



Australian
National
University

Mobile User Interface Retrieval

Zhaowen Xu

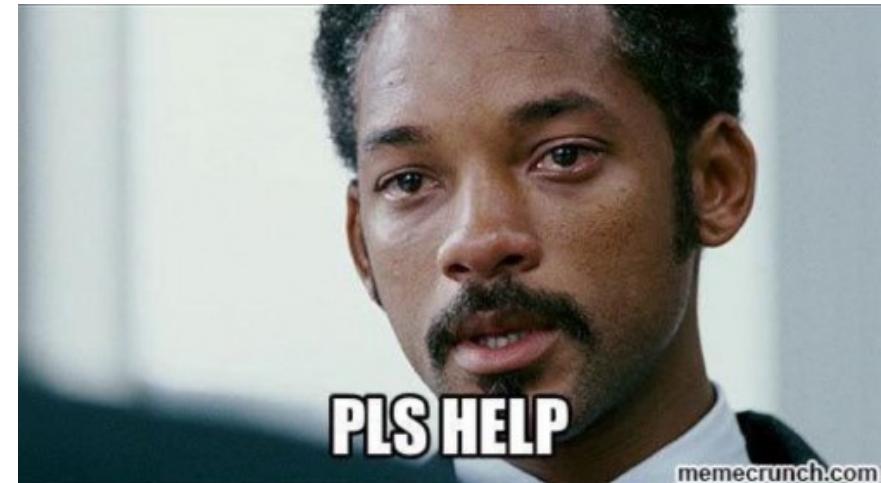
Supervisor: Dr. Zhengchang Xing

Motivation

- Some small companies or start-ups **may not hire UI designers**, so developers need to design UIs by their own.
- Survey showed that more than half of 5700 respondents didn't have **UI design** training but working on UI design tasks.

Goal

- We need to help them !!!!!!!
- Design a tool to help developers to design UI

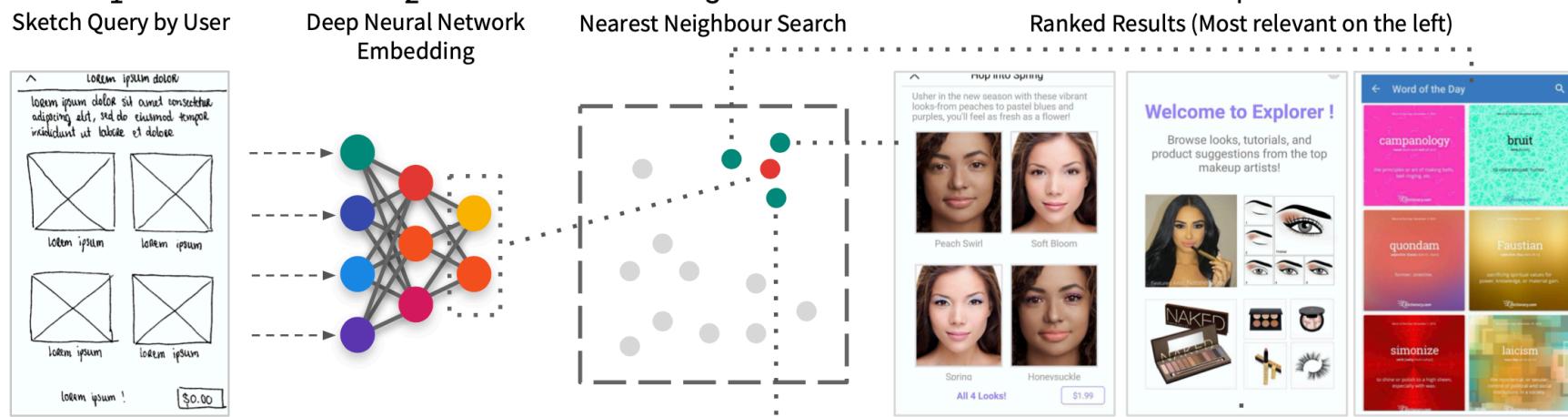


How to help them in UI designing?

Show them **good designs**
based on their requirements

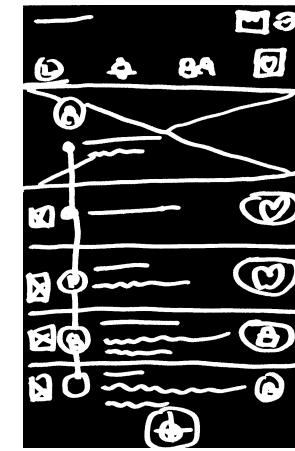
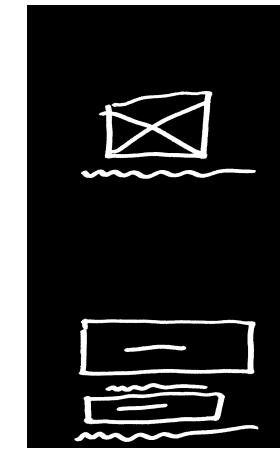
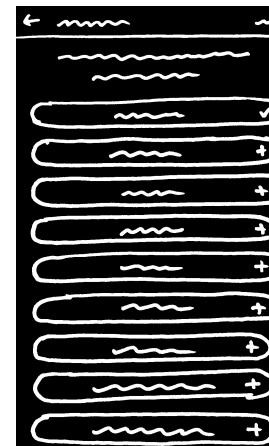


