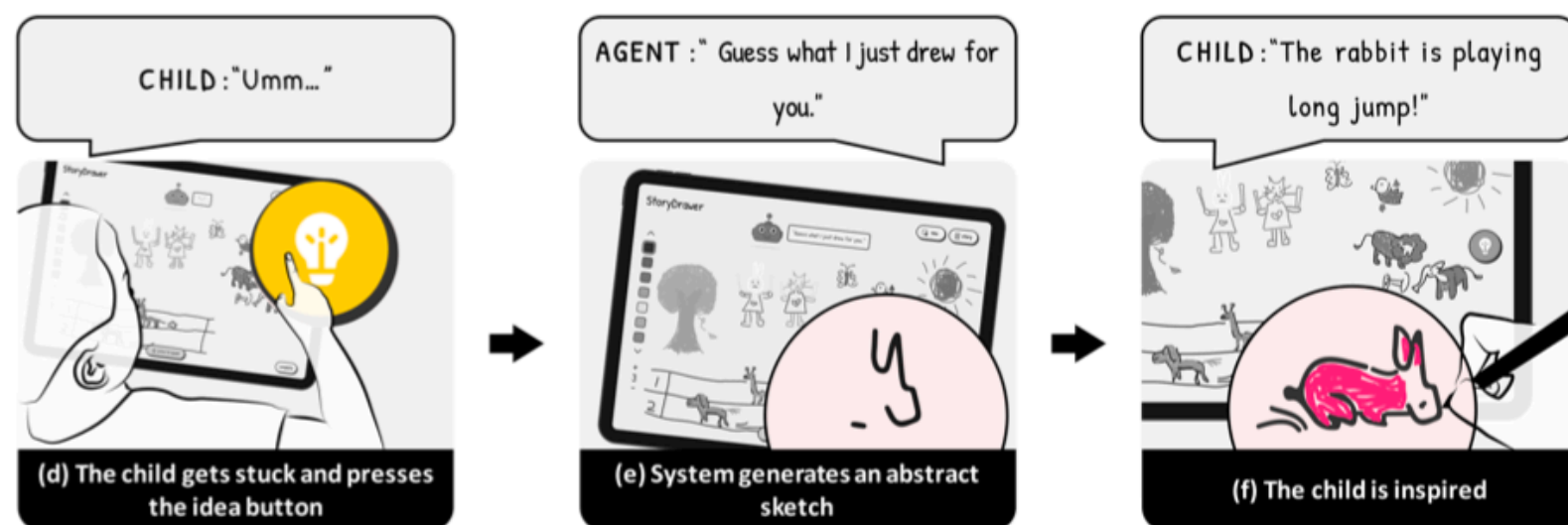
Strategy 2: generate abstract sketch based on existing drawing.

This project has helped to make kids drawing process more engaging and assist them in generating elaborate and creative visual storytelling.

### COLLABORATIVE STRATEGY 1:



### COLLABORATIVE STRATEGY 2:



<https://doi.org/10.1145/3491102.3501914>

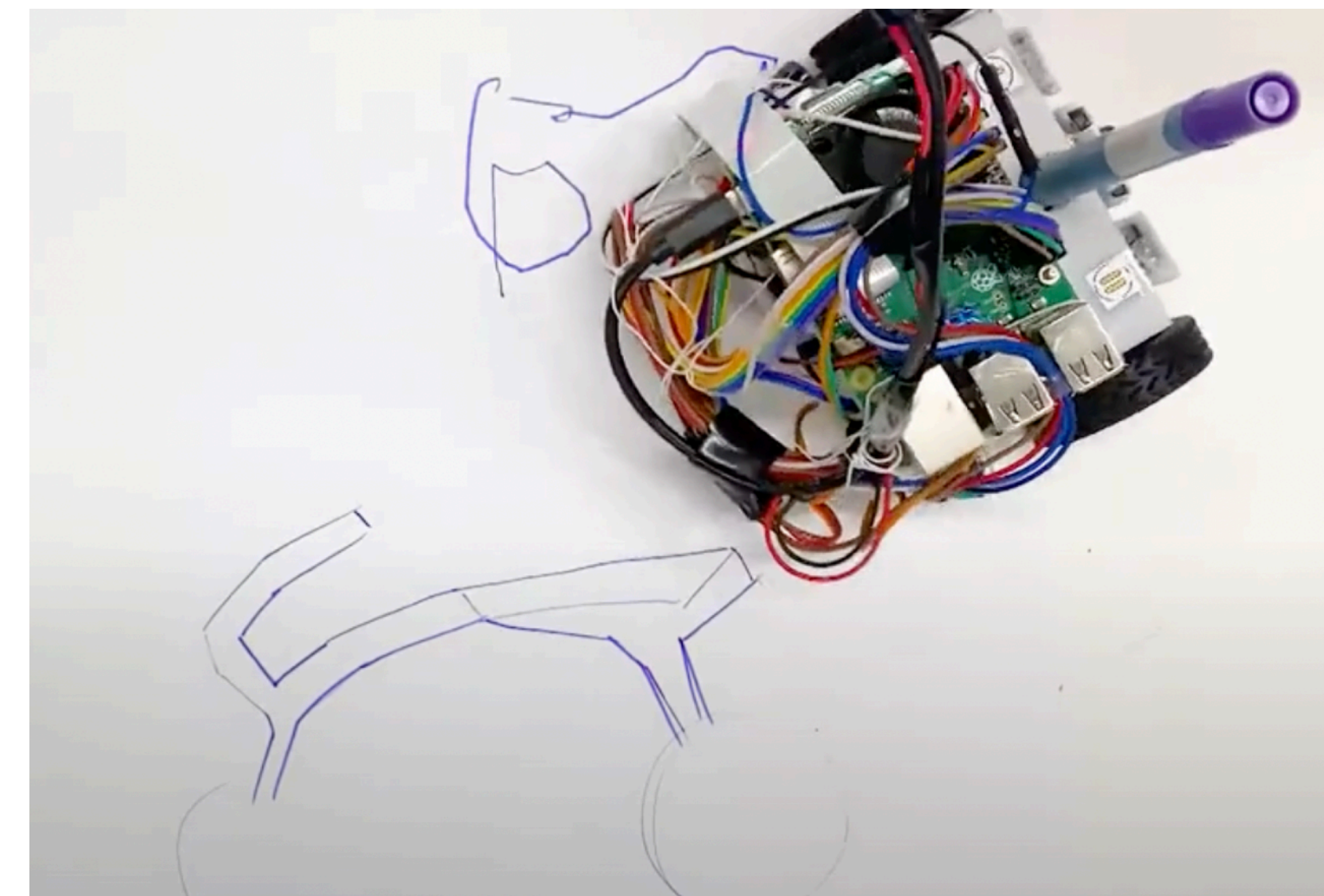
AI can assist children in drawing process

## Coobie

The robot draw on the paper based on designer's sketch to give designer inspirations.

Coobie's drawings give designer unexpected idea.

This research also showed the robot could provide a more friendly and engaging experience than the virtual agent when corporate with human.



<https://doi.org/10.1145/3313831.3376258>

Robots are more friendly and interactive

# Literature Research

## Children, robot and creativity

### Can children play with robots?

Children might see the robot as a smart toy

Some children perceived robots as their friends and think the robot has feelings

If the robot shows its curiosity when interacting with children, Children will be more curious.

Interacting with a growth mindset robot can improve children's willingness in solving challenging task



<https://www.media.mit.edu/projects/robot-mindset-and-curiosity/overview/>

Hae Won Park, Rinat Rosenberg-Kima, Maor Rosenberg, Goren Gordon, and Cynthia Breazeal. 2017. Growing Growth Mindset with a Social Robot Peer. In Proceedings of the 2017 ACM/IEEE International Conference on Human-Robot Interaction (HRI '17). Association for Computing Machinery, New York, NY, USA, 137–145. <https://doi.org/10.1145/2909824.3020213>

Goren Gordon, Cynthia Breazeal, and Susan Engel. 2015. Can Children Catch Curiosity from a Social Robot? In Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction (HRI '15). Association for Computing Machinery, New York, NY, USA, 91–98. <https://doi.org/10.1145/2696454.2696469>

Randi Williams, Hae Won Park, and Cynthia Breazeal. 2019. A is for Artificial Intelligence: The Impact of Artificial Intelligence Activities on Young Children's Perceptions of Robots. In CHI Conference on Human Factors in Computing Systems Proceedings (CHI 2019), May 4– 9, 2019, Glasgow, Scotland UK. ACM, New York, NY, USA, Article 4, 11 pages. <https://doi.org/10.1145/3290605.3300677>



## YOLO: Your Own Living Robot

A social robot for children's storytelling that is designed for children to stimulate their creativity.

