Design Compsition Critique

Presenter: Sidong Feng (u6063820)
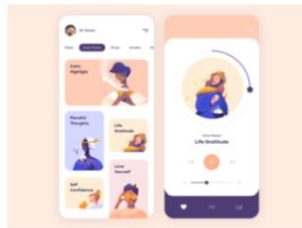
Supervisors: Dr Zhenchang Xing

Dr Chunyang Chen

Background

Graphic User Interface (GUI) design online sharing is a routine activity among designers
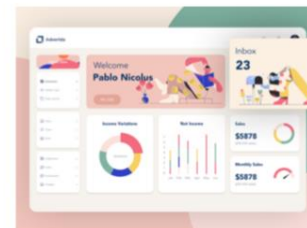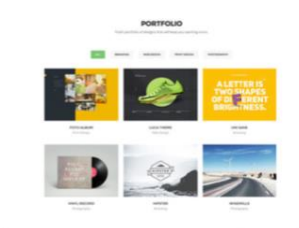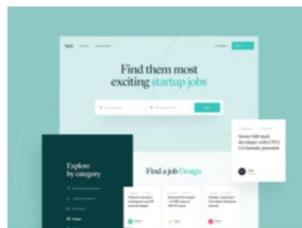
- boost portfolio
- gain inspiration
- understand trend

Mobile

Website

Dribbble   GraphicBurger   Behance
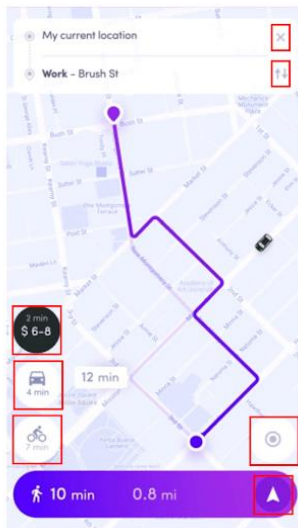
Motivation

1. Inefficient tagging-based search due to **unclear**, **incomplete** and **inconsistent** tags annotated by uploader.

- o Search for **e-commerce** cannot retrieve any result of **ecommerce**, vice versa.

Motivation
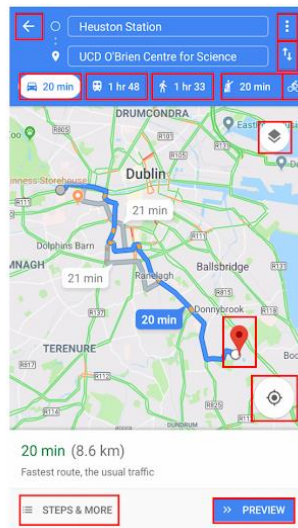
2. Design Practicality
   - Creative design <u>artworks</u> only
   - **BUT** <u>practical</u> GUI designs in <u>real</u> applications is needed
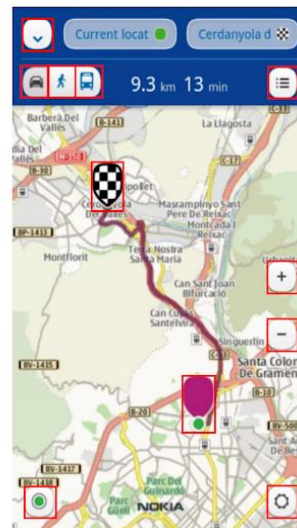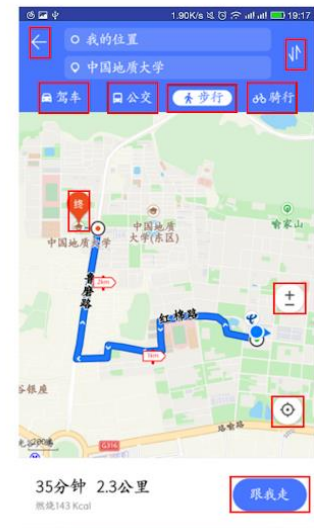

Artwork   Google Map   HERE WeGo   Baidu Map   Tencent Map

Motivation

3. Design Granularity
   - <u>Whole</u> design of the GUI only
   - **BUT** the detailed design of the GUI <u>components</u> is needed
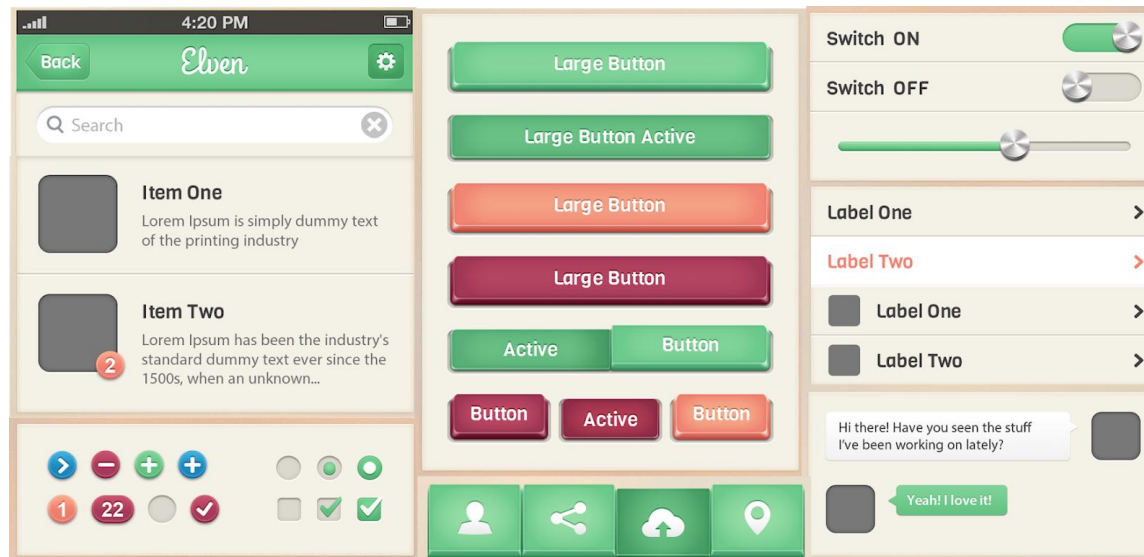
Objective

Design Gallery (http://mui-collection.herokuapp.com/)

- Support advanced tagging-based search for whole UI artwork design
- Support multi-faceted search for component-oriented practical design