Swire: Sketch-Based UI Retrieval

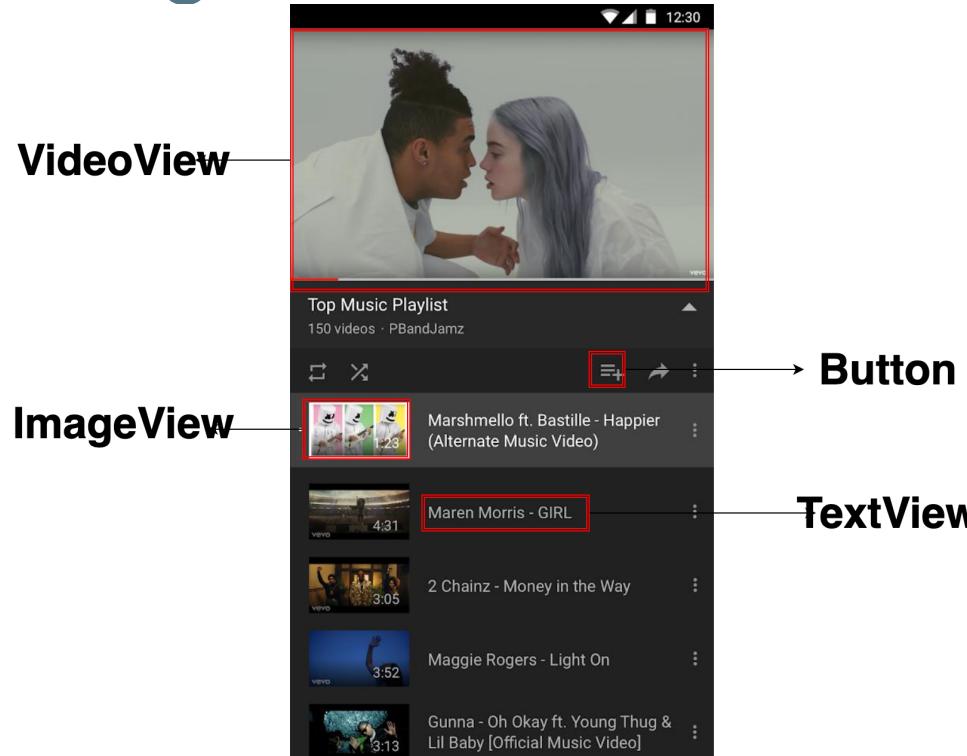


Problem of Swire

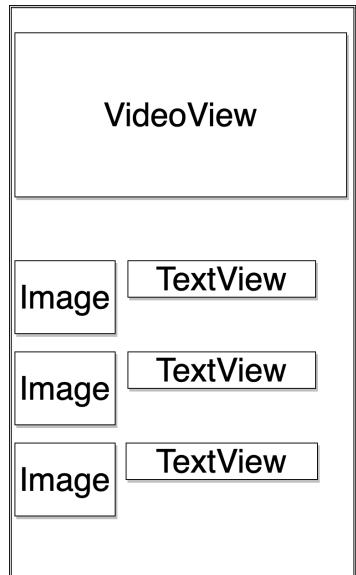
- Relies on human labeled data (sketches)
- Collect only 3000 Sketches
- Result not good



Android Widget

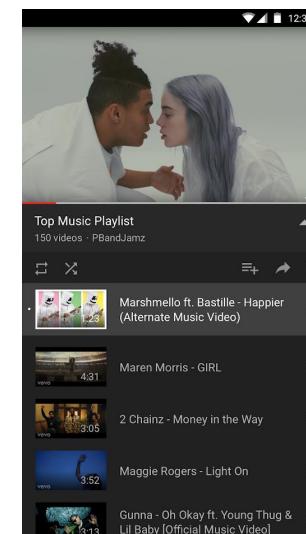


UI retrieval



Find Similiar

Widget Design



Design 1



Design 2

Dataset

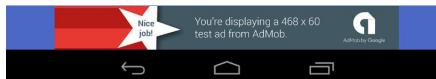
- More than 40000 Android UI images and their layout information
- Crawled by tools **automatically**



A Escrava Isaura

2794 Views

Acompanhe a cena exibida no capítulo desta segunda-feira (26) de A Escrava Isaura. Para ver a novela na íntegra acesse o R7 Play.



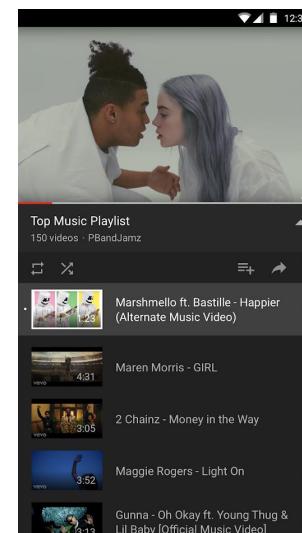
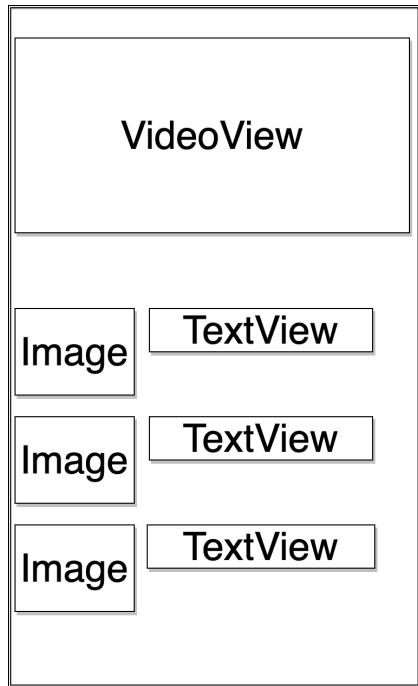
Layout XML

```
<node index="0" text="" resource-id=""  
class="android.widget.ImageView"  
package="com.r7.rederecord" content-desc=""  
checkable="false" checked="false"  
clickable="false" enabled="true"  
focusable="false" focused="false"  
scrollable="false" long-clickable="false"  
password="false" selected="false"  
bounds="[0,0][800,1216]">  
<node.....>
```

```
<node.....>
```

```
>
```

How to achieve this?



Design 1

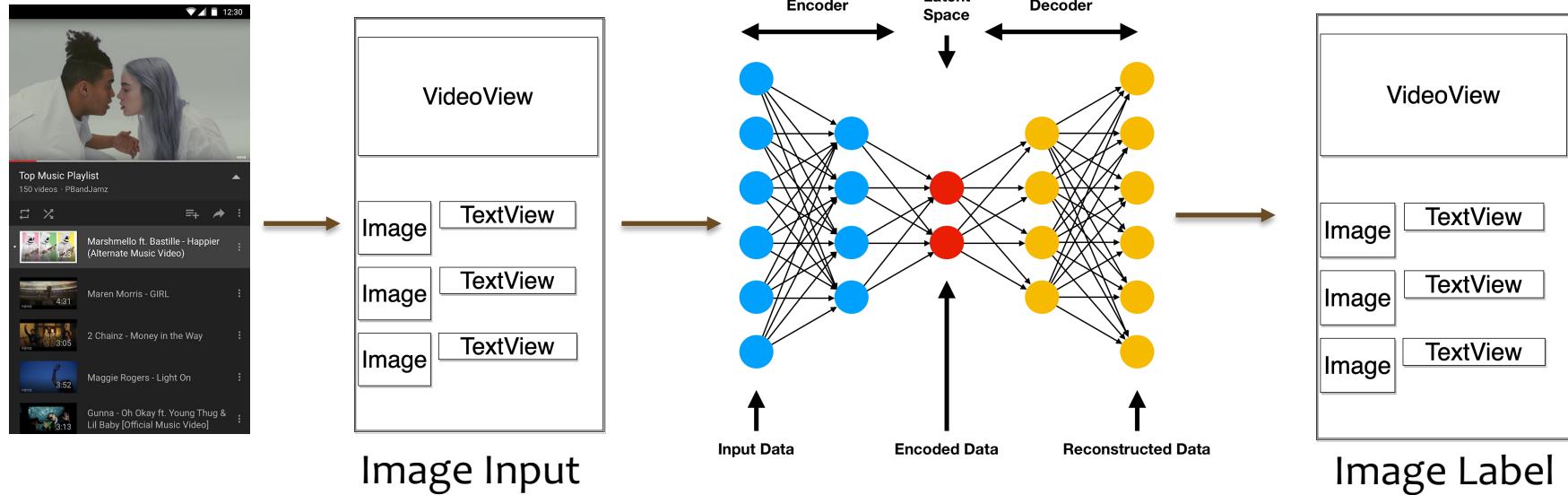


Design 2



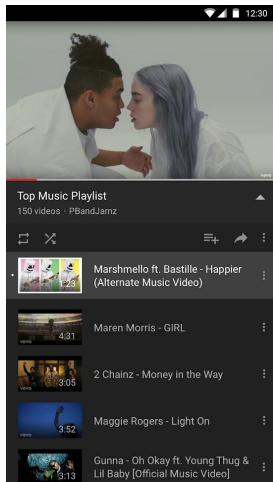
Acompanhe a cena exibida no capítulo desta segunda-feira (26) de A Escrava Isaura. Para ver a novela na íntegra acesse o R7 Play.