YOLO can inspire children to have more original ideas in the story creation process, and improve their creativity.

Techniques1 Mirroring: To stimulate convergent thinking, the robot will carry out the same movement as the children did.

Techniques2 Contrasting: To stimulate divergent thinking, the robot will carry out the different movements as the children did.



Patricia Alves-Oliveira, Patricia Arriaga, Matthew A. Cronin, and Ana Paiva. 2020. Creativity Encounters Between Children and Robots. In Proceedings of the 2020 ACM/IEEE International Conference on Human-Robot Interaction (HRI '20), March 23–26, 2020, Cambridge, United Kingdom. ACM, New York, NY, USA, 10 pages. <https://doi.org/10.1145/3319502.3374817>

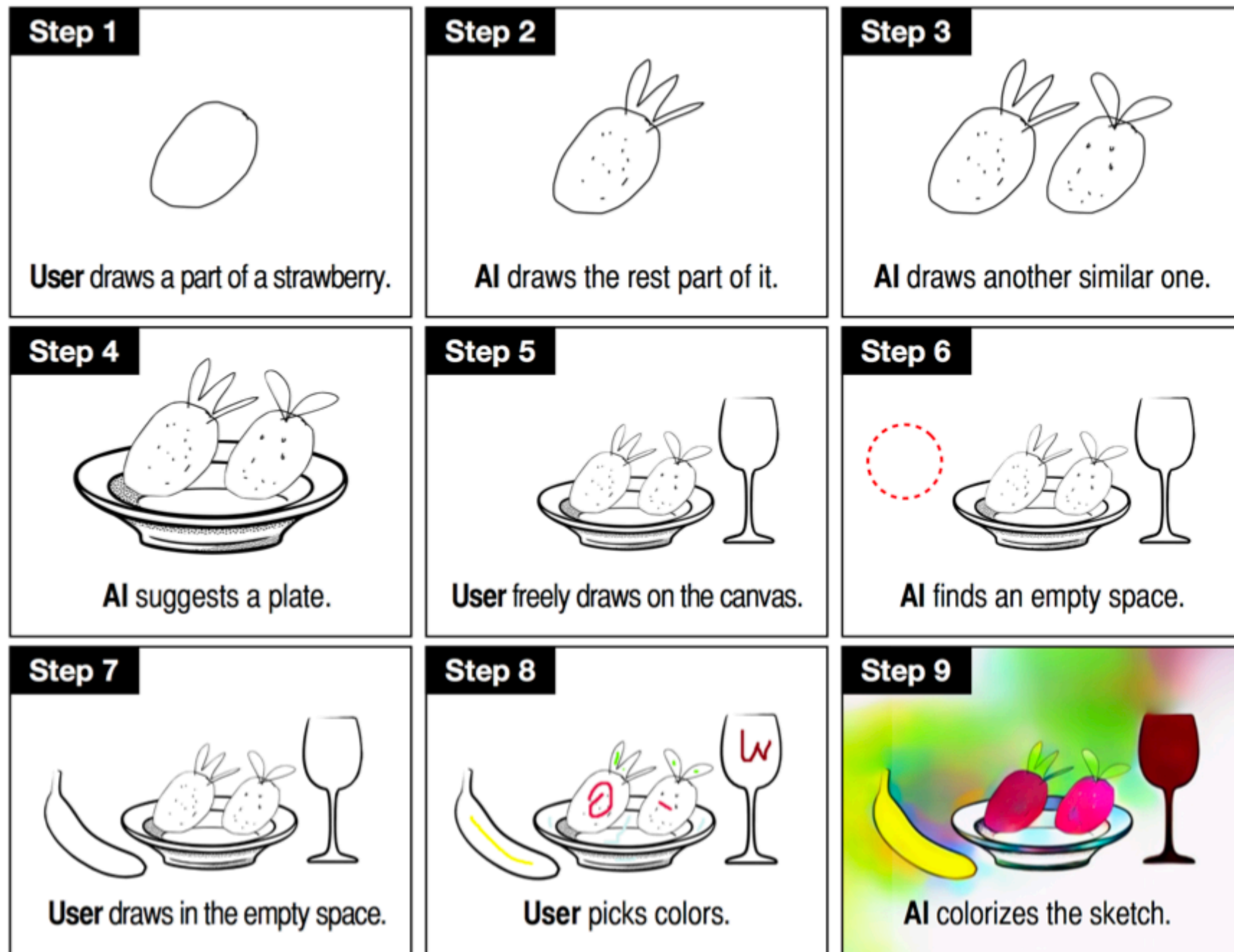
Patricia Alves-Oliveira, Patricia Arriaga, Ana Paiva, and Guy Hofman. 2021. Children as Robot Designers. In Proceedings of the 2021 ACM/IEEE International Conference on Human-Robot Interaction (HRI '21), March 8– 11, 2021, Boulder, CO, USA. ACM, New York, NY, USA, 10 pages. <https://doi.org/10.1145/3434073.3444650>

## Interacting with robot can increase children creativity

# Literature Research

How to design human-AI interaction to give the user an enjoyable experience in co-create activity

## DuetDraw



<https://doi.org/10.1145/3313831.3376258>

### Findings:

During the task, although AI's is considered as not predictable, comprehensible and controllable, user enjoyed to work with AI

Users are surprised by the AI if it can give them unexpected inspirations

Users tend(want) to lead the task

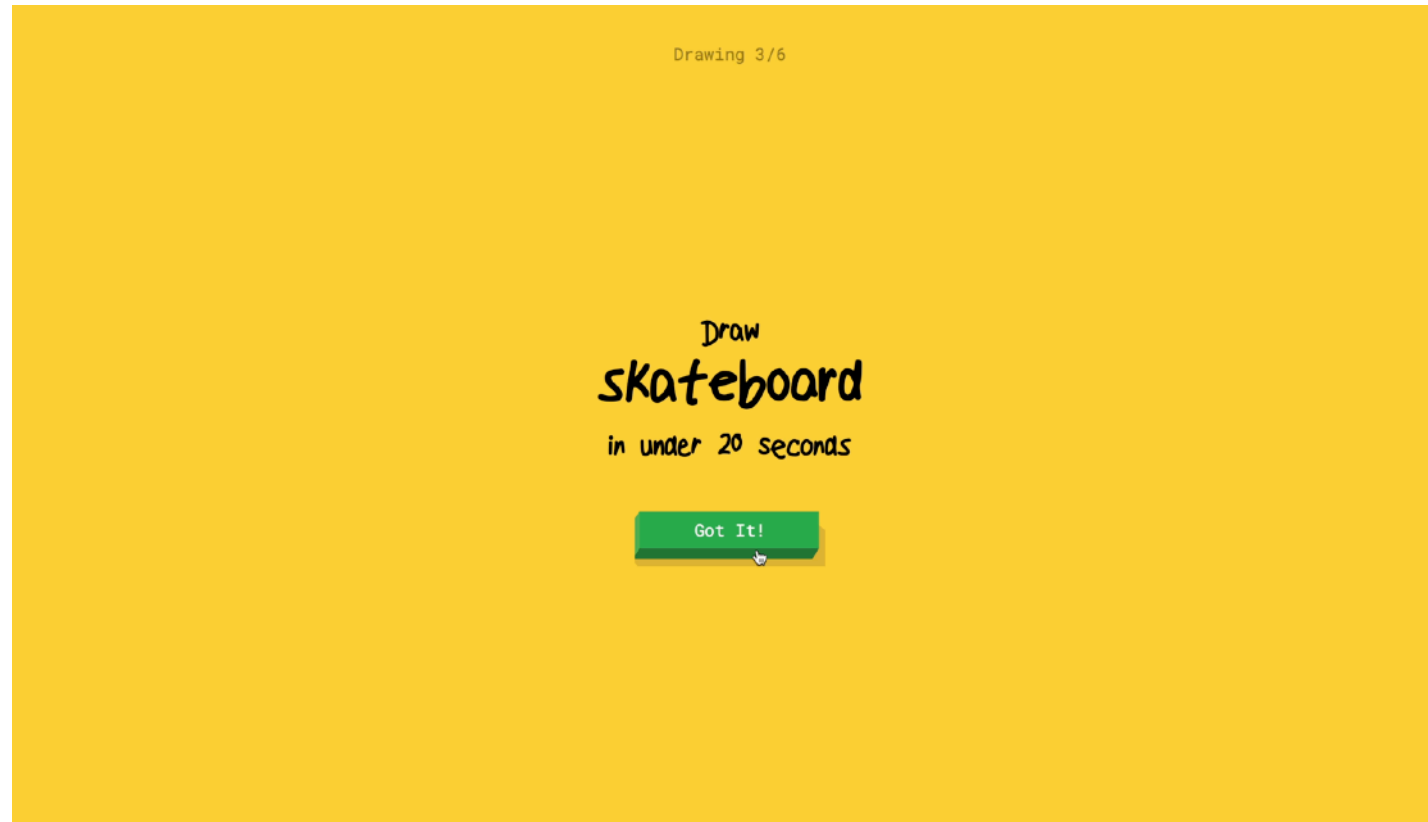
If the AI draws better than the user, user might feel upset