Artwork and wireframe

Components from practical UI

Final UI
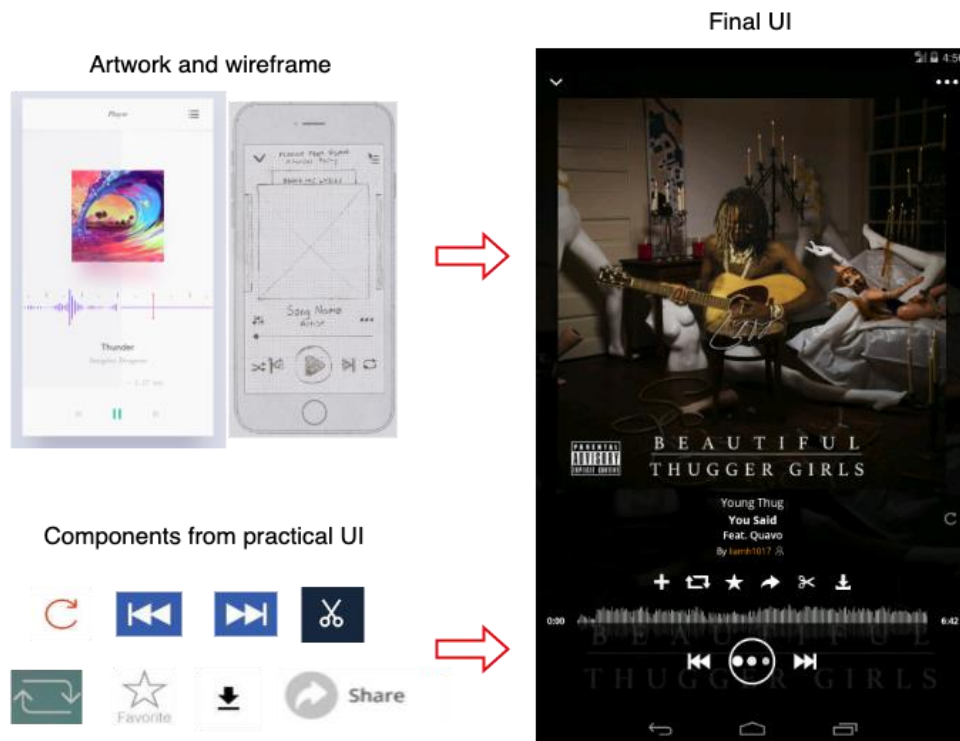
Whole UI Artwork Search

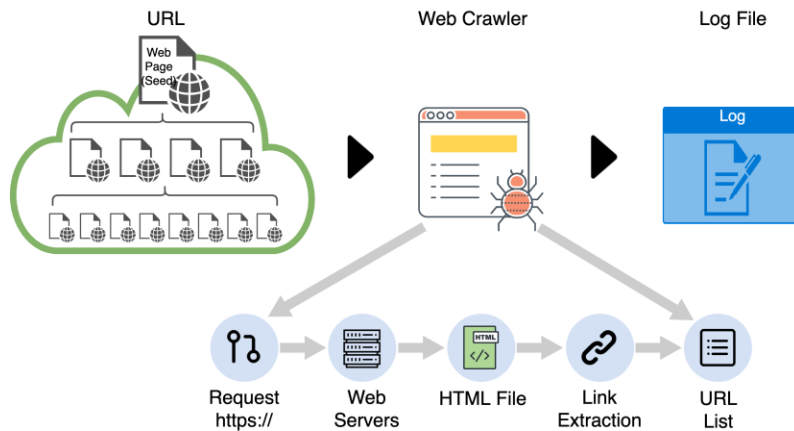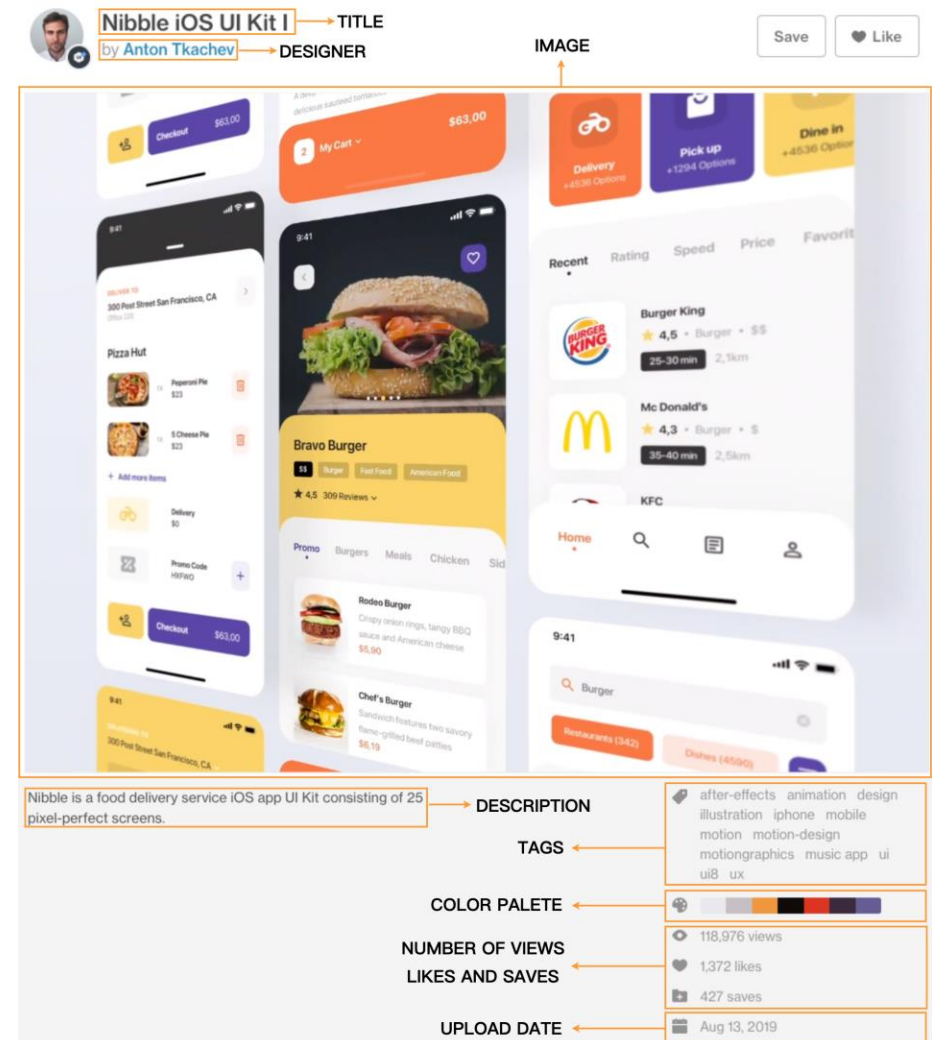- Problem Definition
  - undescriptive tags   =>   unclear
  - same-meaning tags   =>   inconsistent
  - missing tags   =>   incomplete

- Approach
  - A structured UI semantic vocabulary (solve unclear and inconsistent)
  - A tag prediction model (solve incomplete)

Data Collection

- Breadth-First method[1] to crawl 61,700 UI designs from Dribbble [2] and its associated information

UI Semantics

Problem	Example	Definition	Solution
Implicit Correlation	(payment, checkout)	Association Rule Mining [3]	Aprori algorithm [4]
Category Classification	Sport: gym, workout	Consensus-driven approach	Google's Material Design
Synonyms and misspelling	visualisation, visualizatio n, vizualization	Semi-automatic method [5]	Word embedding model NLTK [6]
Abbreviation	ui, **u**ser **i**nterface	Rule based method	character is in the same order, first character, etc.