Unsupervised Learning: Autoencoder



UI Retrieval Database

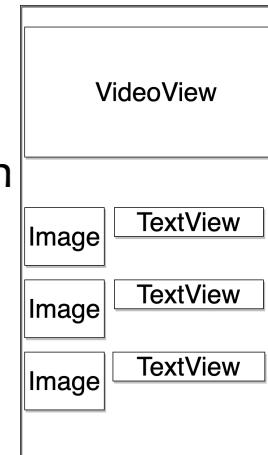
UI



Widget Map

1 Dimensional Array

Already known



Encoded to

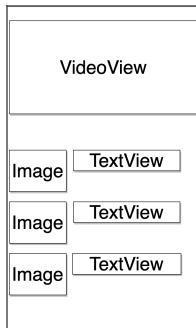


Retrieving Scenario

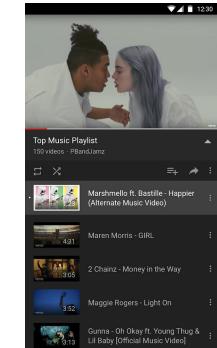
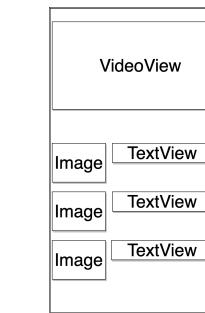
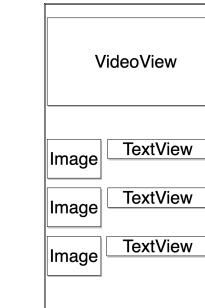
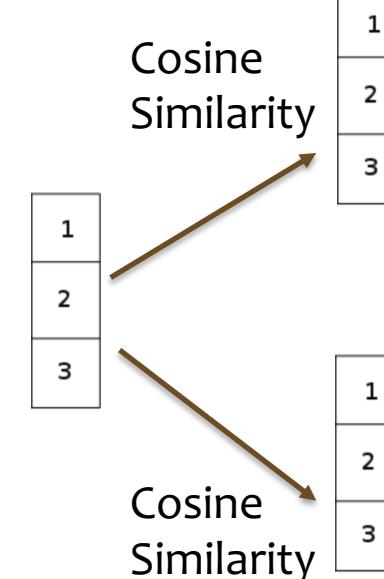
Top-n in Database

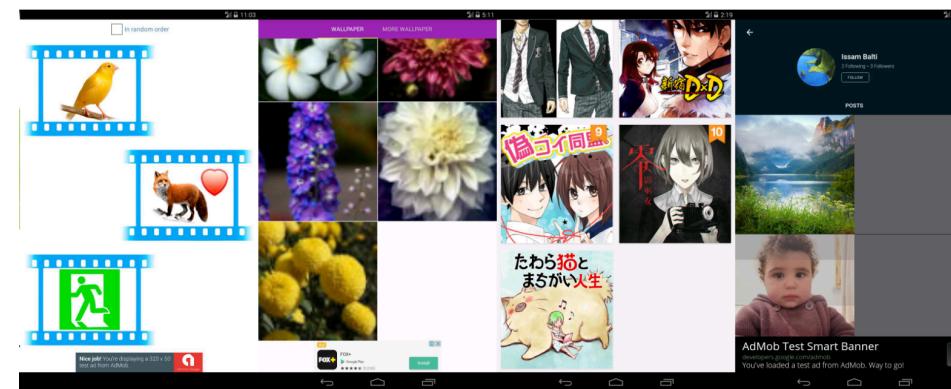
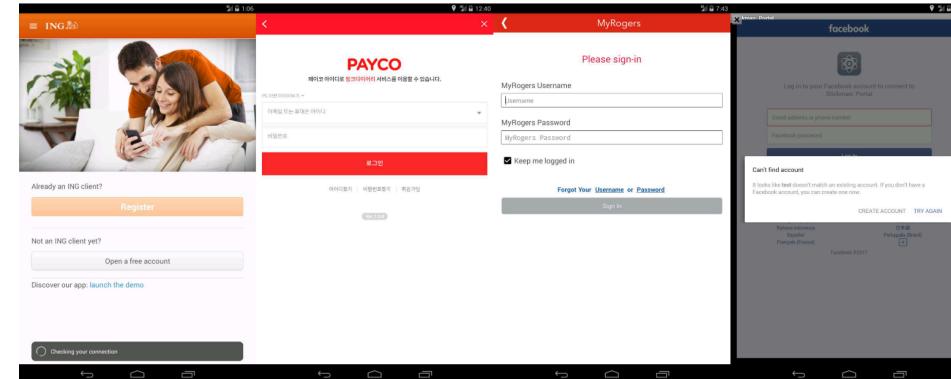


Draw



Encode

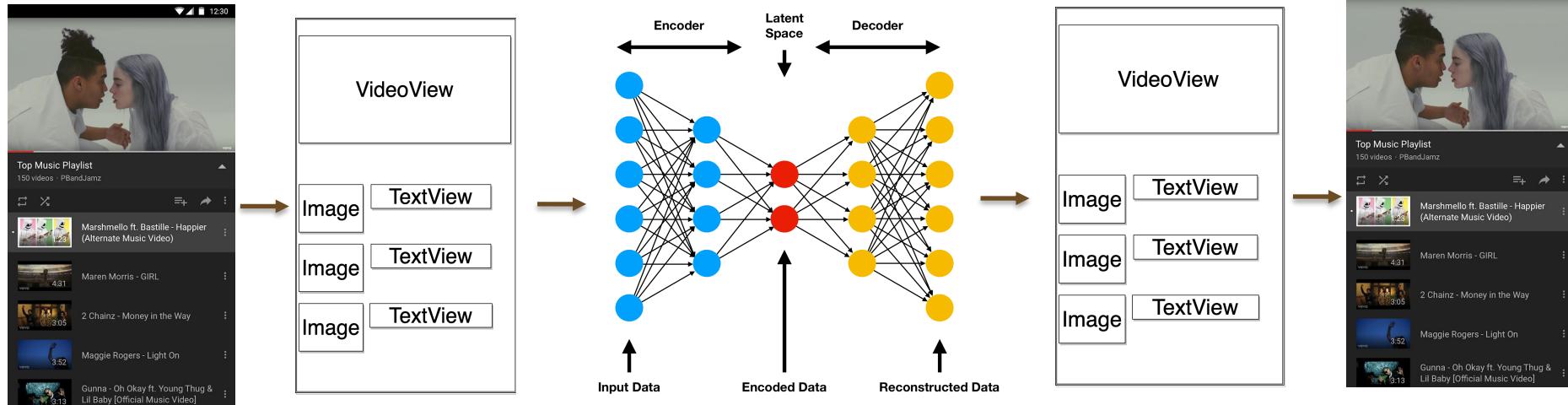




Benefits

- Find good layouts and colorways
- A novel UI searching method
- Check whether missed some widgets

What if there has no layout information?

