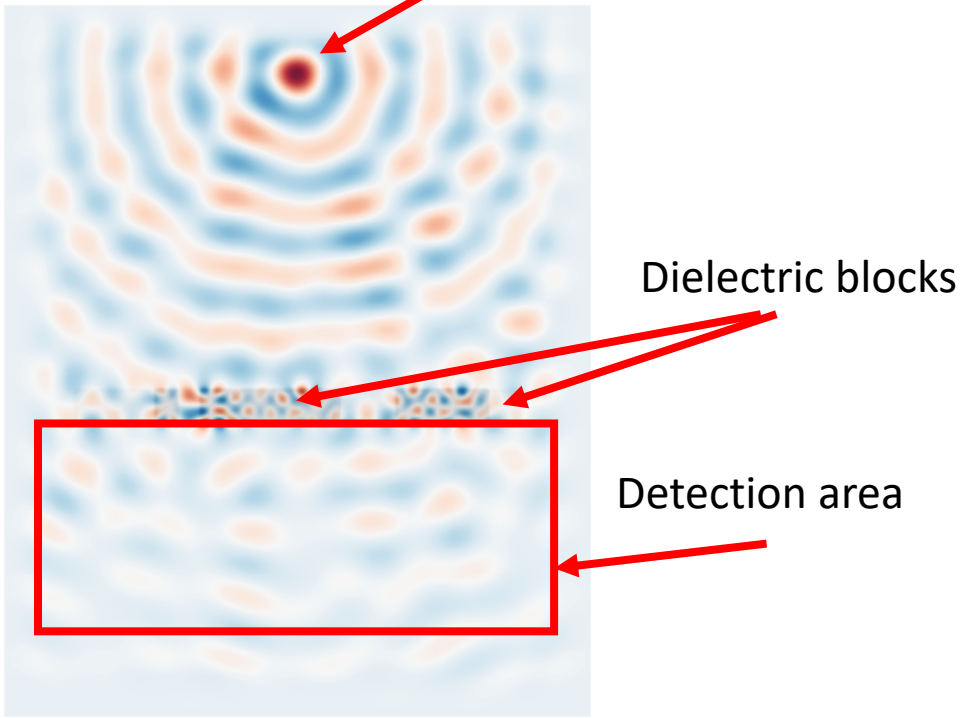
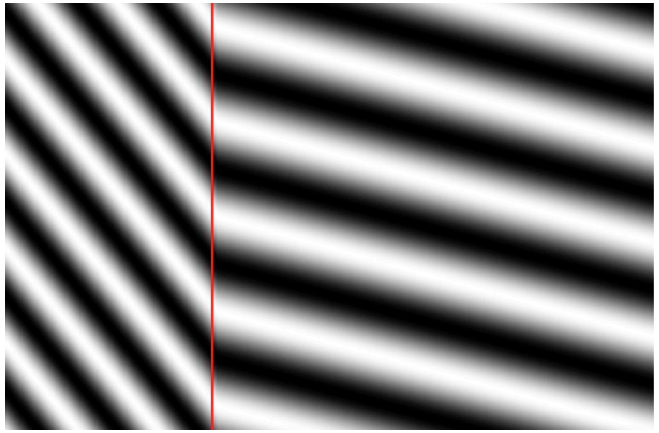
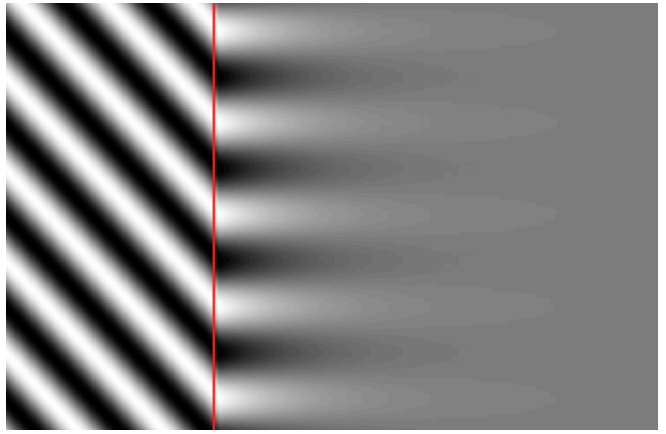
Background





Propagation mode
- No decaying
- Contains low-frequency information (low resolution)