Users should do the creative part

# Case Study

In all projects, the AI respect humans' creativity and let human to perform the creative part

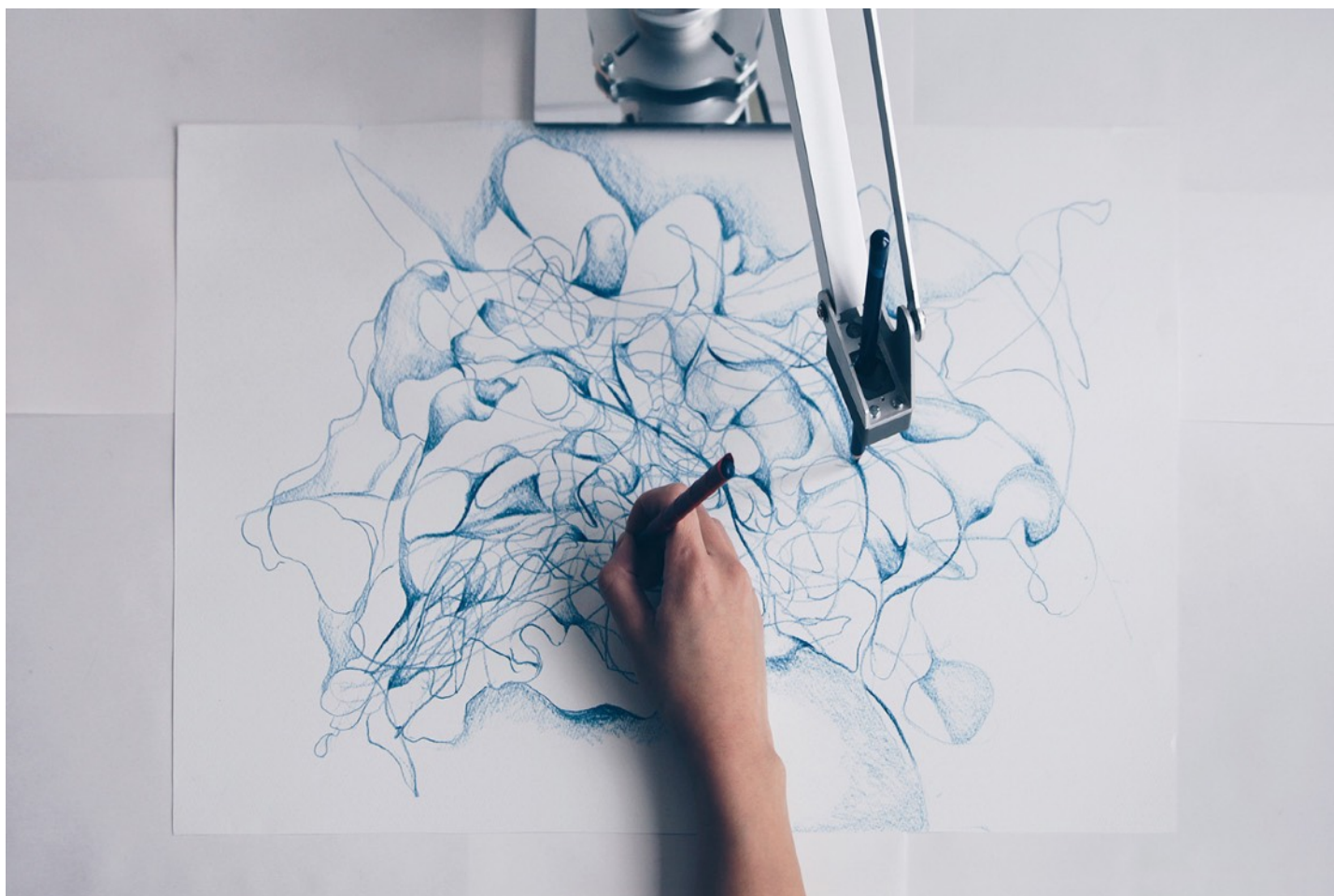
## Quick Draw!



Users draw an object in 20 seconds and a neural network will guess what users are drawing. In this process, users are contribute in training the neural net work and add their drawing to the dataset.

Developed by Google

## Drawing Operations Unit: Generation 2 — MEMORY



<https://sougwen.com>

The robotic arm using machine learning to mimic the drawing style of the artist Sougwen Chung. The robot create artworks with the artist.

## Word to World



<https://xinyue.de/word-to-world.html>

Visualize real-time speech

Tools: Google Speech API, Google Natural Language API, Unity, Asset store(Unity)

## How AI Can Help Human in Creative Process

More fun

Provide inspirations

Provides a new way to create

# Can children play with robots?

Playing alone or with friends or with robots?

Playing with a robot is more like playing with friends, but less fun. Playing with a robot has more fun than playing alone.

Children tend to perceive robots as their human friends. But children are still more interactive and expressive when they play with friends



Shahid, Kraemer, E., & Swerts, M. (2014). Child-robot interaction across cultures: How does playing a game with a social robot compare to playing a game alone or with a friend? Computers in Human Behavior, 40, 86-100. <https://doi.org/10.1016/j.chb.2014.07.043>

# Design Opportunities

Apply social robots in education.

Apply in the region/country that has less social resources (or the demands are greater than the resources could be provided)

For kids cannot go out and play with their friends during the pandemic

For kids stay in the hospital



<https://www.media.mit.edu/projects/collaborative-robot-storyteller/overview/>



[https://www.youtube.com/watch?v=\\_YtpNwC7BNc](https://www.youtube.com/watch?v=_YtpNwC7BNc)