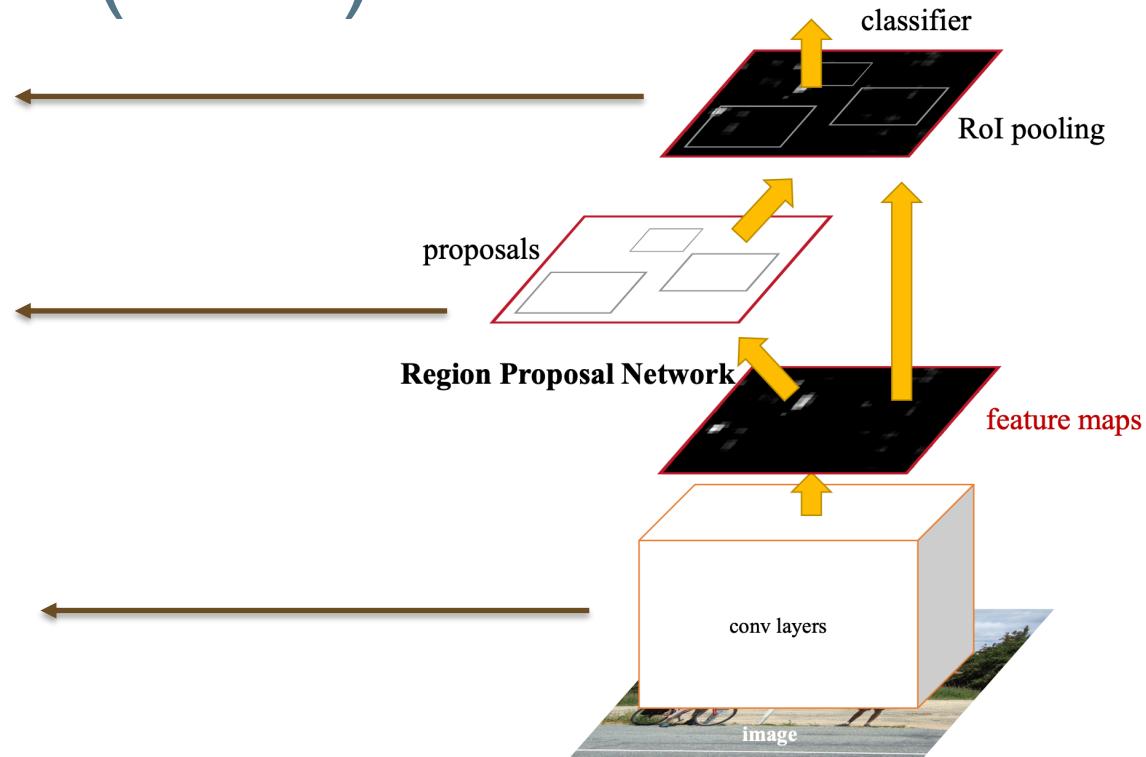


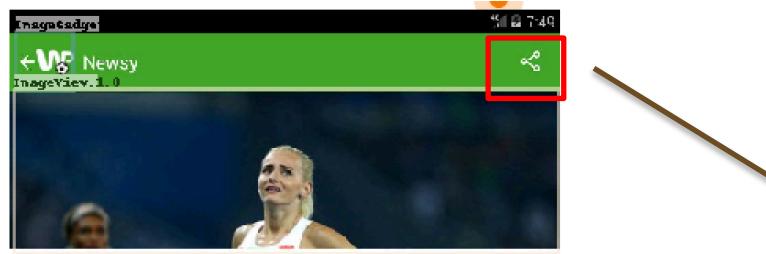
Faster R-CNN (2015)

Classify Objects

Find Region of Interest

Feature Extractor
(ResNet 101 for
this project)





Miss the button

Uzyskała w tym sezonie życiową formę zdobyła indywidualne pierwszy w karierze medal wielkiej imprezy. Piękny sen Justyny Święty został jednak przerwany przez kontuzję, która może nawet wykuczyć ją z udziału w mistrzostwach świata w Londynie.

To były kły szczęścia. Po zakończeniu biegu na 400 metrów na mityngu w Hengelo Justyna Święty nie kryła wzruszenia. Nie dość, że Polka wygrała, to jeszcze uzyskała świąteczny czas 51,16 s,bijącawój rekord życiowy. "Marzenie się spełniaje" - skomentowała później swoją sukces zawodniczka z Raciborza.

Dla jednudzięsiięciolatki cały 2017 rok układał się znakomito. Już zima Święty pokazała swoją moc - najlepiej wzbudziła swój rekord życiowy pod dachem (52,09) polet i zdobyła złoty medal mistrzostw Polski. Następnie w Belgradzie wywalczyła pierwszy w karierze medal w konkurencji indywidualnej na wielej międzynarodowej imprezie.

W Serbii zdobyła brązowy krążek w biegu na 400 metrów, a dzień później doprowadziła sztafetę co złota. Tygodnie miały, a sukcesów