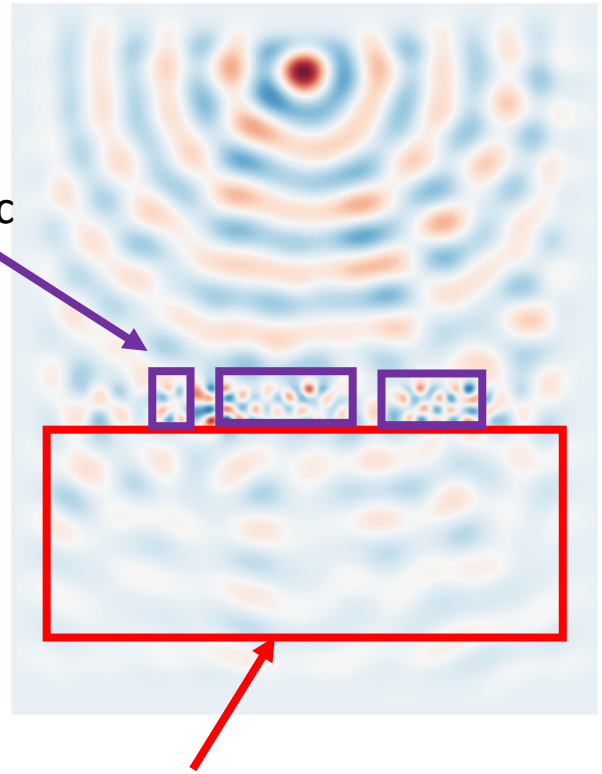


Evanescent mode
- Decays quickly
- Only exists at the surface
- Contains high-frequency information (high resolution)

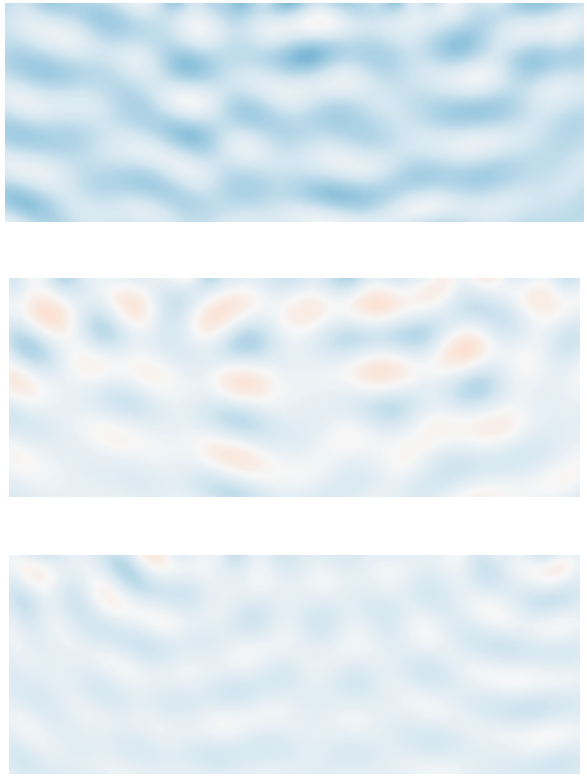
Motivations:
- Extract information from evanescent mode
- Realize sub-wavelength imaging

https://en.wikipedia.org/wiki/Evanescent_field

Problem Statement and Dataset



crop



CNN

CNN

CNN

Input size: 10 * 128 * 64

Output size: 1 * 256 (binary numbers)

