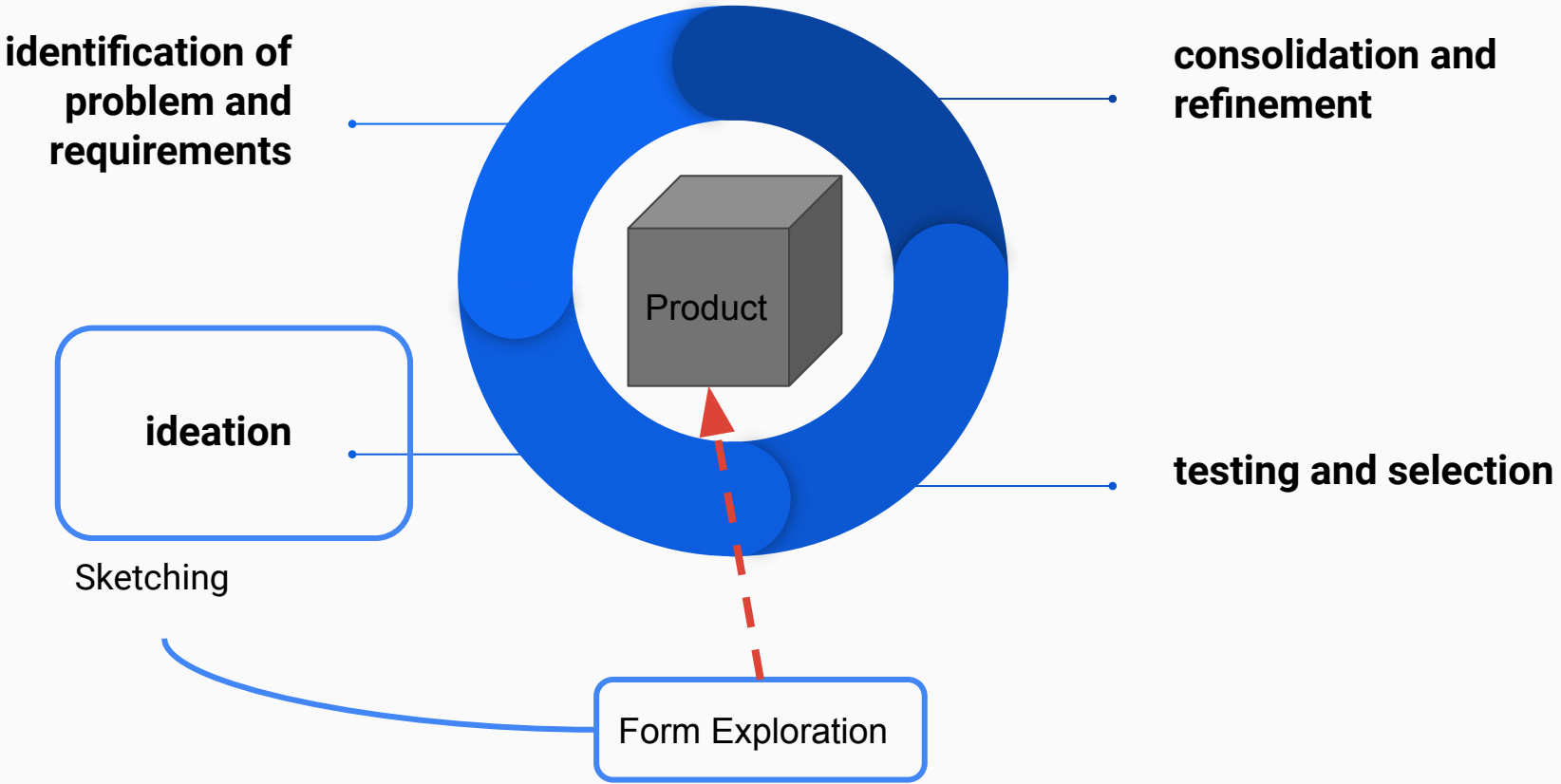
An AI-Based Pedagogical Tool for Creating Sketched Representation of Emotive Product Forms in the Conceptual Design Stages

Sunny Prakash Prajapati[1] , Rahul Bhaumik[1] , Tarun Kumar[2] , Unais Sait[1]