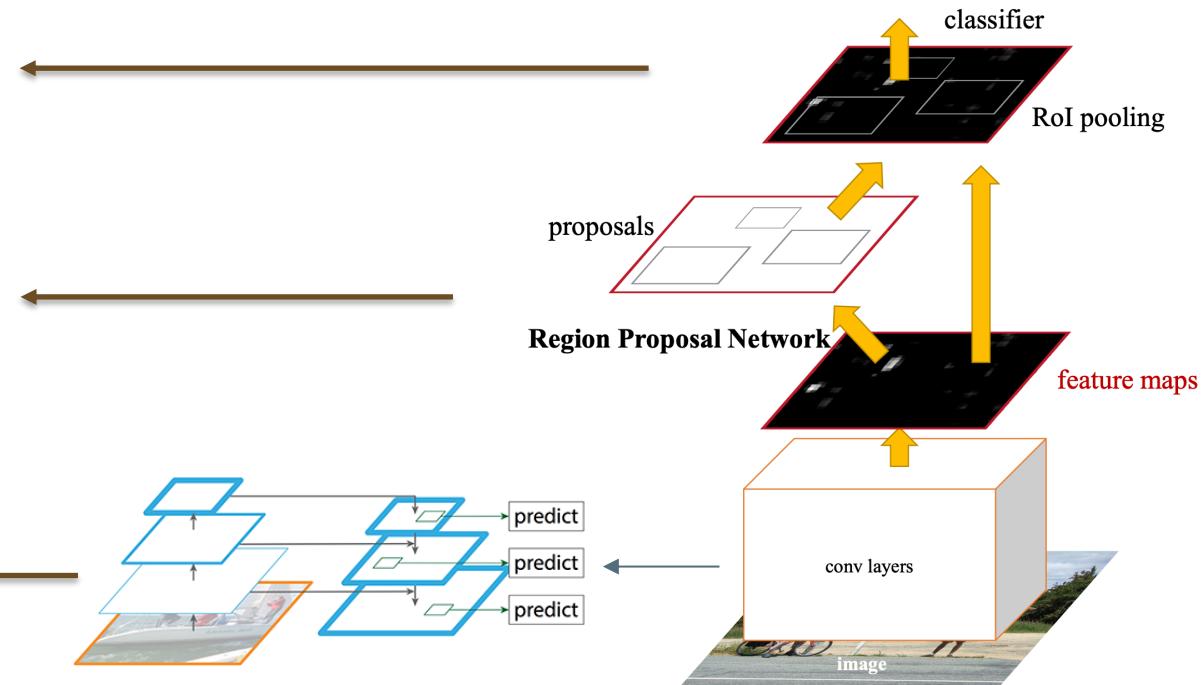


Feature Pyramid Network (2016)

Classify Objects

Find Region of Interest

FPN
Feature Extractor



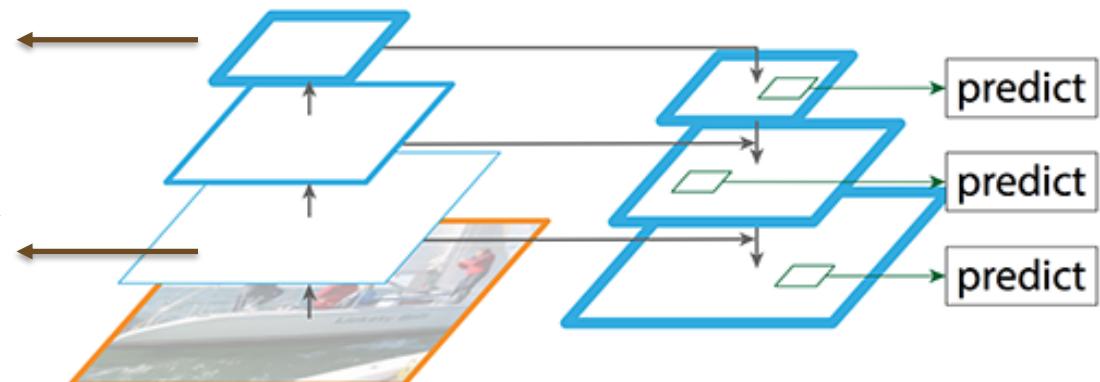
Feature Pyramid Network (2016)

Lower resolution, more semantic meanings

Higher resolution, fewer semantic meanings

Deeper

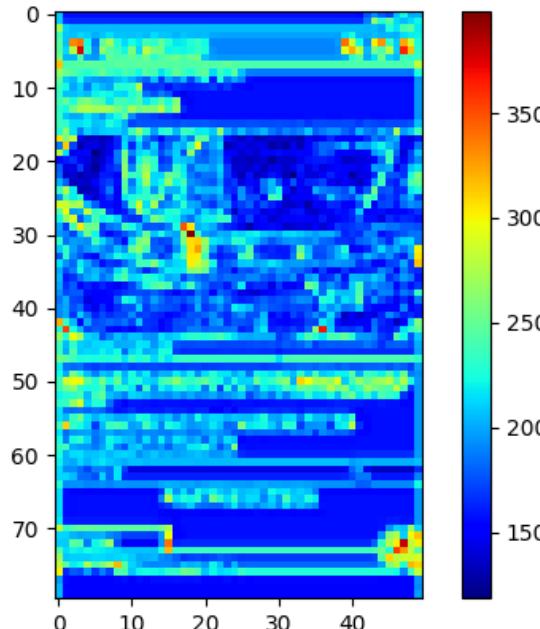
Shallow



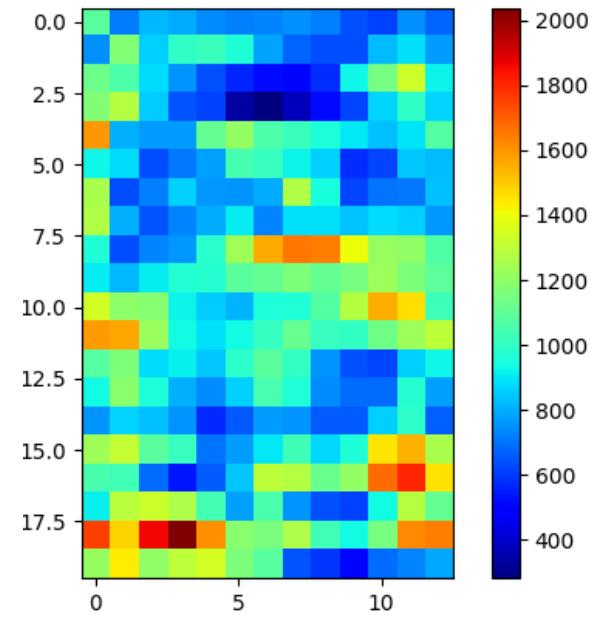
Input UI



Shallow Layer's Heat Map



Deep Layer's Heat Map





Find my Phone

Sound  Switch: 0 

Ringtones  Default ringtone (Unknown ringtone)

Volume  ImageView: 0.78  Switch: 0 

ImageView: 0.78  Switch: 0 

Intensity  ImageView: 0.86  Switch: 0 

Bash  Switch: 0 

Intensity  Switch: 0 

Set Alarm screen brightness  Switch: 0 

Brightness value  ImageView: 0.783  Switch: 0 

Stop alarm screen  Button: 0.77 
Choose an action to stop alarm screen

Disable "Home", "Recent apps", and "Volume" buttons when Alarm screen turned on  Switch: 0 

Detect disconnecting by WiFi  Switch: 1 

The screenshot shows a search results page for 'Patagonia 5" Boardshort'. The top navigation bar includes a back arrow, a magnifying glass icon, and a shopping bag icon. The search bar contains the text 'EditText: 0.95' and a placeholder 'Select a size'. Below the search bar is a green button labeled 'Cty'.

The main content area displays the following details:

- RatingBar: 0.97** (with a progress bar from 0 to 100%)
- Button: 0.99** (with a 'SEE PHOTOS' label)
- Available Online Only**
- If You Like This, You Might Be Into These**
- ImageView: 0.99**: Image of a blue Patagonia short.
- ImageView: 1.0**: Image of a green patterned Patagonia short.
- ImageView: 0.99**: Image of a black Adidas short with white stripes and a logo.

At the bottom, there are two buttons: 'Add to Wish List' and 'Add to Bag'.