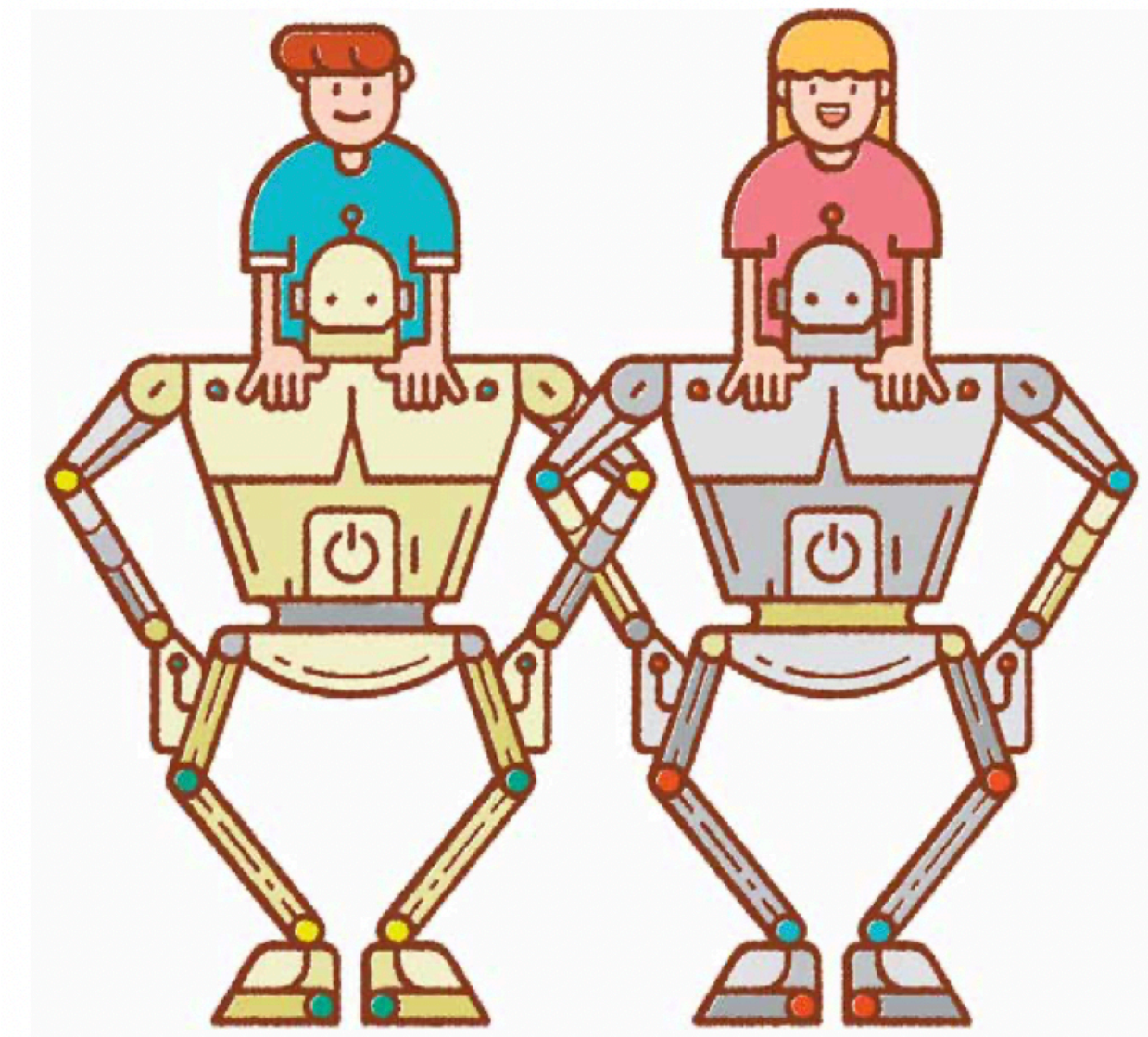
# Design Proposal

The project DrawBot apply neural network models on the robot Reachy to enable the robot could draw with kids.

Reachy can draw abstract sketches to inspire children when they get stuck, use emotional expressions to encourage children to enrich their drawing, and understand their drawings to provide suggestions and inspirations which unexpected by children.

As a result, this project proposes a new way to assist drawing and inspire the users in their creative process, as well as explore the possibility of children-Robot(and AI) interaction in drawing activities

**By applying this project to children's drawing activity, the robot Reachy will act as an assistant to support kids in the creative process and respect kids' autonomy by letting them make each decision.**

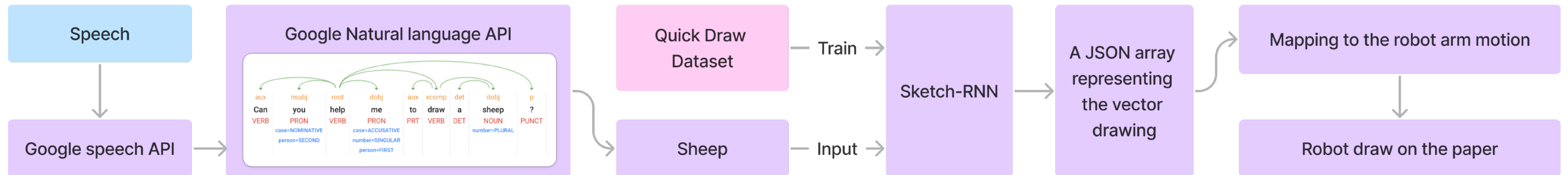
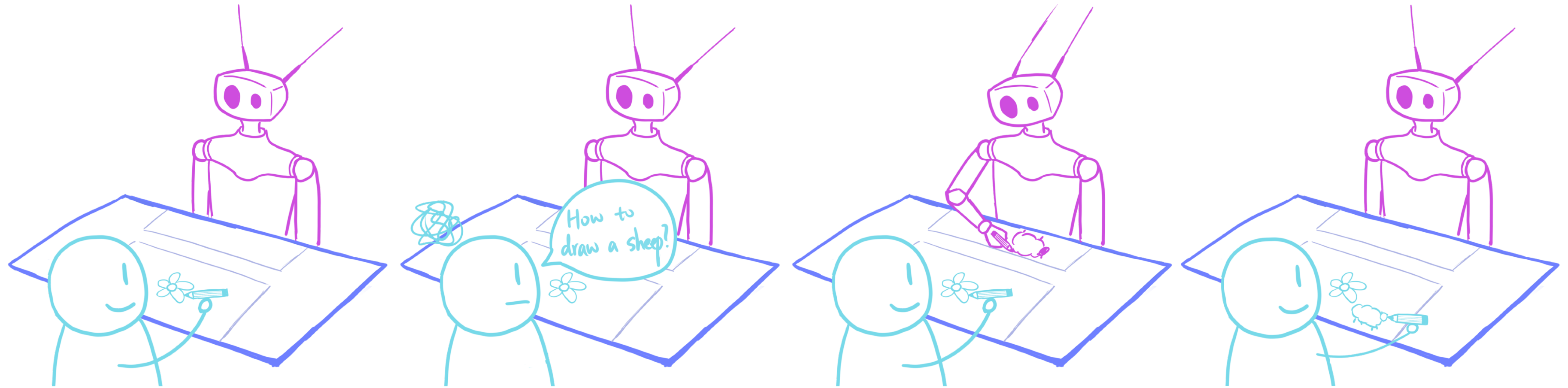


[https://www.accenture.com/\\_acnmedia/pdf-84/accenture-collaborative-intelligence-2018.pdf](https://www.accenture.com/_acnmedia/pdf-84/accenture-collaborative-intelligence-2018.pdf)



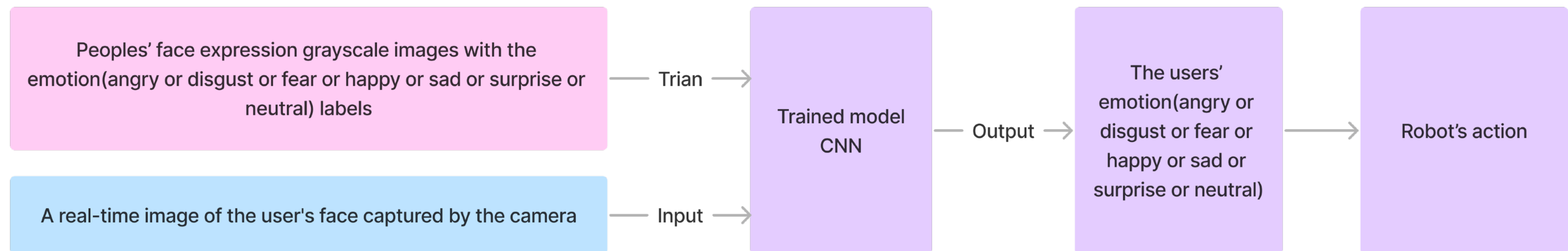
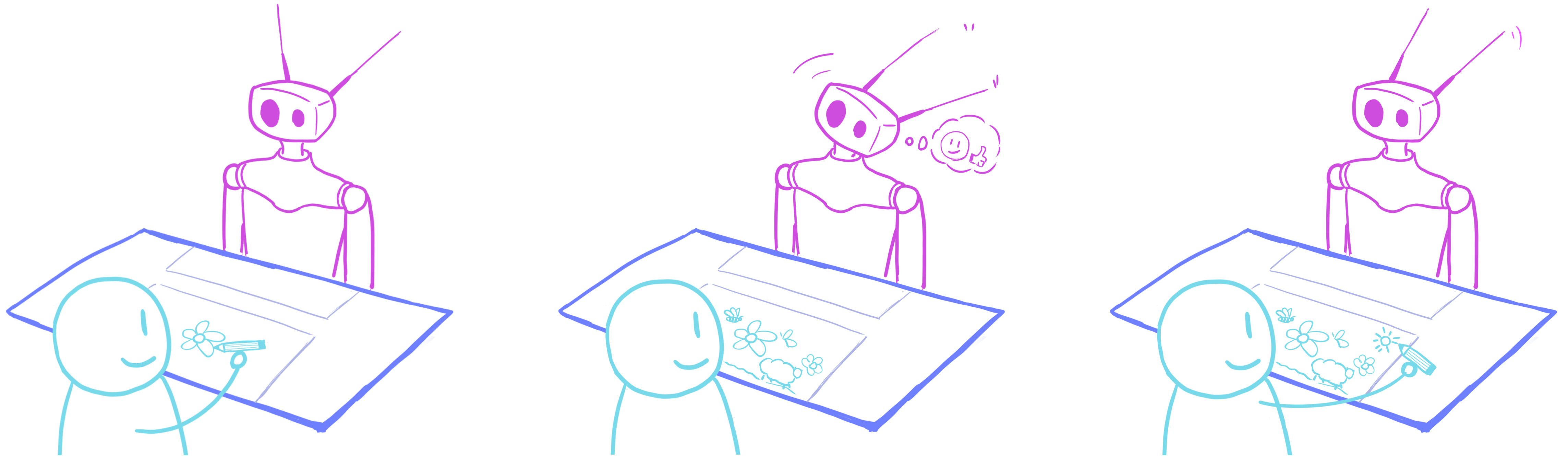
# How the Robot works