1. Faculty of Architecture & Design, PES University
2. Center for Product Design & Manufacturing, IISc Bangalore

Contents

Introduction: Design Thinking Process → Product Development



Introduction: Models to study emotions

Plutchik's theory

Complex emotions are based out of eight fundamental emotions

[anger, fear, sadness, disgust, surprise, anticipation, trust, and joy]

Discreet

Russell's circumplex model

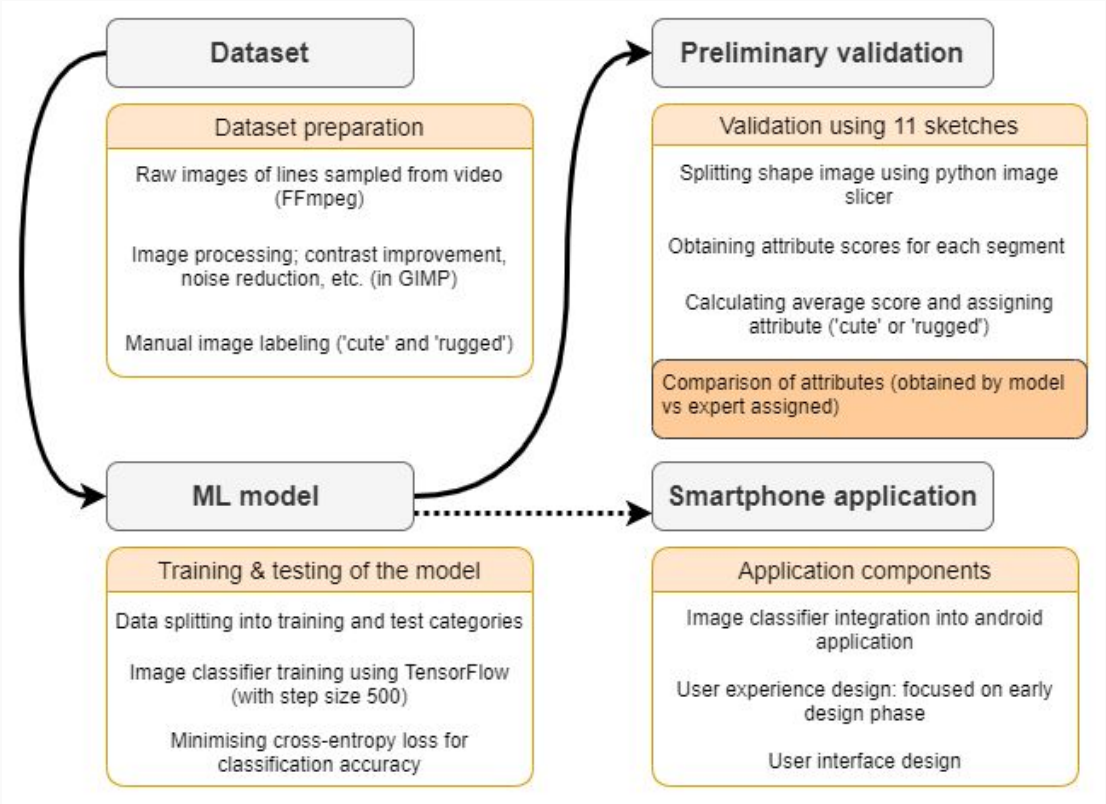
Emotional states can be mapped on a parametric space

[Valence (*positivity or negativity of emotion*)
Arousal (*alertness and calmness*)]