The screenshot shows a mobile application interface for a comic book. At the top, there are navigation icons for back, forward, search, and cart. The main content area displays the title "Amazing Spider-Man Vol. 1: Brand New Day" with a price of \$9.99-20.13. Below the title is a summary: "Looking for the one superhero comic you just have to read? You've found it! Amazing Spider-Man is the cornerstone of the Marvel Universe. This is where you'll find all the big-time action, major storylines and iconic Spider-Man magic you'd come to expect from the Wall Crawler." To the right, there's a green button labeled "Button: 0. 9" and "ADD ALL TO CART".

LATEST RELEASES (1–16 of 32)

ImageView: 0. 99

Amazing Spider-Man Vol. 10: New

RatingBar: 0. 92

ImageBadge: 0. 92

ImageView: 0. 99

Amazing Spider-Man Vol. 11

RatingBar: 0. 92

ImageBadge: 0. 92

COMIXOLOGY UNLIMITED (1–16 of 32)

ImageView: 1. 0

Amazing Spider-Man Vol. 1

RatingBar: 0. 92

ImageBadge: 0. 92

ImageView: 1. 0

Amazing Spider-Man Vol. 2

RatingBar: 0. 92

ImageBadge: 0. 92

Spider-Man Vol. 1: Brand New Day

RatingBar: 0. 92

Spider-Man: The Gauntlet Vol. 1

RatingBar: 0. 92

ImageView: 1.0

Button: 0.92

The steps up

ImageView: 0.86

ImageView: 0.96

ImageView: 0.9

Which of the two men sitting on the steps correct?

Button: 1.0 button: 1.0 Button: 1.0 Button: 0.99



bilateralFilter
and
Laplacian



Binarize



Cut non-pixel
rows and columns



Final Result

Things to do

- Compare baselines (HOG, SIFT, etc)
- Calculate Evaluation Metrics
- User Studies
- Write thesis

Reference

- Huang, F., Canny, J.F. and Nichols, J., 2019, May. Swire: Sketch-based user interface retrieval. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (pp. 1-10).
- Ren, S., He, K., Girshick, R. and Sun, J., 2015. Faster r-cnn: Towards real-time object detection with region proposal networks. In *Advances in neural information processing systems* (pp. 91-99).
- Lin, T.Y., Dollár, P., Girshick, R., He, K., Hariharan, B. and Belongie, S., 2017. Feature pyramid networks for object detection. In *Proceedings of the IEEE conference on computer vision and pattern recognition* (pp. 2117-2125).

Thank you for listening.

Inverse Optical Design

PENG YONG

Supervisor: Stephen Gould, Andrey Sukhorukov, Dragomir Neshev

February 29, 2020

Overview

① Introduction

- motivation
- task

② inverse optical design in 1D

- verification of the model
- inverse model
- forward model
- robustness of the design

③ inverse optical design in 2D

- verification of the 2Dmodel

Motivation

- Driver monitoring system(DMS): a vehicle safety system, which alerts the driver when signs of distraction are detected.
- DMSs are usually based on infrared illuminaiton.
- necessity of DMS: more than 1 million people die every year in car accident. Driver fatigue and distraction have surfaced as major safety issue worldwide.
- The inverse optical design is the key optical element of driver monitoring system.

Task

- model the inverse problem by deep learning
- determine what metasurface distribution is needed to produce a given holographic image.

Inverse optical model in 1D

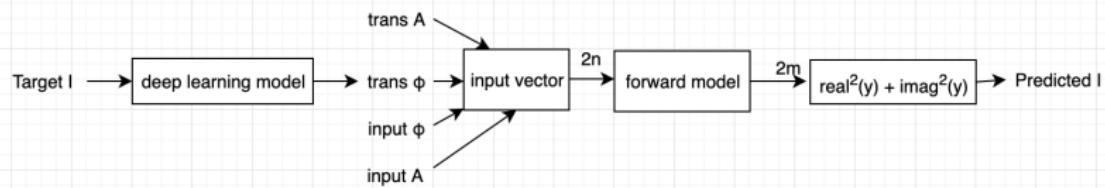


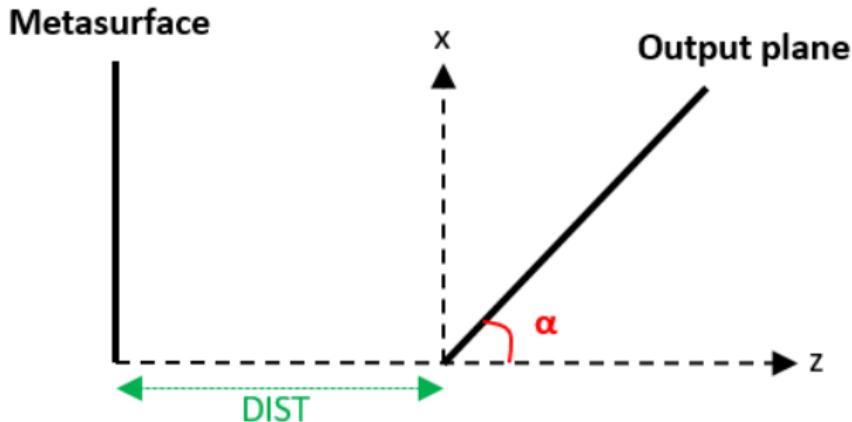
Figure 1: Approach for the project



$$I_{\text{out}}^{\text{target}} \rightarrow \text{DeepModel}(\theta) \rightarrow x \rightarrow \text{ForwardModel} \rightarrow y \rightarrow I_{\text{out}}^{\text{predicted}}$$

- Transmission phase is in $[-\pi, \pi]$
- The input A and input Φ is generated by using function `generated_input_wave(w0)`
- The transmission amplitude is fixed at 1.

Inverse optical model in 1D



$$\text{New distance : } d = \text{DIST} + x \tan\left(\frac{\pi}{2} - \alpha\right)$$