UI Semantics
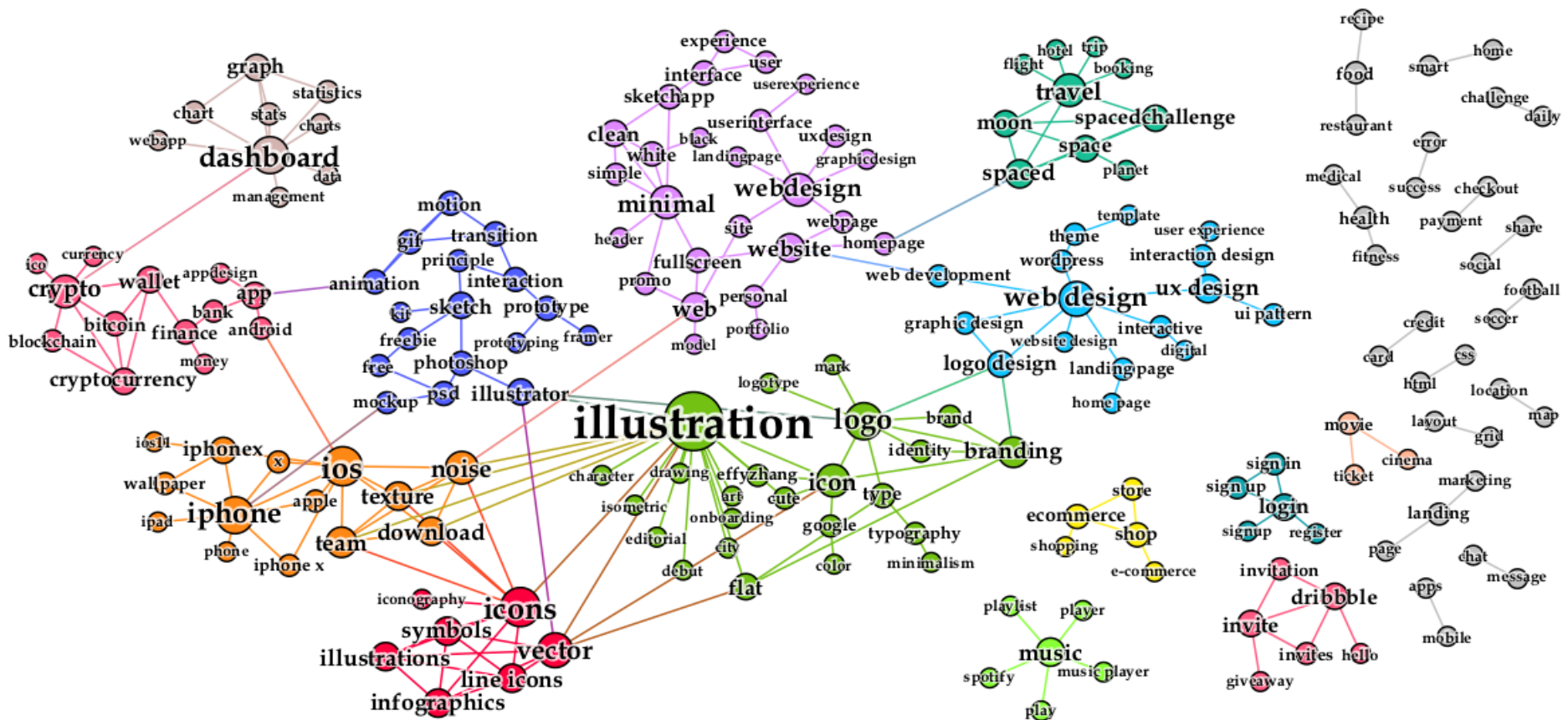
CATEGORY	ASSOCIATED TAG NAME
PLATFORM	
Website:	Website, Web, Mac, Macbook
Mobile:	Mobile, Phone, IOS, Iphone, Android
Tablet:	Tablet, Ipad, Ipadpro
COLOR	
White:	White
Yellow:	Yellow, Golden, Orange
Red:	Red
Pink:	Pink
Purple:	Purple
Blue:	Blue, DarkBlue, SkyBlue
Green:	Green, DarkGreen, Aquamarine
Grey:	Grey, Silver, DarkGray
Brown:	Brown
Black:	Black
APP FUNCTIONALITY	
Music:	Music, Musicplayer, MusicApp
Food & Drink:	Food, Restaurant, Grocery, Drink
Game:	Game, Videogame
Health & Fitness:	Fitness, Health
News:	News
Sport:	Sport, Gym, Workout
E-commerce:	E-commerce, Store, OnlineShop
Social Networking:	SocialNetwork, Blog, Messenger, Facebook, Instagram, Dating, Chat
Travel:	Travel, Trip, Tourism
Weather:	WeatherApp, Temperature
Lifestyle:	Fashion, Furniture, Real Estate
Education:	Education, E-learning
Reference:	Dictionary, Atlas, Encyclopedia
Entertainment:	Movie, TV, Netflix, Youtube
Medical:	Medical, Healthcare, Hospital
Books:	DigitalReading, DigitalBookstroe
Kids:	Kids, Children
Finance:	Finance, Wallet, Bank, Business, Insurance, Marketing
Utilities:	Calculator, Clock, Measurement, WebBrowser
Navigation:	DrivingAssistance, TopographicalMaps, PublicTransitMaps
SCREEN FUNCTIONALITY	
Landing Page:	LandingPage
Login:	Login, Signin
Signup:	Signup, Registration
Checkout:	Checkout, Payment
Search:	Search
Profile:	Profile
Contact Page:	Contact, ContactPage
SCREEN LAYOUT	
Dashboard:	Dashboard
Form:	Form
Table:	Table
List:	List
Grid:	Grid
Gallery:	Gallery
Toolbar:	Toolbar, Toolbox
Chart:	Chart

STANDARD(#)	ABBREVIATION & SYNONYMS
ui (61309):	user interface, user_interface, user-interface design, uidesign
website (28009):	web, websites, webpage, website development, web design
ux (24209):	user experience, uxdesign, ux_design
mobile (8554):	mobiledesign, mobile phone, mobile_design, smartphone
illustration (7159):	illustration, digital_illustration, kids_illustration
app (5887):	apps, application, app development, app design
landing page (5536):	landing-page, landingpage, landing page design
minimal (4938):	minimalism, minimalistic, minimalist
ios (4741):	ios8, ios9, ios11, ios_design
iphone (4736):	iphone x, iphonex, iphone 7, iphone_8
icon (4230):	icons, icon design, icon pack
logo (3704):	logo design, logos, logotype
food (2881):	fastfood, food_blog, junk_food, doughnut
clean (2723):	clear, clean_design
flat (2481):	flat design, flat-design, flat-art
interaction (2402):	interactive, microinteraction, interaction design, user interaction
dashboard (2141):	dashboard design, dashboards
branding (2071):	branding design, rebranding, selfbranding
sketch (2060):	sketching, sketches, adobe_sketch
ecommerce (1974):	e-commerce, online commerce, shopping
vector (1940):	vectors, vector art
product (1841):	products, product page, product detail
typography (1820):	interface typography, 3d_typography
gradient (1671):	gradients, gradient design, blue gradient
gif (1441):	gifs, looping_gif
layout (1400):	layout design, layouts
concept (1378):	conceptual, concepts, concept art
motion (1361):	motion graphics, motion design
responsive (1347):	responsive design, response
music (1251):	music player, musician, musical, concert
restaurant (1221):	restaurants
profile (1204):	profiles, user_profile, userprofile
travel (1197):	travelling, travel agency, travel guide
animation (1194):	animations, 3danimation, 2danimation
simple (1108):	simply, simplistic, simple_design
graphic (1047):	graphics, graphic design, graphicdesigner
color (1000):	colors, colorful
white (988):	whitelabel, white design, white theme
login (919):	log_in, sign_in, login screen
modern (915):	modernistic, fashionable