Continuous

R: Emotion → {words}

Methodology: Overview



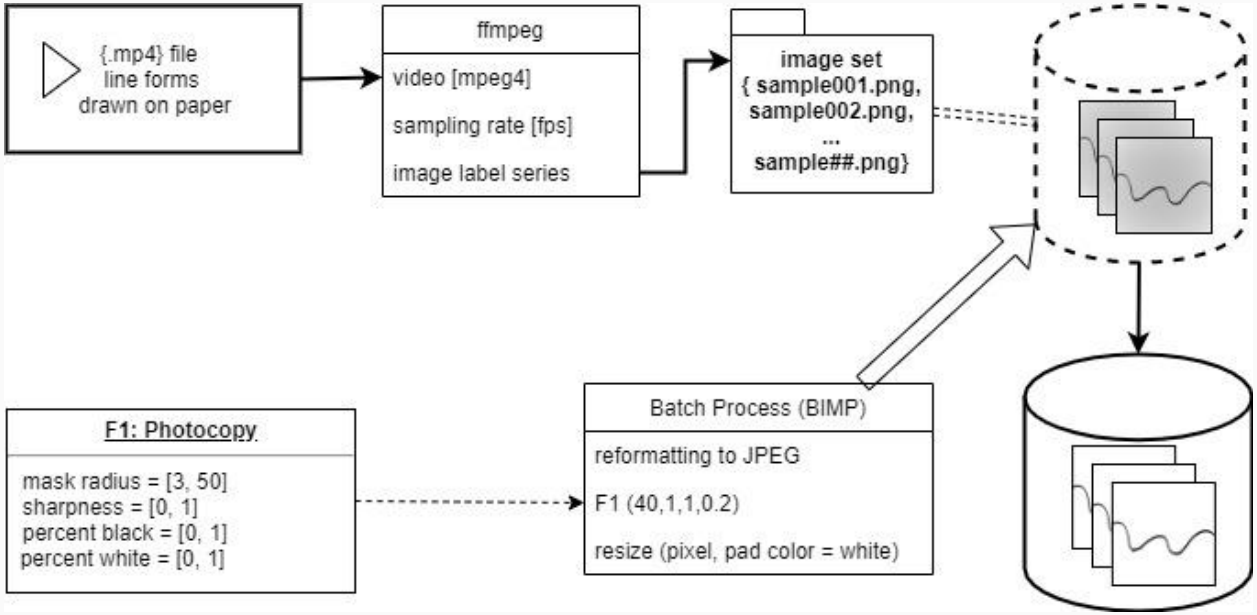
Methodology for the development of an AI-based pedagogical tool

Methodology

Preparation of the dataset

Hand drawn lines

Images processing: contrast improvement, modification to match input spec of CNN



Dataset preparation for the image classification model

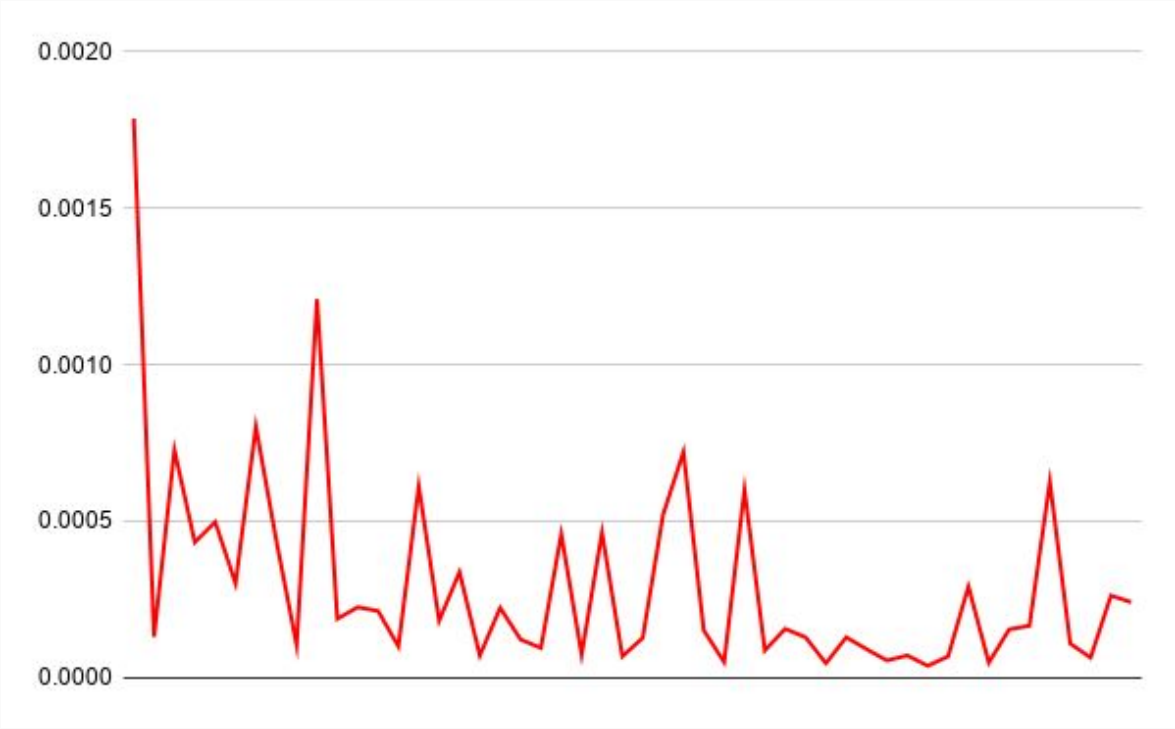
Methodology

Training and testing of the model

Trained using TensorFlow platform (79.8 % accuracy)