Figure 2: Illustration for the model in 1D

Verification of model in 1D

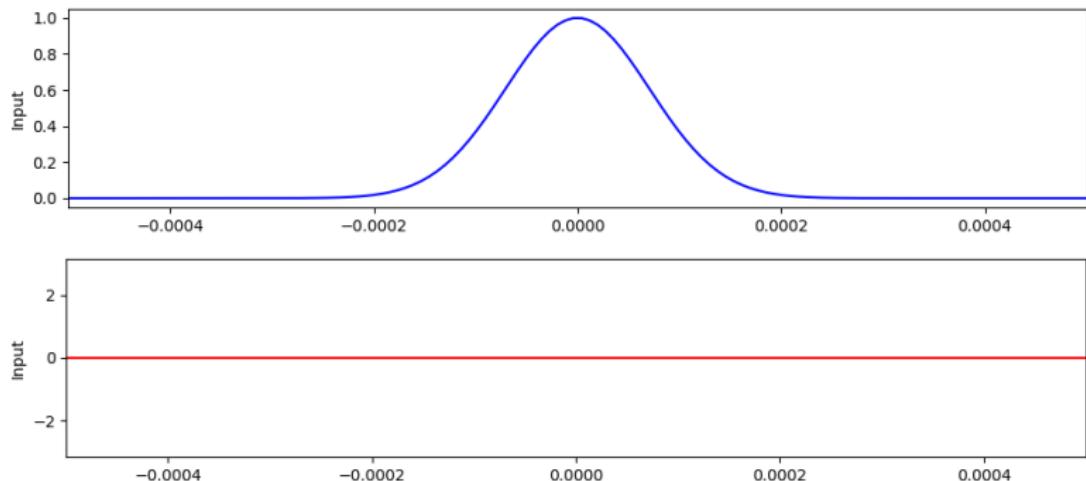


Figure 3: Amplitude (in blue) and phase (in red) of the input wave in 1D

Verification of model in 1D

Output

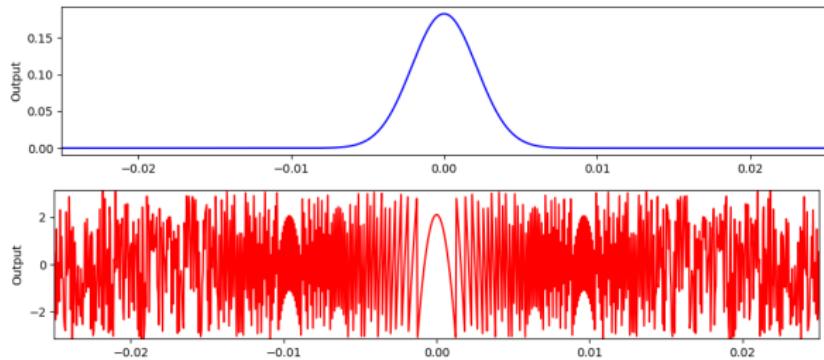


Figure 4: Amplitude (in blue) and phase (in red) of the output wave in 1D

Verification of model in 1D

We can plot the difference in amplitude and phase between the output wave and the beam. The metasurface does not interference in this case (amplitude set to 0 and phase set to 1). Amplitude is decreased.

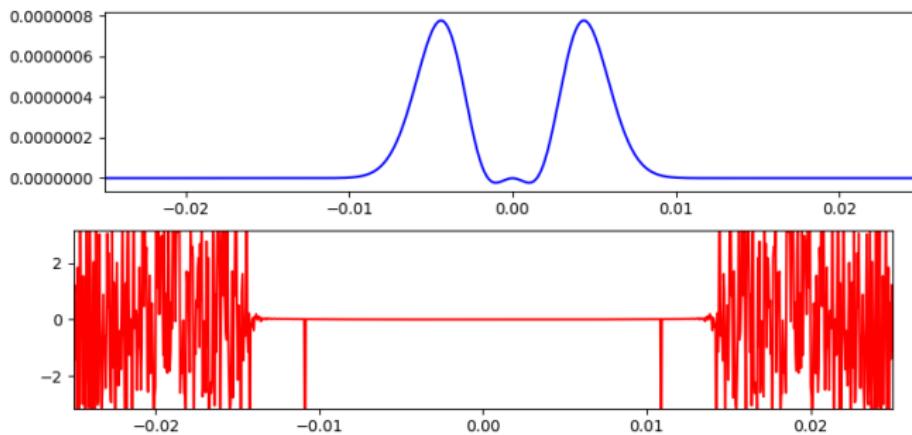


Figure 5: Amplitude (in blue) and phase (in red) of the difference between the output wave and the beam in 1D

Data generation for inverse model

The Intensity data is point cloud generation, like the figure below. In 1D case, it is just a line of points from the point cloud image.



Figure 6: data cloud point figure

Inverse model

- Inverse model will generate transmission phase by given Intensity.
- Inverse model is multilayer preceptron in 1D case.
- The input 1024 data points and the outputs is 128 data points.
There are total nine layers.

Inverse model

The generated transmission phase by given intensity.

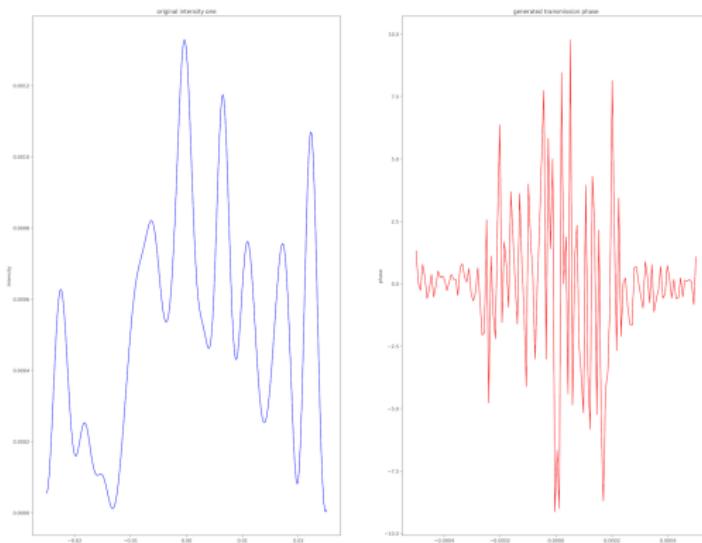


Figure 7: data cloud point figure

Forward model

- Input beam interfere with transmission phase and transmission amplitude.
- The transmission phase will influence the output intensity.
- The free space propagation green function is written as complex matrix for forward model.
- The complex input vector and complex green function matrix is decomposed into real number vector and real number matrix.

Forward model

The output Intensity given the transmission phase.

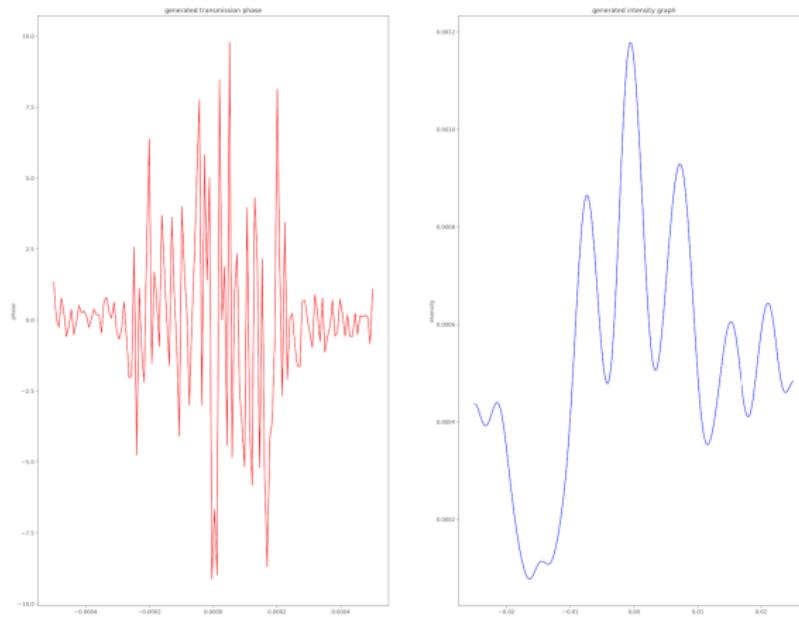


Figure 8: data cloud point figure

Inverse optical model

- The whole inverse optical design contains inverse and forward process.
- We can get the generated intensity by given intensity by inverse optical design.
- We train the model by minimizing the error:

$$E = (I_{\text{out}}^{\text{target}} - I_{\text{out}}^{\text{predicted}})^2$$

- The transmission phase distribution will be obtained once we train the model well.