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Whole UI Artwork Search

- Approach
  - ~~A structured UI semantic vocabulary (solve unclear and inconsistent)~~
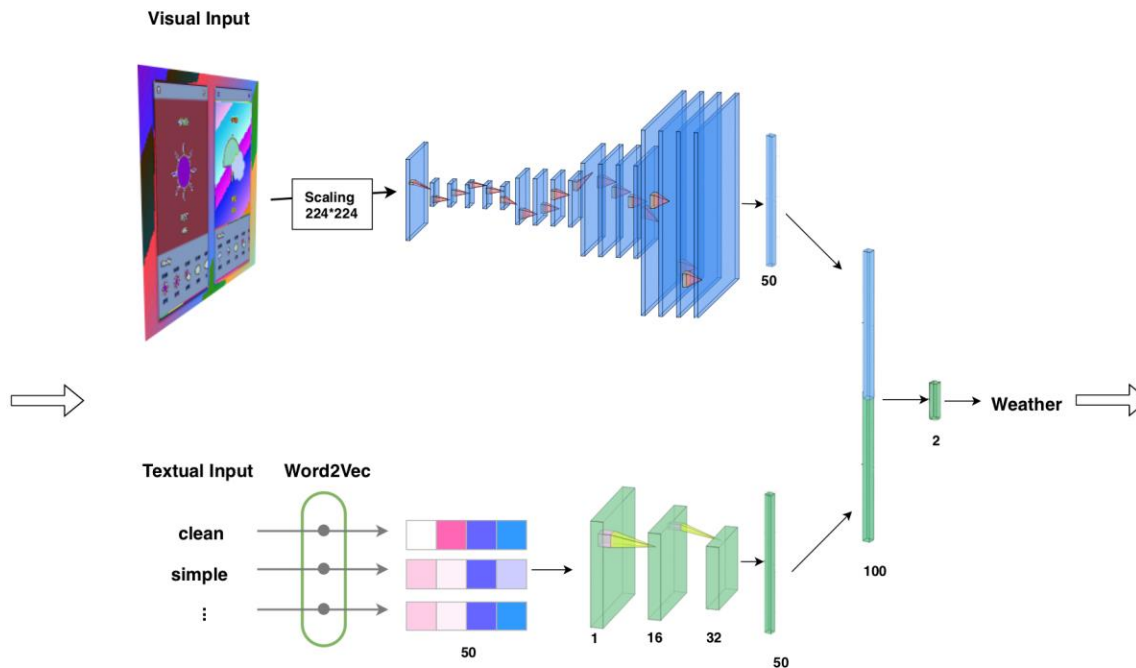 - **A tag prediction model (solve incomplete)**

Tag Prediction

- Multi-Labels problem => Multiple Binary Classifier
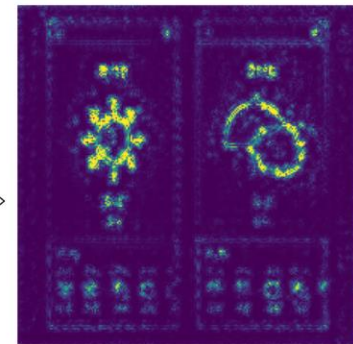- Capture visual and textual information

Tag Prediction

- Intensity of Image and Tag

Image vectors	Tag vectors	Accuracy
10	90	0.5972
20	80	0.7056
30	70	0.6528
40	60	0.8134
50	50	**0.8272**
60	40	0.8222
70	30	0.8194
80	20	0.7981
90	10	0.7715
32	32	0.8008
64	64	0.8130

Tag Prediction

- Baseline: Histo+SVM, Histo+DT

- Our model achieve 82.72% accuracy

CLASSES	ACCURACY					
	Histo +SVM	Histo +DT	ResNet -pretraind	ResNet +pretraind	Tag_CNN only	ResNet +CNN +pretrained
App Function						
music	0.6636	0.5545	0.6727	0.7909	0.8545	**0.8909**
food&drink	0.5765	0.6294	0.7529	0.7882	0.7706	**0.8294**
ecommerce	0.5565	0.5726	0.6895	0.7460	0.8306	**0.8710**
finance	0.5655	0.5833	0.6964	0.7500	0.8274	**0.8512**
travel	0.5211	0.5842	0.7316	0.7053	0.8053	**0.8474**
game	0.5814	0.5814	0.8062	0.7984	0.7597	**0.8605**
weather	0.5745	0.7021	0.7447	0.7872	0.8085	**0.8298**
sport	0.4220	0.6147	0.6147	0.6239	0.7064	**0.7798**
Color						
yellow	0.5865	**0.7596**	0.7404	0.7404	0.6442	0.7500
red	0.6667	0.7083	0.8194	**0.8472**	0.6111	**0.8472**
pink	0.7609	0.6522	0.7826	0.7391	0.6522	**0.8261**
blue	0.6600	0.6800	0.7700	0.7400	0.6800	**0.8700**
green	0.7000	**0.8714**	0.8286	0.7714	0.6571	0.7857
white	0.6111	0.6111	0.7778	0.7333	0.7333	**0.7888**
black	0.6241	0.6015	0.8496	0.8271	0.6617	**0.8571**
Screen Function						
landing page	0.5465	0.5346	0.7106	0.7017	0.7947	**0.8115**
signup	0.4907	0.5556	0.7731	0.7130	0.7361	**0.7778**
checkout	0.5545	0.4182	0.6000	0.7091	0.7545	**0.8000**
profile	0.4667	0.5538	0.5487	0.6513	**0.9026**	0.7590
Screen Layout						
dashboard	0.5867	0.6067	0.7600	0.7933	0.7867	**0.8800**
chart	0.6061	0.6667	0.7121	0.7424	**0.8485**	0.8030
form	0.5429	0.5000	0.6857	0.7429	0.5714	**0.7714**
list	0.6136	0.5909	0.7045	**0.9091**	0.6364	0.8182
grid	0.5000	0.5811	0.6351	0.6486	0.7162	**0.7432**
Platform						
mobile	0.7785	0.7847	0.8356	0.7954	0.9250	**0.9402**
website	0.7513	0.7481	0.8418	0.8224	0.8837	**0.9171**
Average	0.5965	0.6249	0.7342	0.7545	0.7522	**0.8272**

Tag Prediction

- ## Model Behavior

Original Tags:

7ninjas, animation, app, article, browsing, cards, catalog, design, flat, interaction, list, motion, principle, ui, website, wishlist
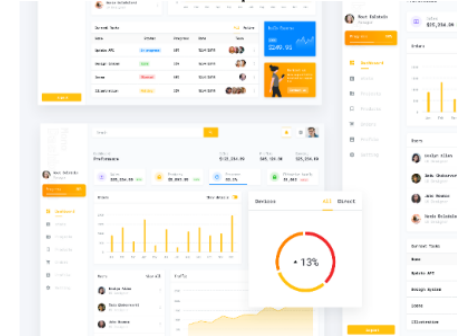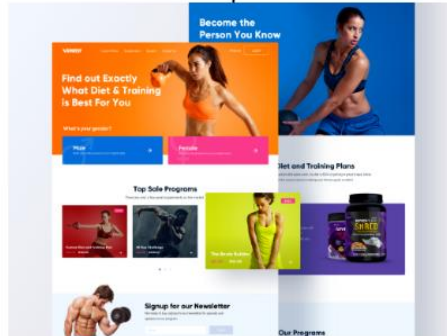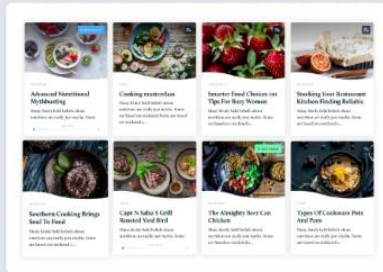
Original Tags:

colorful, colors, fitness, girl, layout, marketing website, product design, ui, ui design, ux, ux design, web, webdesign, web design