Draw a abstract sketches when children get stuck



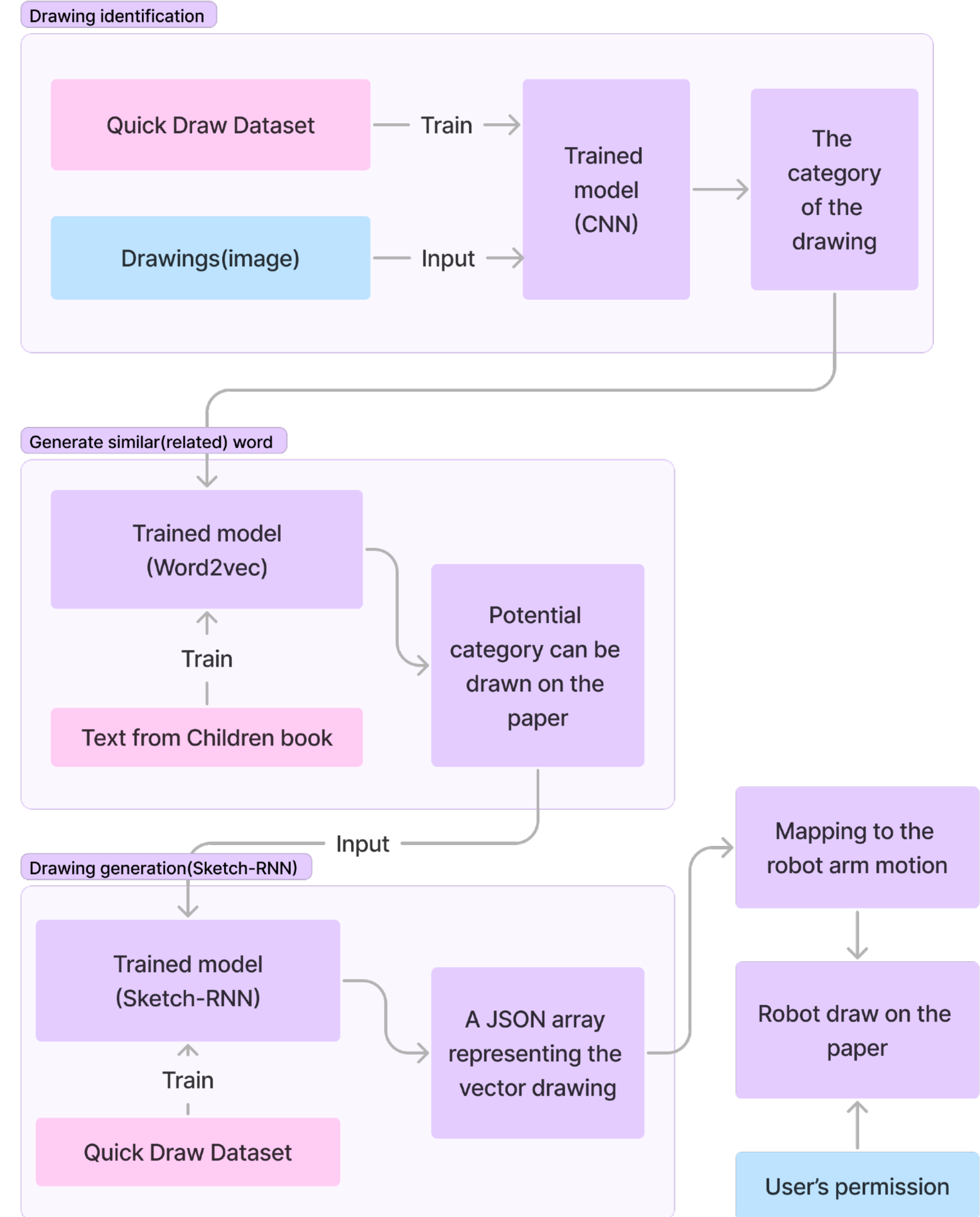
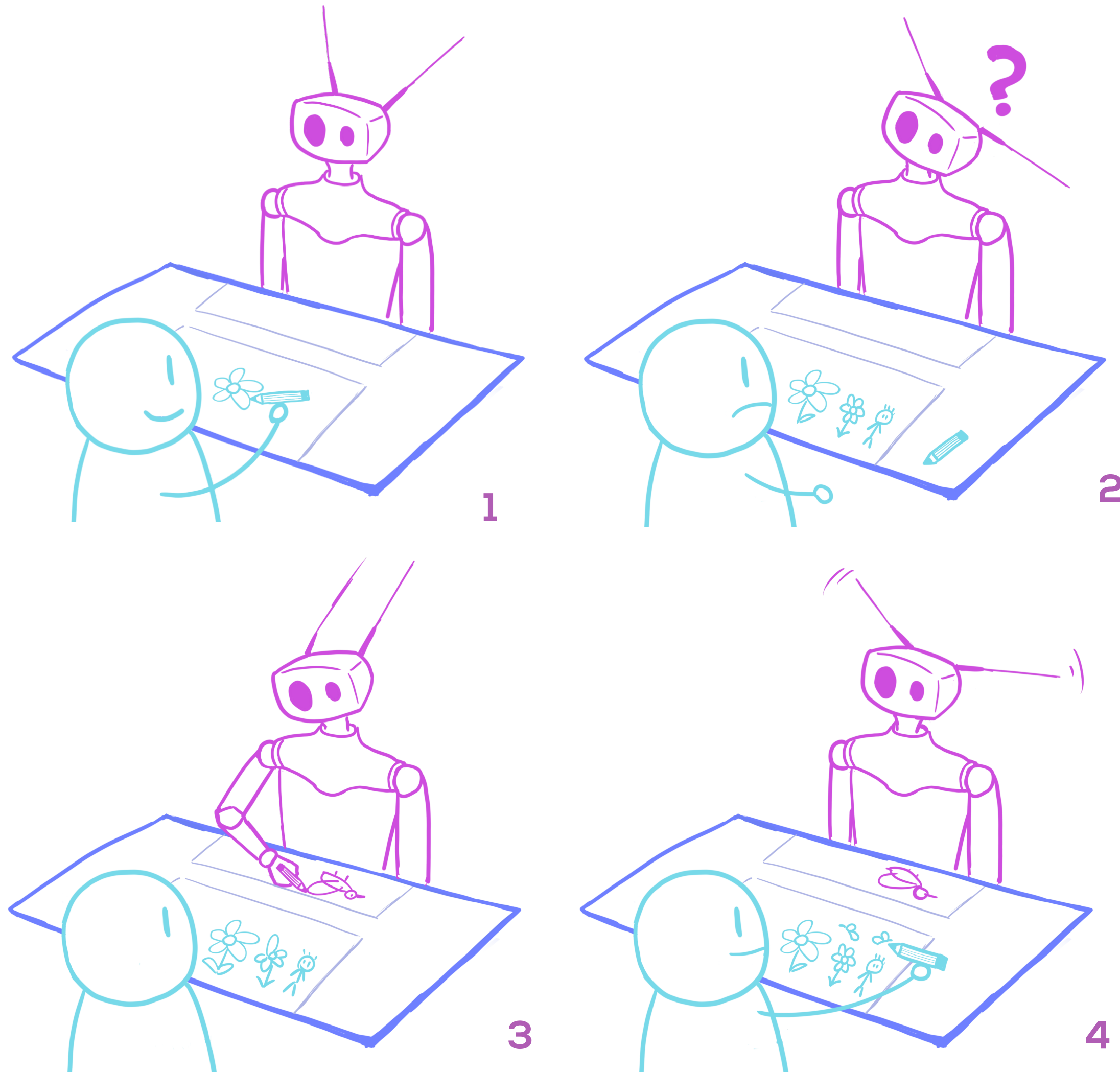
# How the Robot works