Inverse optical model

The intensity comparison graph.

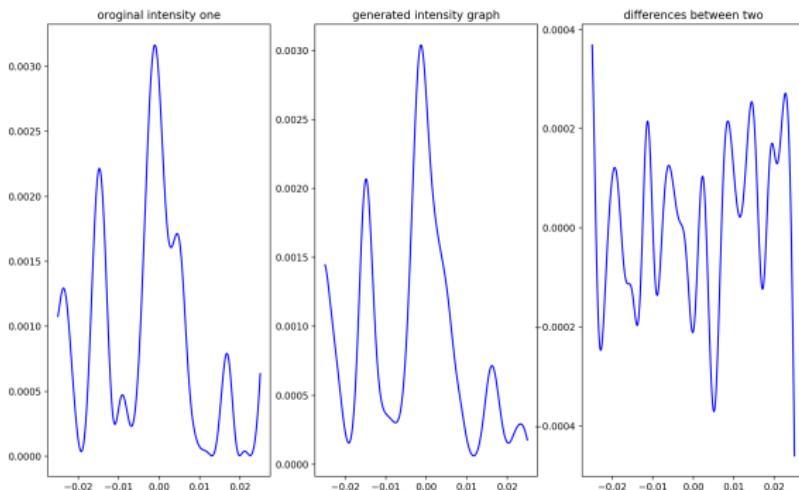


Figure 9: intensity comparison

Robustness of the design

- The different phase is encoded by stacking silicon nanodisks of different diameter.
- During manufacturing, phase can not be 100% accurate. Thus, we add noise on the transmission phase after training to check the robustness of the design, like scale, shift, adding different beam. Still working on this one.....

Inverse optical model in 2D

Verification of the model in 2D. Similar with the 1D model.

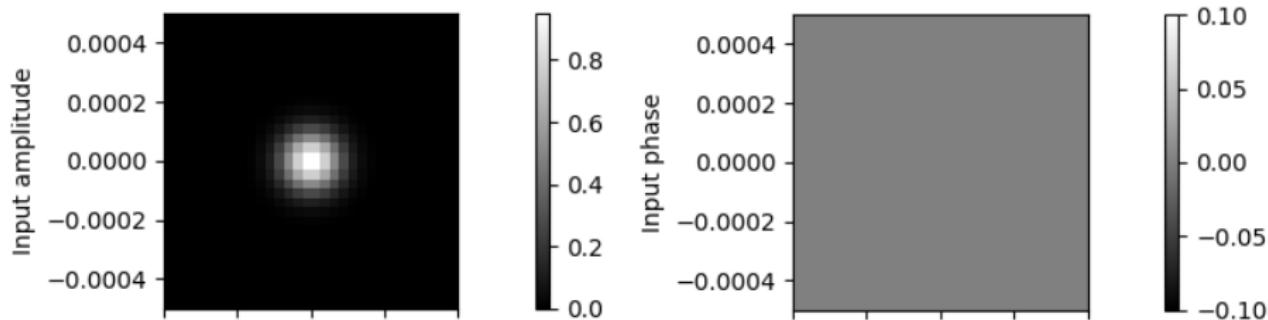


Figure 10: Amplitude (left) and phase (right) of the input wave in 2D

Verification of the model in 2D

The transmission phase is 0 and transmission amplitude is 1. Here is the output amplitude and phase.

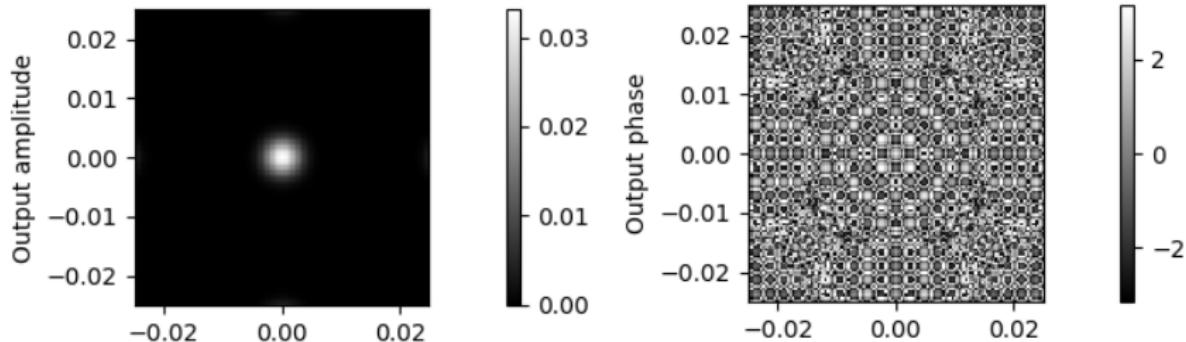


Figure 11: Amplitude (left) and phase (right) of the output wave in 2D

As expected, the output has a larger width and a smaller intensity than input wave.

Verification of the model in 2D

The difference between these two images.

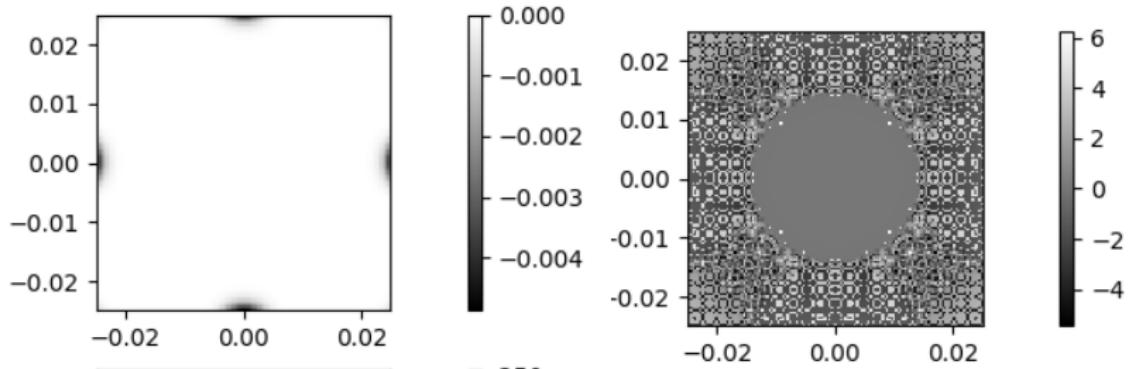


Figure 12: Amplitude (left) and phase (right) of the difference between the output wave and the beam in 2D

We can get that the model is correct.