Original Tags:

bank, chart, dark, graph, list, online paying, payment, payment history, ui, ux

Original Tags:

analytics, analytics chart, dashboard app, design, form, form elements, freebies, graph, icons, ui, uidesign, uikits, web, web design

Predicted Additional Tags:

grid, food&drink

Predicted Additional Tags:

sport, yellow, blue, website, landing page

Predicted Additional Tags:

finance, black, checkout, profile, mobile

Predicted Additional Tags:

chart, yellow, finance, website, dashboard, profile

Tag Prediction

- Feature Visualization
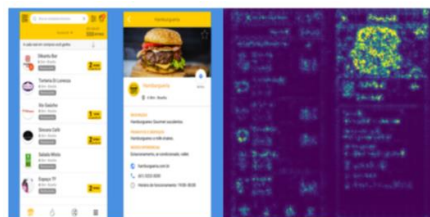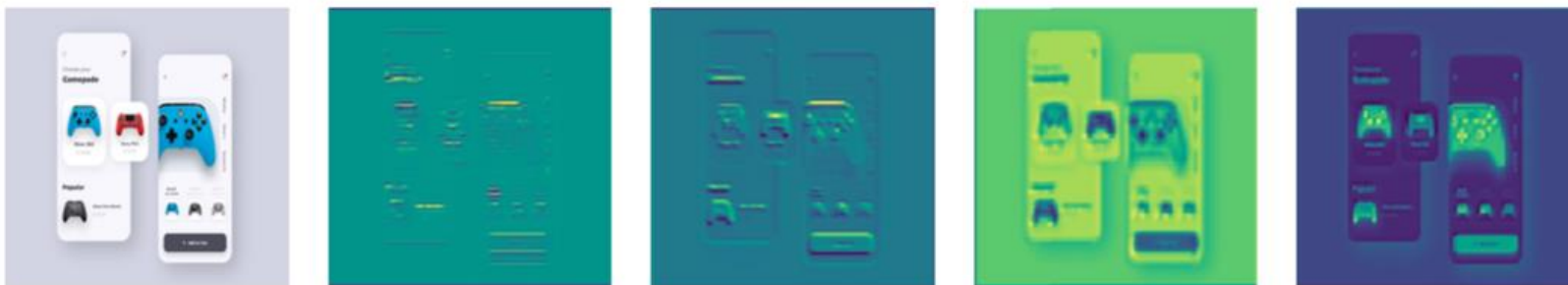
(a) food&drink
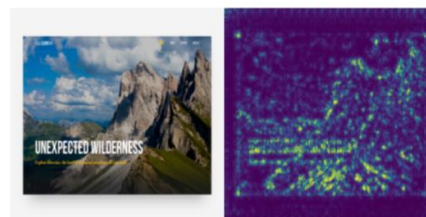
(b) travel
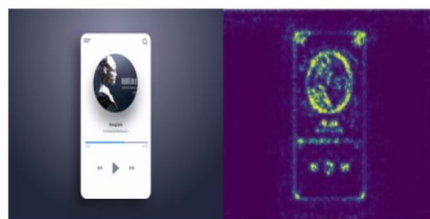
(c) music

(d) chart

Design Gallery

- New database (16,546 UI designs)
- Advanced tagging-based search
- Existing platforms comparison
- Ranking system

Gallery Search

KeyWords

☐ platform   ☐ color   ☐ app   ☐ function   ☐ layout

Link to Dribbble result   Link to local dribbble result

Example:

demo: ios food list

1. iphone blue checkout   2. ios trip list

3. black finance chart   4. website music list

SEARCH

Informal Feedback from Designers

- Visualizing Vocabulary
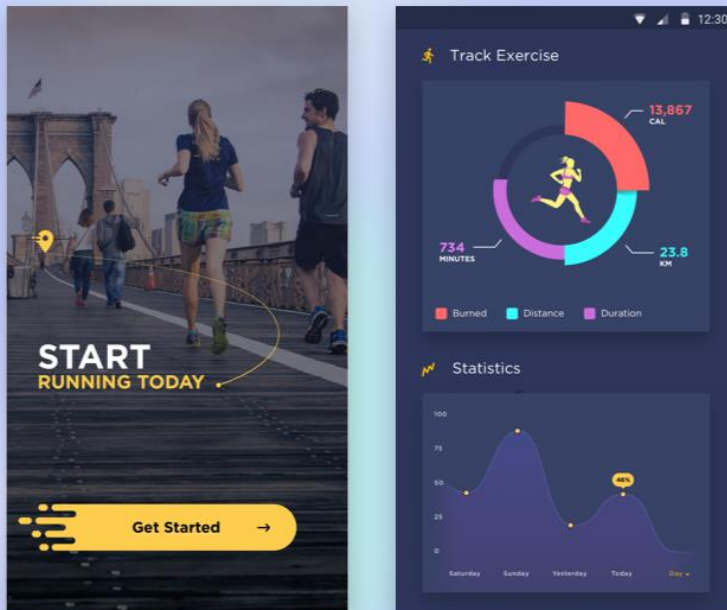
android, ios, apps, running, sport, trainer, exercise, dashbroad, creative, design, flat design, google, material, sketch design

↓

mobile, sport, dashboard, creative, flat, google, material, design, sketch design

↓

mobile, sport, dashboard, creative, flat, sketch design, health&fitness, login, chart, black, blue

Informal Feedback from Designers

- Exploring Variations
- Quicker Inspiration

Query	Number of Dribbble	Number of our gallery
ios trip list	14	187
iphone blue checkout	9	39
black finance chart	10	50
website music list	3	16

Informal Feedback from Designers

- **Design Demographic**
  - Social => Blue, White

	Number of designs	Proportion
Grey	1	0.51%
Brown	2	1.01%
Pink	2	1.01%
Black	42	21.21%
White	48	24.24%
Green	10	5.05%
Blue	80	40.40%
Red	5	2.53%
Yellow	8	4.04%