Encourage children to enrich their drawing



# How the Robot works

Draw to inspire children when children do not have ideas on their drawing

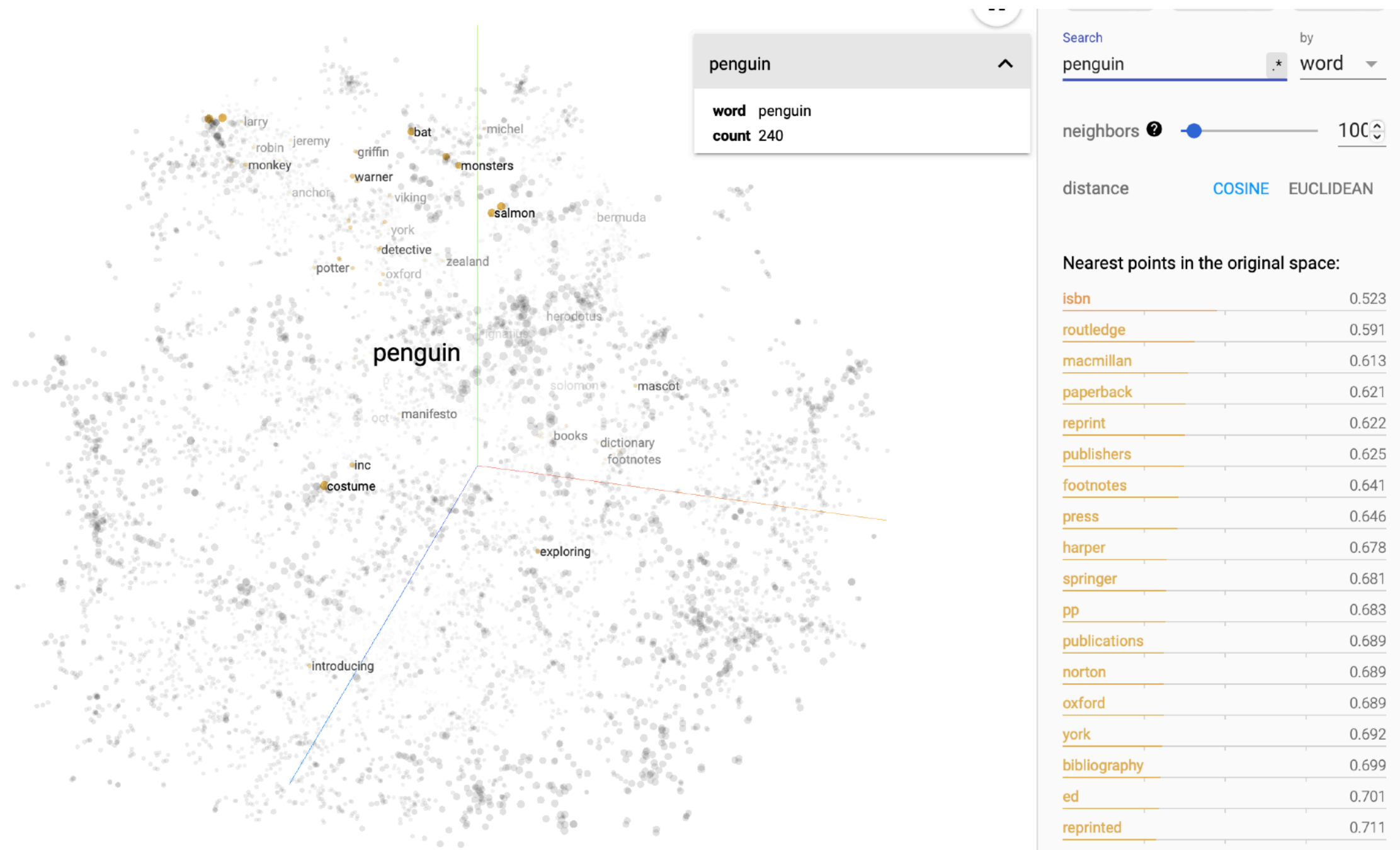


# Applied Dataset and AI Model

## Word2vec

Word2vec uses the natural network to learn associations between words. This model can “vectorize” words to indicate the similarity between words. This project propose using text from children books that were no longer protected by the copyright

Using T-SNE to visualize the vector space:



Propose a new category to draw on the paper based on existing drawings to inspire kids

## Quick Draw Dataset

A open-source dataset contain 50 million drawings across 345 categories. The data was collected from the game Quick Draw.

Each drawing contains:

1. A key id(a unique identifier across all drawings)
2. The category of the drawing
3. Whether this drawing is recognized by the AI
4. The time about when the drawing is created
5. The country-code to indicate where the player is located
6. A JSON array representing the vector drawing



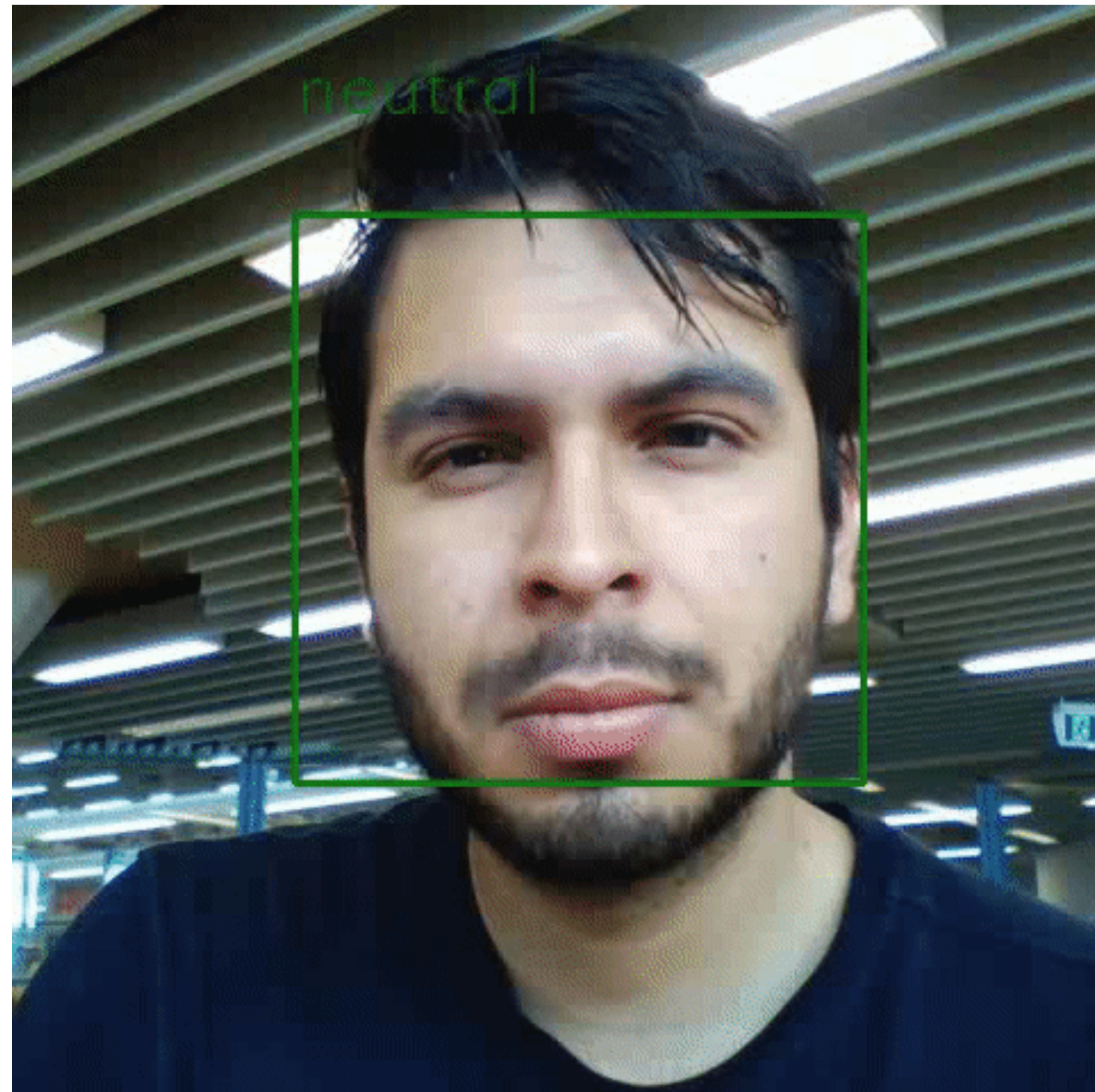
Recognize children’s drawings and generate sketches