CNN Loss function : Cross-Entropy

Attributes: Rugged and Cute



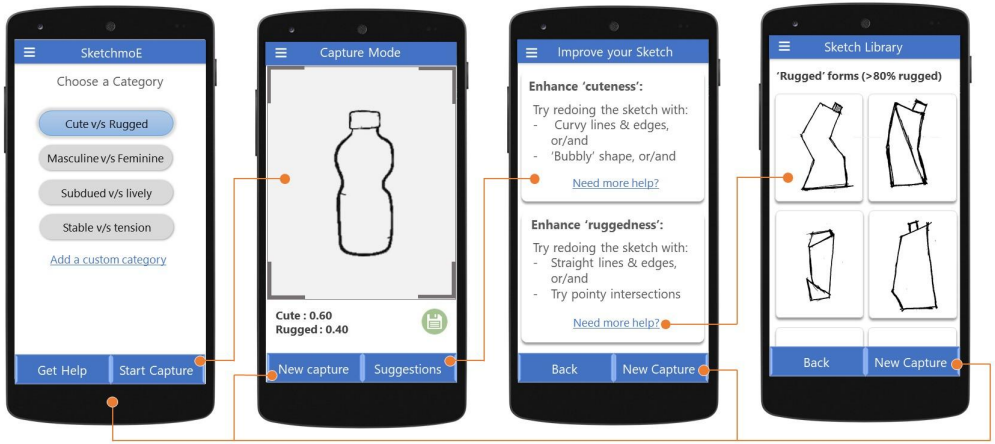
Cross entropy loss during training (initial value of 0.087 is omitted)

Methodology

Smartphone application

Attribute score of the sketched representation [*Evaluation*]

Suggestions on the lines of accentuating selected attribute [*Feedback*[



Screen 1: Home page, comprising options to choose an attribute pair for analyzing a product sketch

Screen 2: Capture screen, to capture any given sketch through phone camera

Screen 3: Suggestion page, providing users with cues for enhancing a particular attribute in the sketch

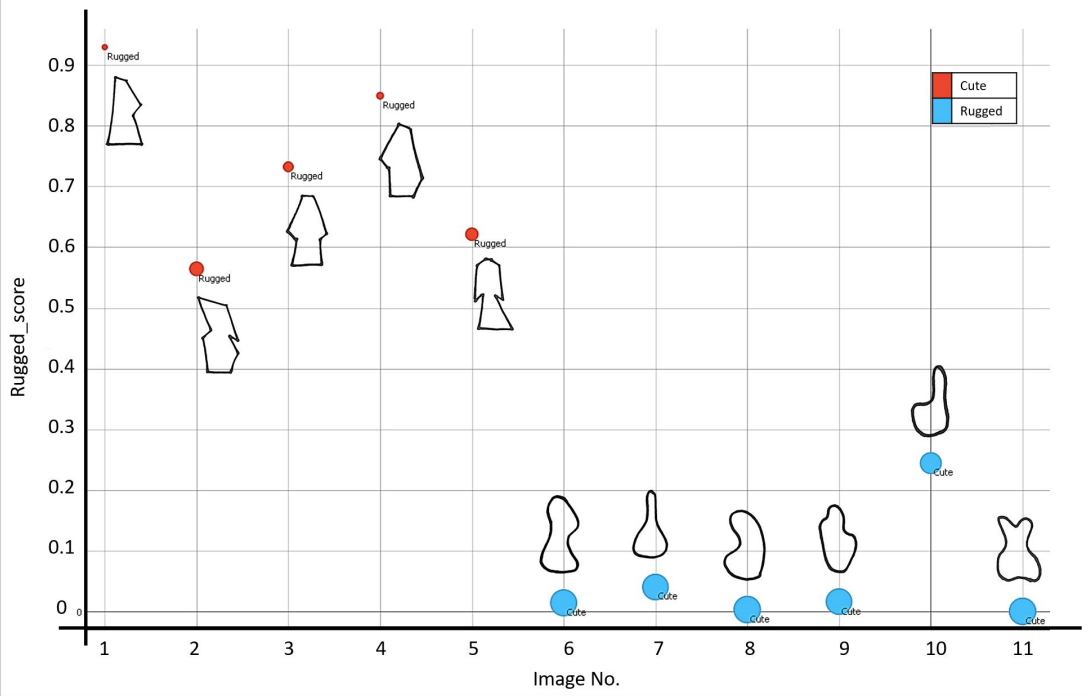
Screen 4: existing sketch library, to provide the user with more information pertaining to an attribute