Grey: 1 Images

Brown: 2 Images

Pink: 2 Images

Black: 42 Images
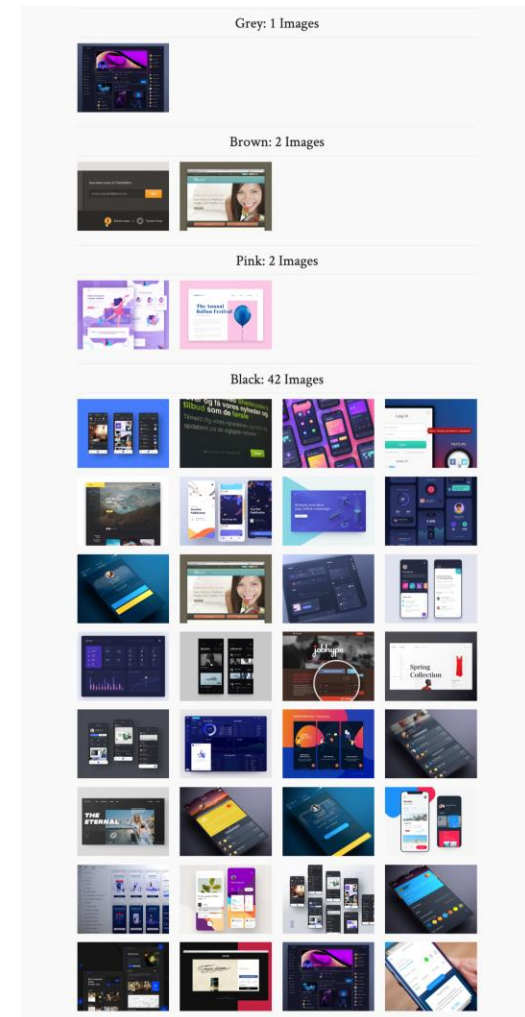
Half-Way

Component-Oriented Search

- Problem Definition
  - Exploit app introduction screenshots
  - 11 types of GUI components in Android
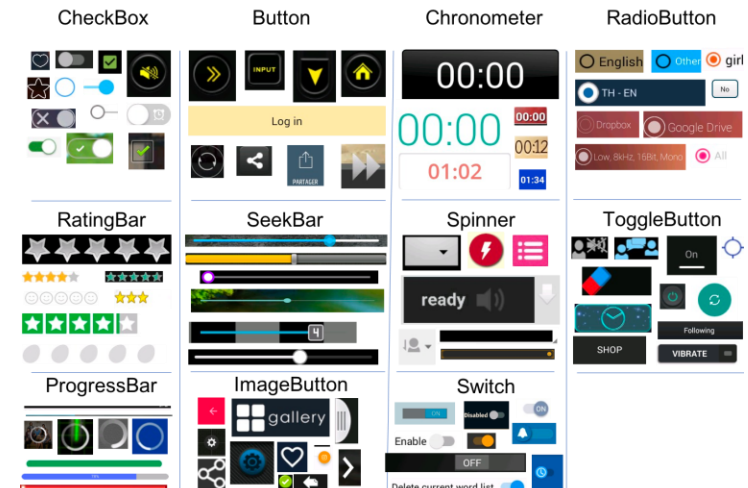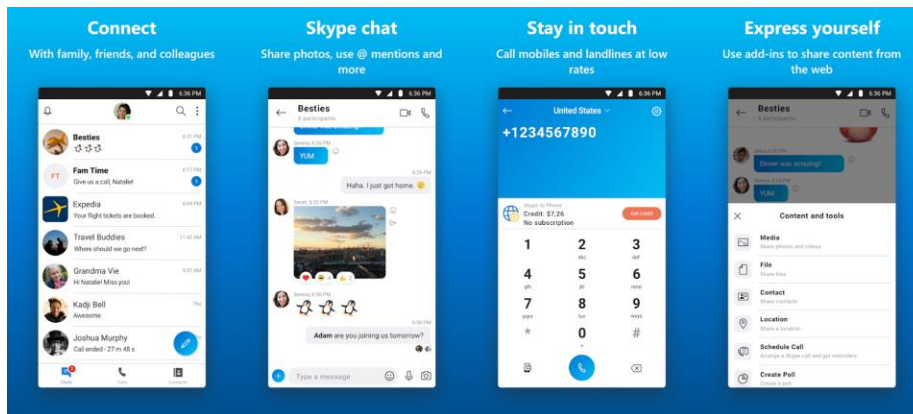
System Flow

1. Screenshots collection (**real-app**, **app introduction**)
- Components detection (**Faster RCNN** [7])
1. Screenshots **Wirification**
2. Post-processing (**duplicates removal**, **color detection**)
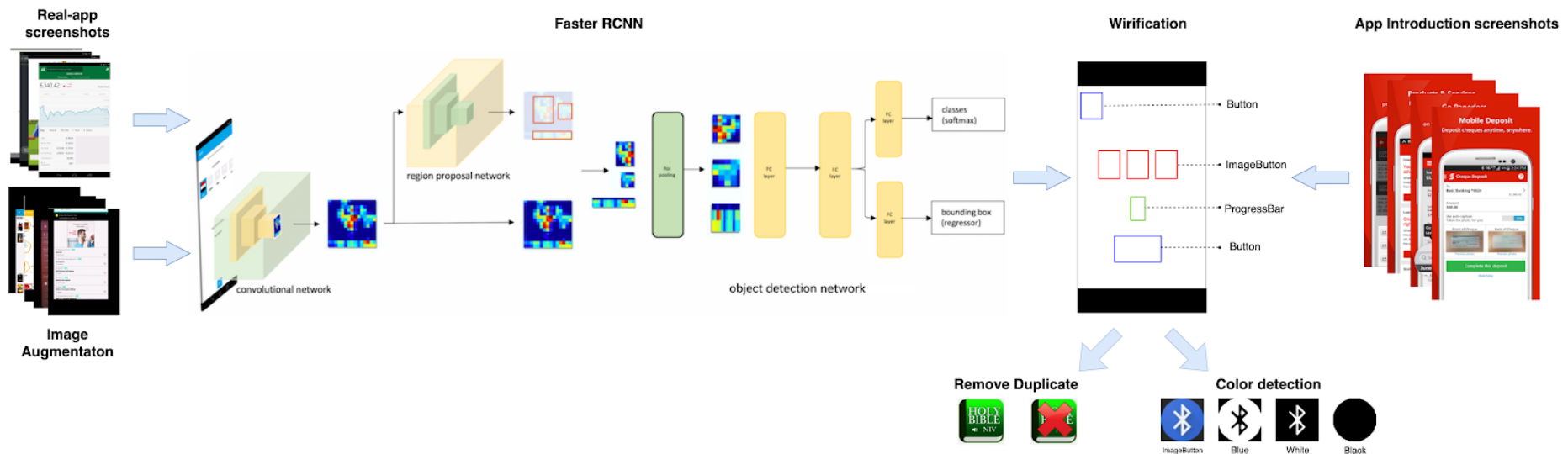
Screenshot Collection

Dataset	Method	Number of screenshots
Real-app	Automated GUI Exploration [8]	68,702
App Introduction	Crawling	469,177

Automated GUI Exploration

UI-1   Scroll Down   UI-2   Click Red-Box   UI-3   Input Text   UI-4

Screenshot Collection

Screenshot Pre-Processing

- ## Duplicates:
  - Design consistency
  - App policy and privacy
  - Similar structure
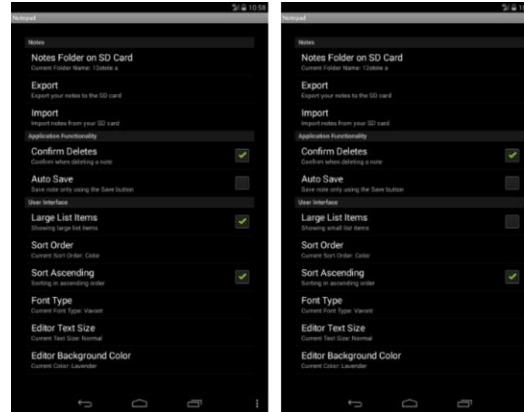
Design consistency
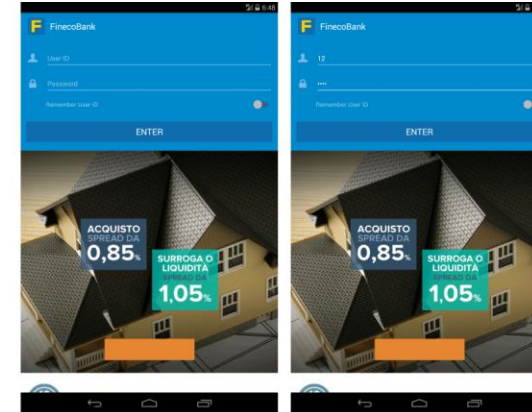
App policy and privacy