# Proposed Dataset and AI Model

Using AI to identify children's real-time emotion

## Face Classification

Using CNN to identify users' real-time emotion



[https://github.com/oarriaga/paz/tree/master/examples/face\\_classification](https://github.com/oarriaga/paz/tree/master/examples/face_classification)

## FER-2013 Dataset

This open dataset contains 48\*48 pixels gray scale face images, each image is labeled in a facial expression among seven category (Angry, disgust, fear, happy, sad, surprise, and neutral)

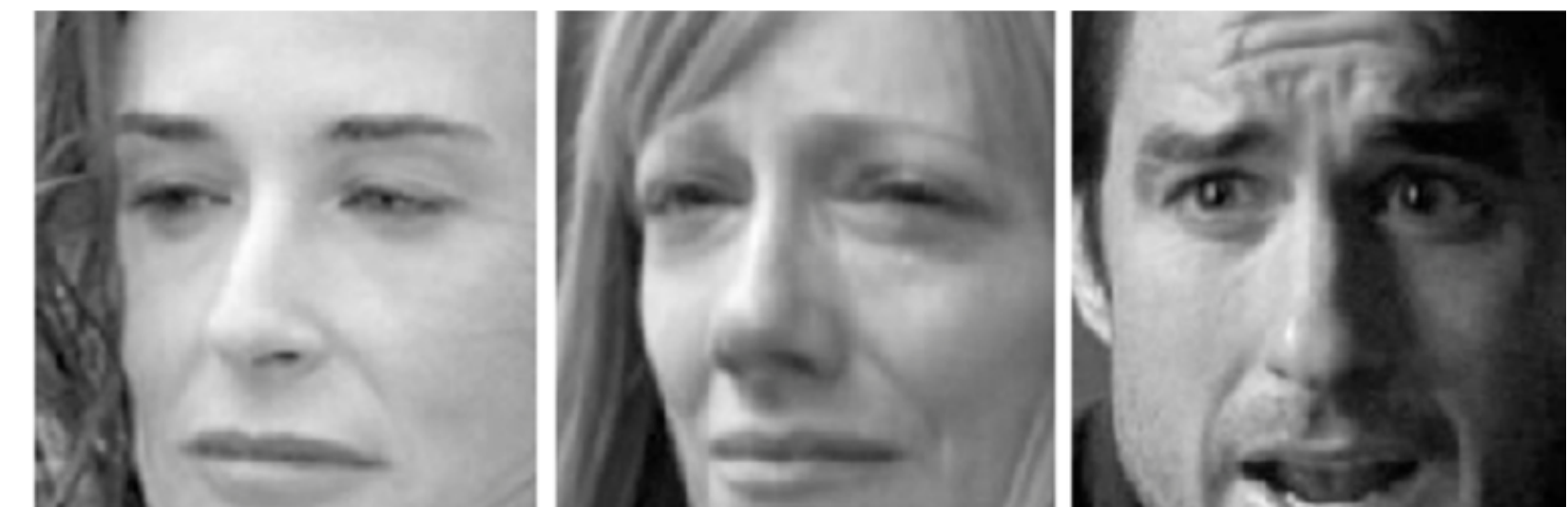


Angry

Disgusted

Fear

Happy