Preliminary Validation

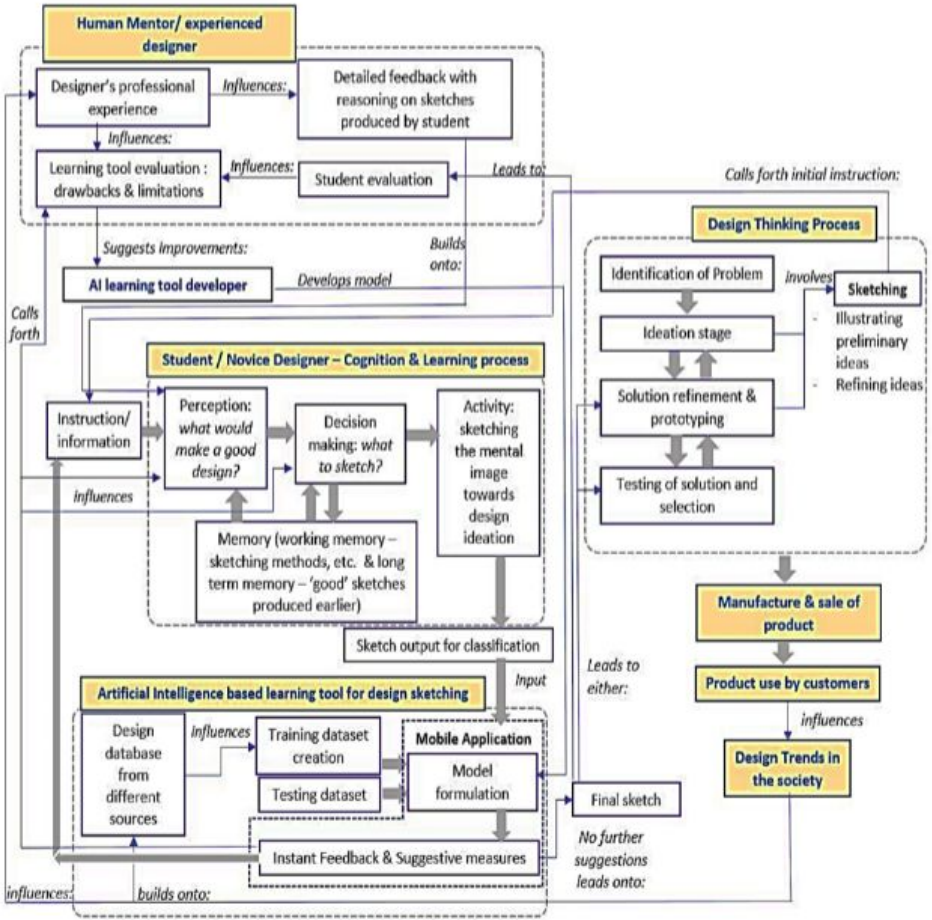
Testing eleven shapes on the re-trained CNN

Comparison of the classification results to the attributes assigned by a veteran designer

Attribute score average attribute score of the parts (four parts in this case)



Conclusion: Systemic Framework



The systemic diagram represents the positioning of the AI-based learning tool in the broader context of the 'Design Thinking' process.

Conclusion: The big picture

- Intervention in the design process : Ideation (synthesis and refinement) and consolidation (conceptualization) stage
- Aim: Influence of the pedagogic tool (AI based) in the student's learning process to create desirable emotive forms (over time)
- Human mentor as the key system element:
  - Human assisted learning (mentor → novice)
  - Tool development (human → AI based tool)
- Roadmap to data driven design approach

Thank You!