- ## Solution
  - Breadth-First Traversal [9] of DOM tree
    - Eg. *CheckBox[21,499][191,542]SeekBar[21,456]….*
  - Levenshtein distance [10] to calculate string similarity
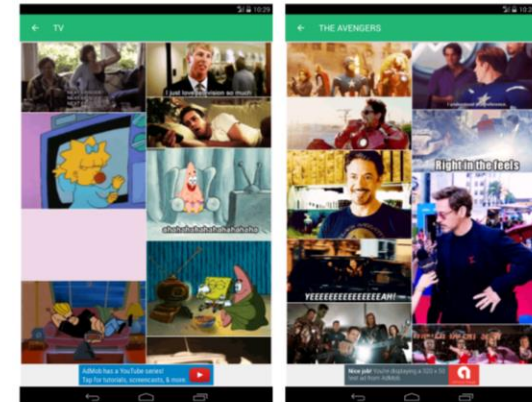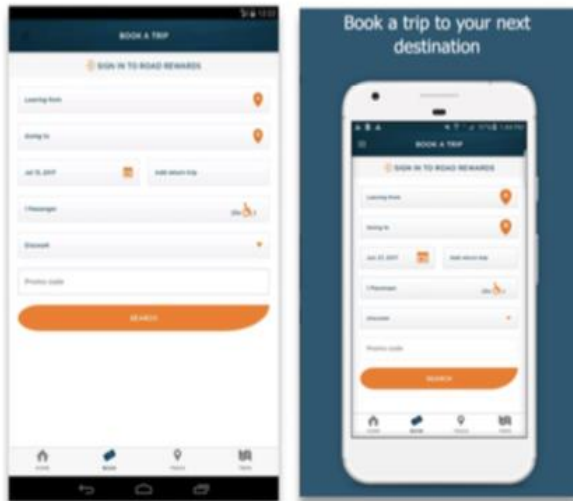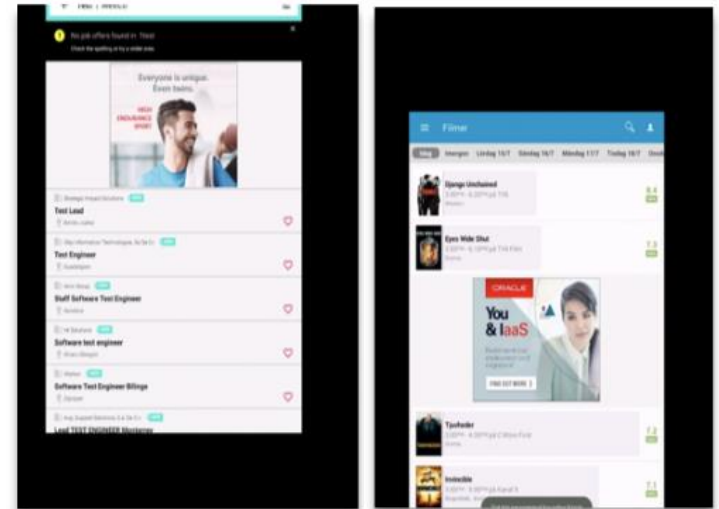

Similar structure

Image Augmentation

- **Problem**: App introduction screenshots contains other information
- **Solution**: randomly **resize** and **move around** over center

Problem

Solution

Evaluation

- Evaluation Metrics
  - Recall, Precision, mAP based on IoU

With image augmentation

IoU	Recall	Precision	mAP
0.6	0.65	0.73	0.69
0.7	0.60	0.79	0.66
0.8	0.53	0.84	0.62
0.9	0.36	0.90	0.44

Without image augmentation

IoU	Recall	Precision	mAP
0.6	0.51	0.68	0.56
0.7	0.44	0.72	0.48
0.8	0.37	0.80	0.43
0.9	0.26	0.87	0.36

Overall performance, **Recall**: *0.62*, **Precision**: *0.76*, **mAP**: *0.51*

Evaluation

- Model Behaviour

(a) Components with texts in different languages (accurately detected)

(b) Components sharing the same background (accurately detected)

(c) Many components (accurately detected)

Without Augmentation

With Augmentation

Without Augmentation

With Augmentation

Post-processing GUI Components
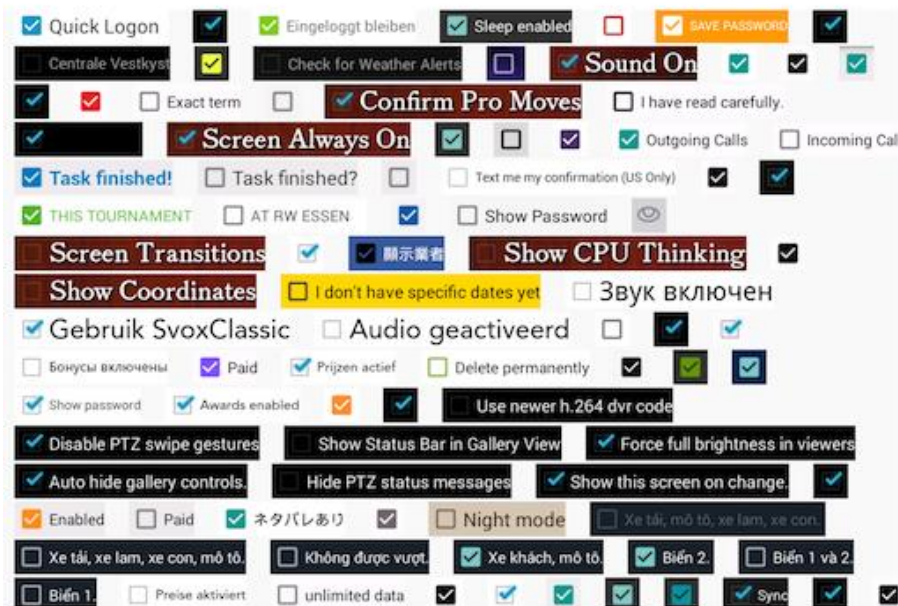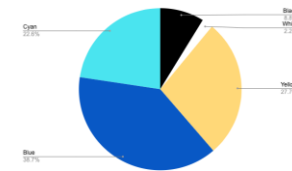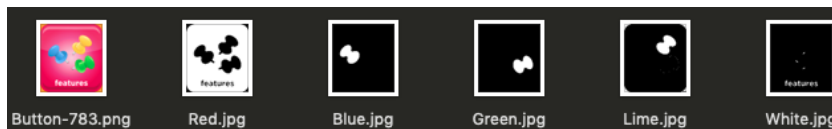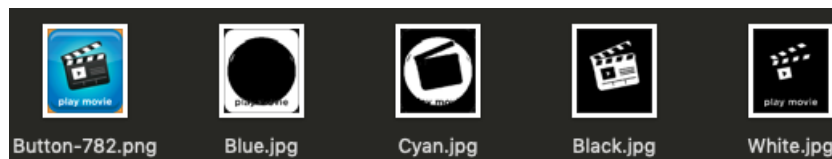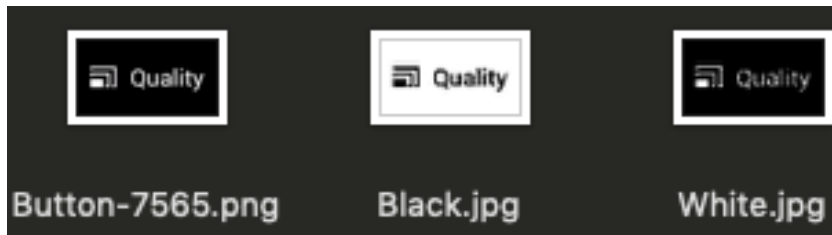
| Removing Duplicate UI Components	**Structural Similarity Index (SSIM)** [11]
Determining Primary Color	**HSV color space** [12]
Font Indentification	**Myfonts tool** [13]