Neutral

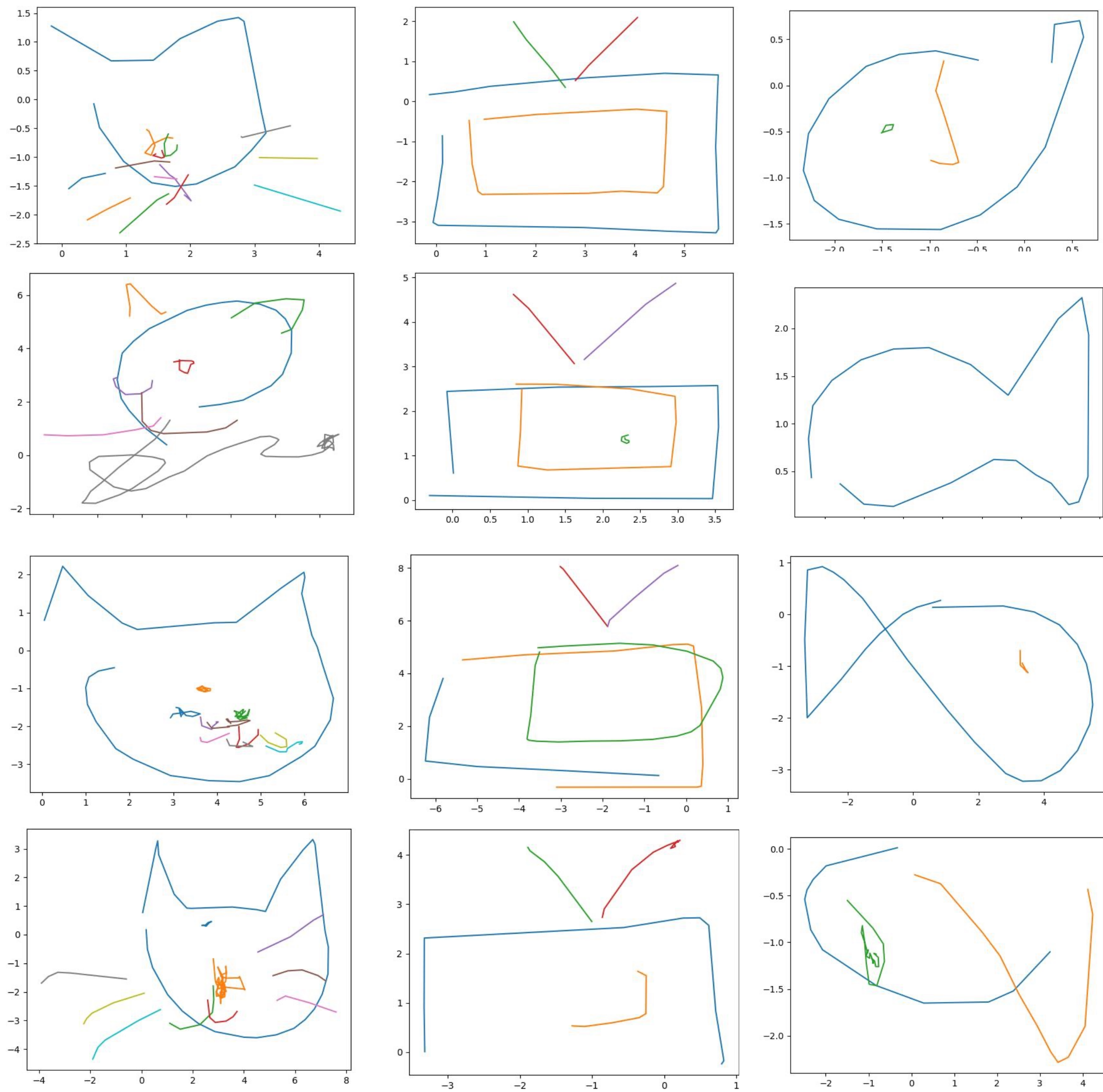
Sad

Surprised

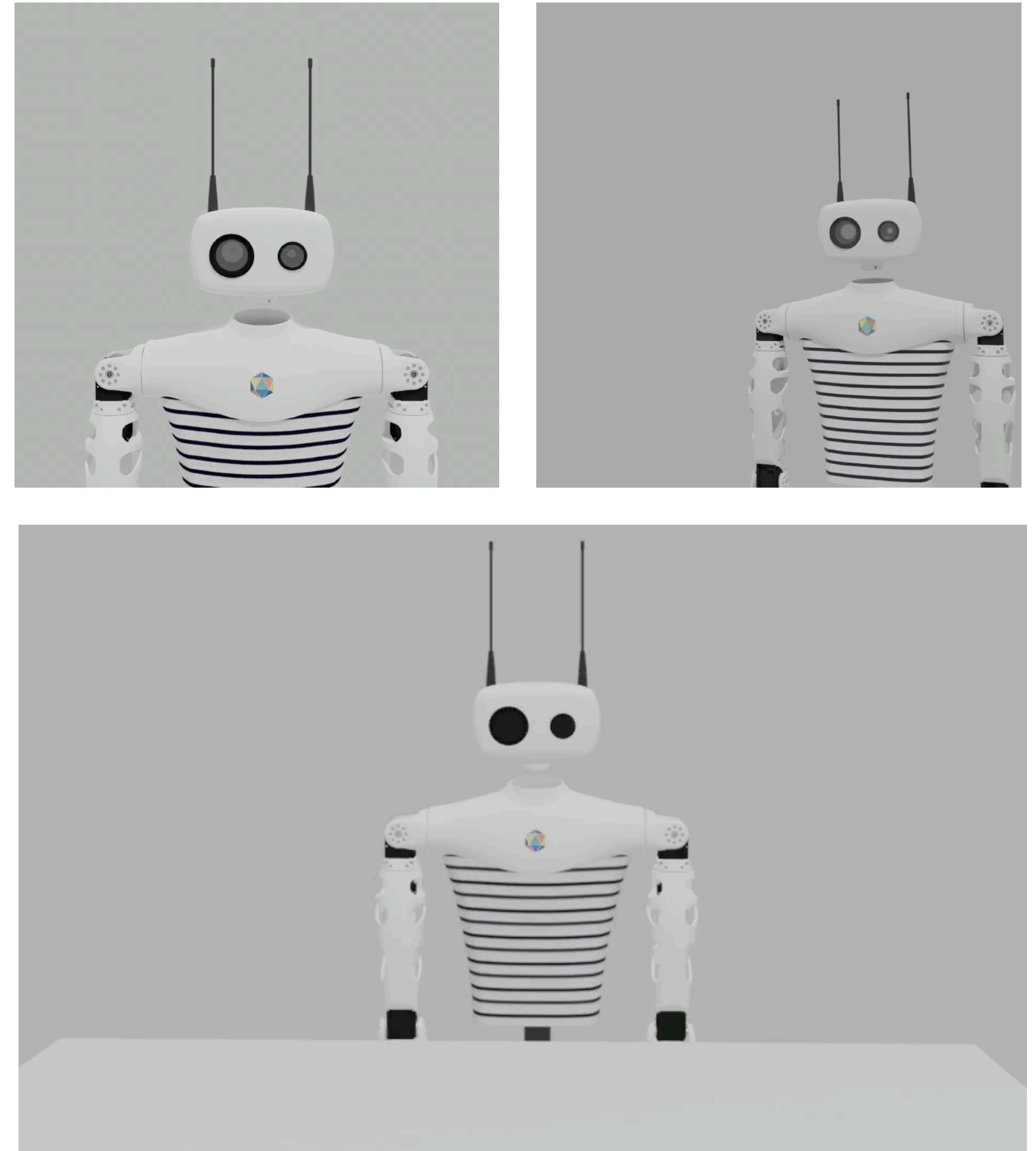
<https://www.kaggle.com/datasets/msmbare/fer2013>

# Prototyping

## Genrate sketches using Sketch-RNN

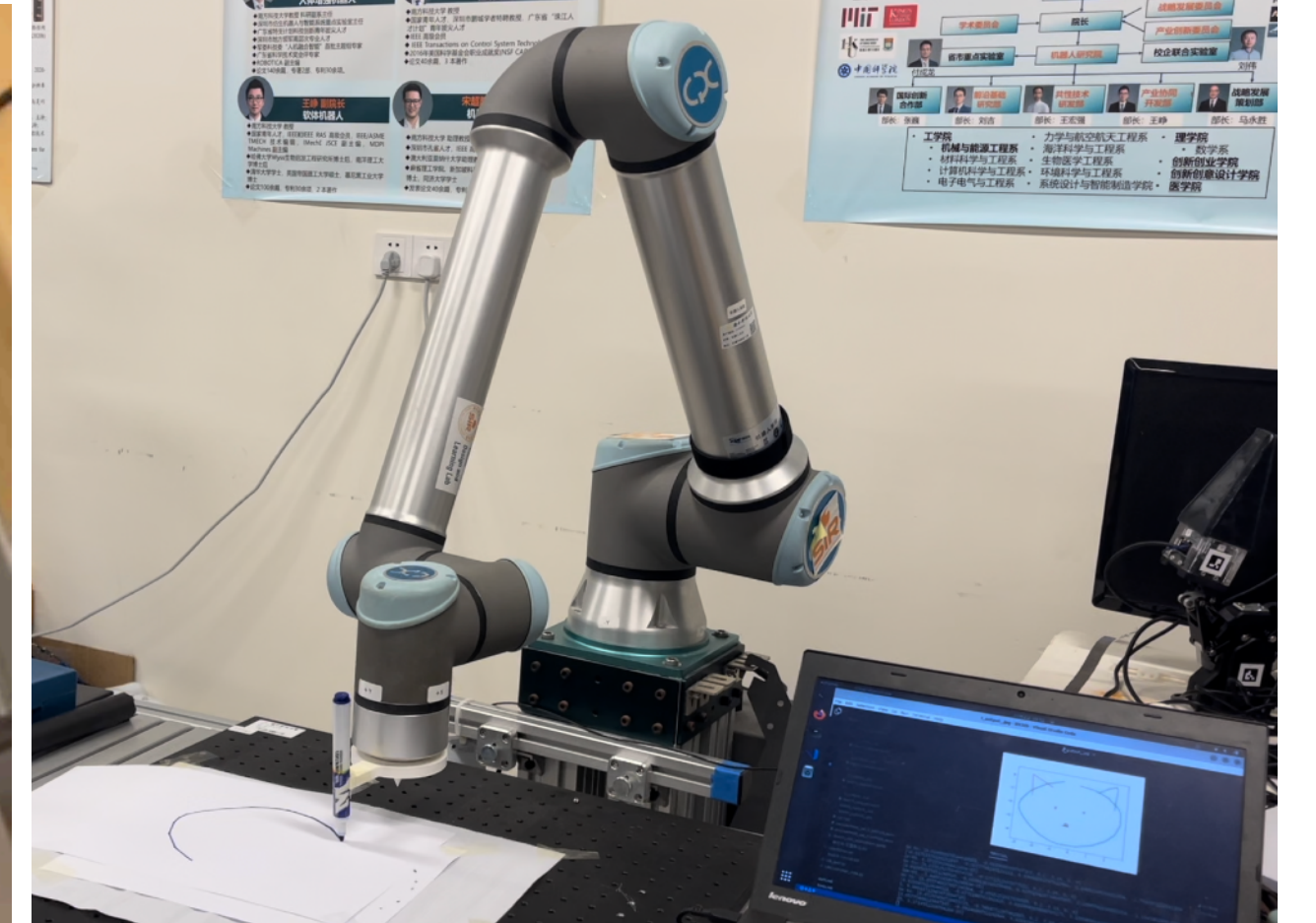


## Reachy's emotion expression



# Prototyping

Use the robot arm to draw a cat



Special thanks: 邱诺凡 Nuofan QIU

# Future Developments

Modify the interaction strategy to make the whole experience more engaging

Make the robot more educational

# Q&A

Final Presentation

DS323 AI in Design

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