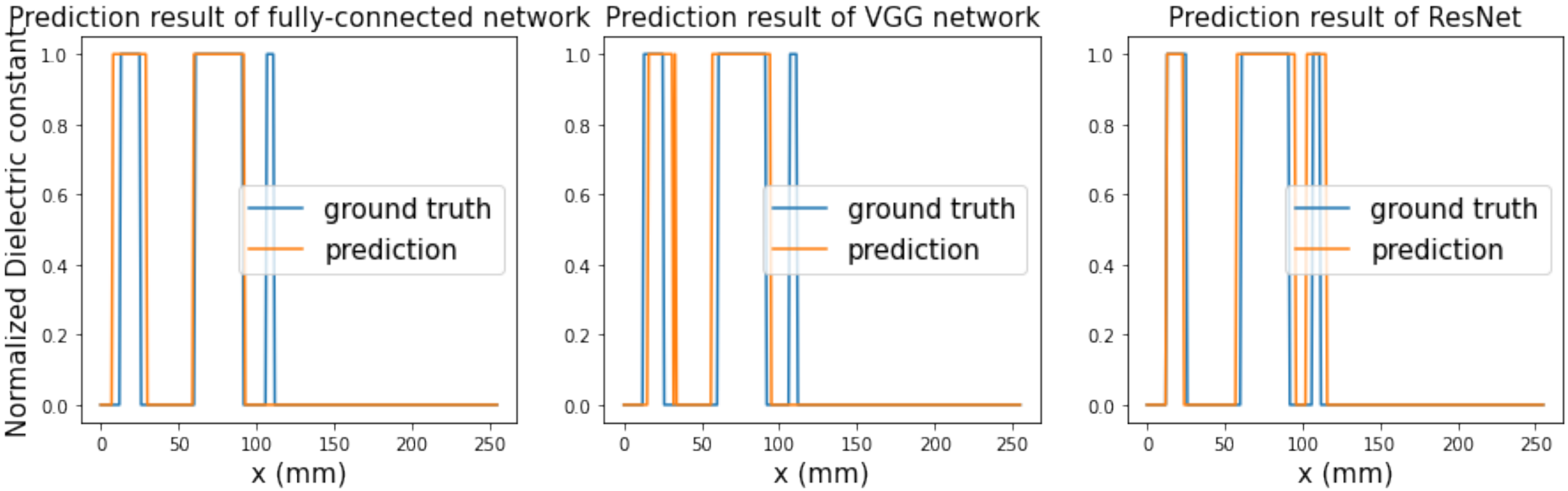
- Dataset: 18,000 different setups, with different numbers and sizes of blocks
- Generated by electromagnetic field solver

Methods and Results

$$\text{accuracy}_i = \frac{1}{256}\sum_{j=1}^{256}(y_{ij} == \hat{y}_{ij})$$

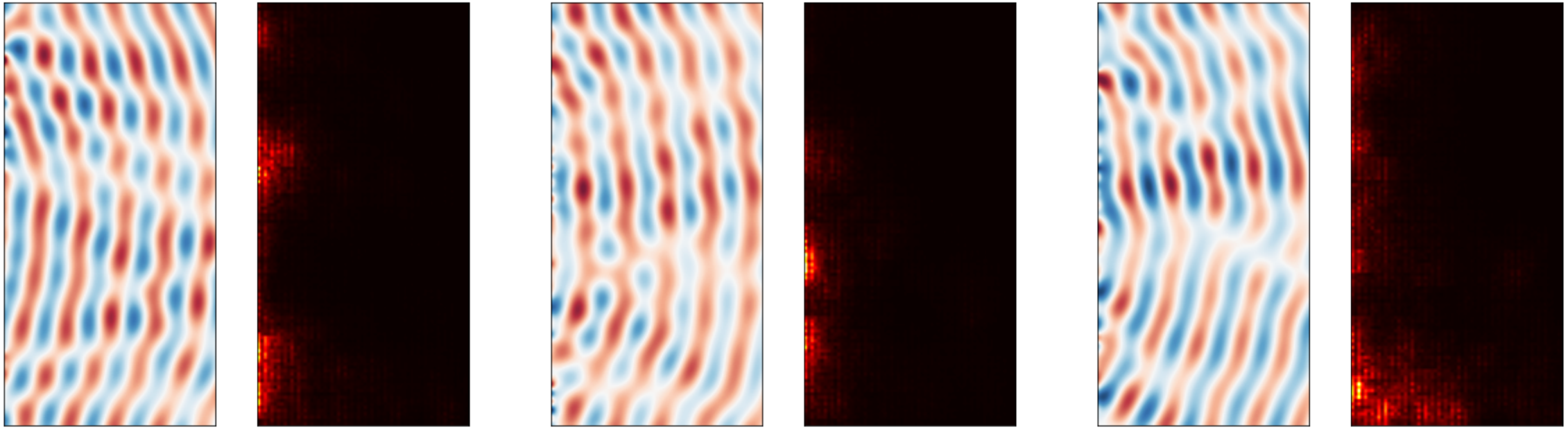
$$\text{average accuracy} = \frac{1}{N}\sum_{i=1}^{N}\text{accuracy}_i$$

	FC	VGG	ResNet
Accuracy	94.2%	96.7%	98.1%
# parameters	328,716,256	129,824,704	12,247,296
Best learning rate	5.0×10^{-3}	1.3×10^{-4}	2.8×10^{-4}



Saliency Maps Analysis

Propagation direction



Saliency maps analysis confirms

- Evanescent wave decays quickly during propagation
- Evanescent wave is crucial to the precise prediction of the sub-wavelength structures' information