Post-processing GUI Components

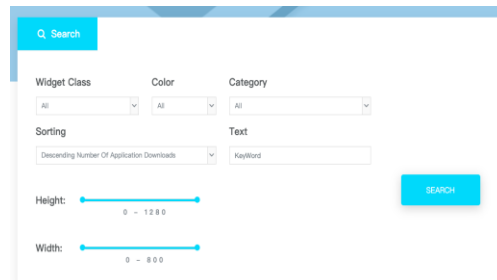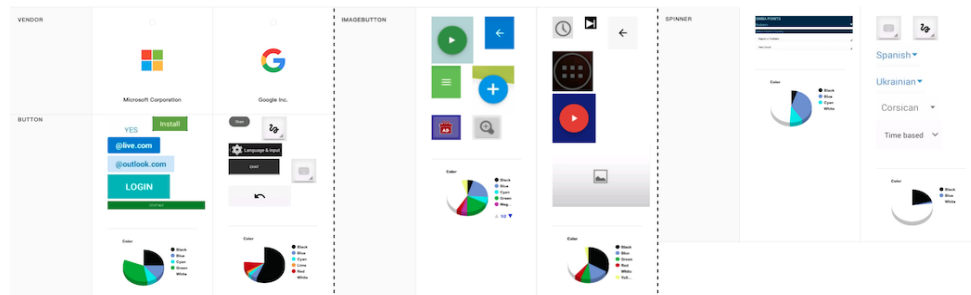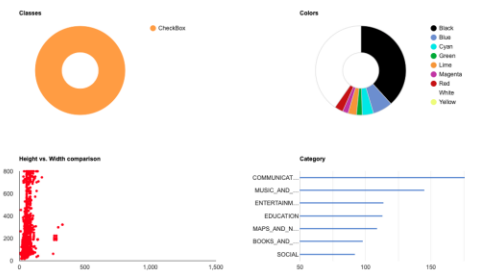- Removing Duplicate UI Components

Post-processing GUI Components

- Determining Primary Color
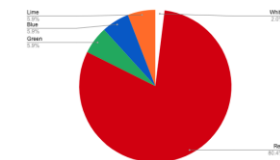
Design Gallery

- Database
- Multi-faceted Search
- Design Demographics
- Design Comparison
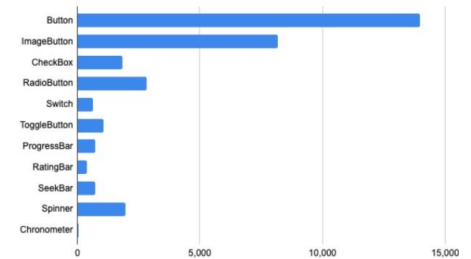
Design Gallery
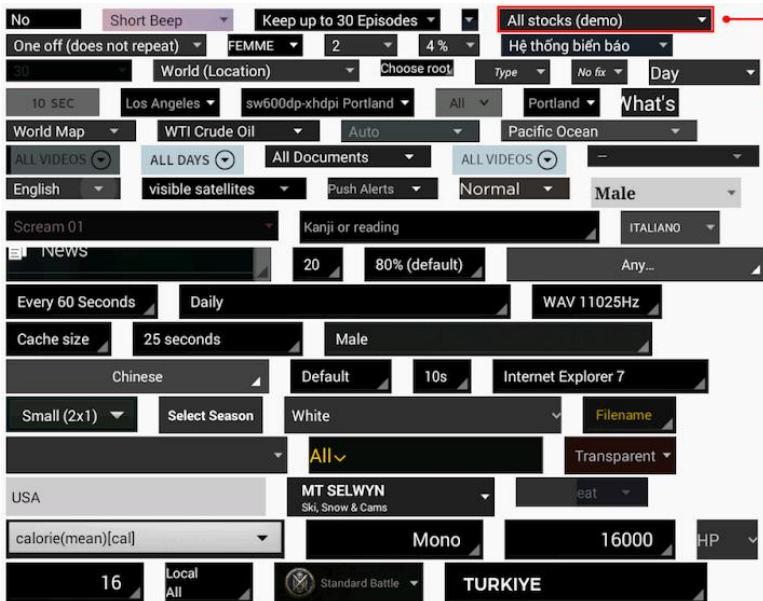
Conclusion

We provide a GUI Design Gallery through invisible crowdsourcing: supporting design search and knowledge discovery beyond content sharing

Future work

- Support image-based search
- Extend gallery database, including video analysis
- Design Synthesis
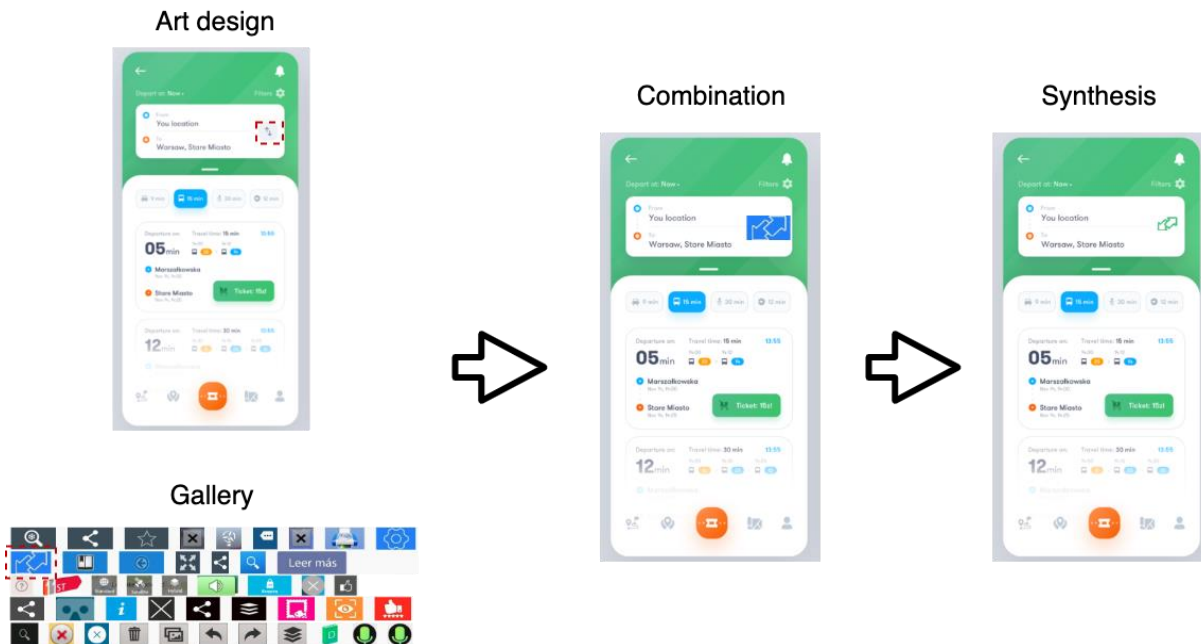
Corporation

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