

SkinProfiler

Low-Cost 3D Scanner for Skin Health Monitoring with Mobile Devices



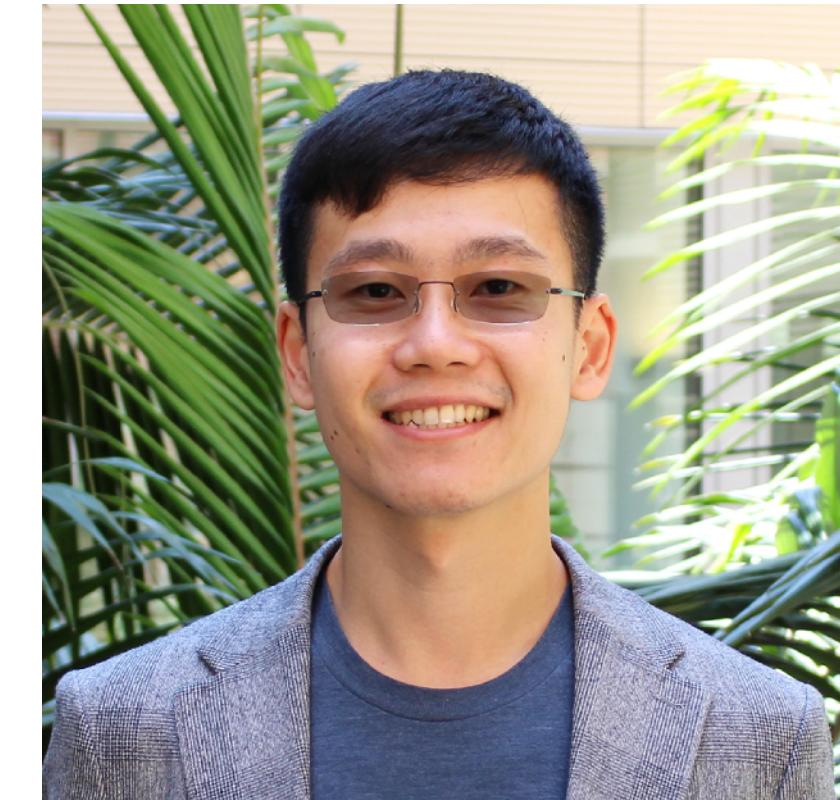
Zhiying Li



Tejas Viswanath



Zihan Yan



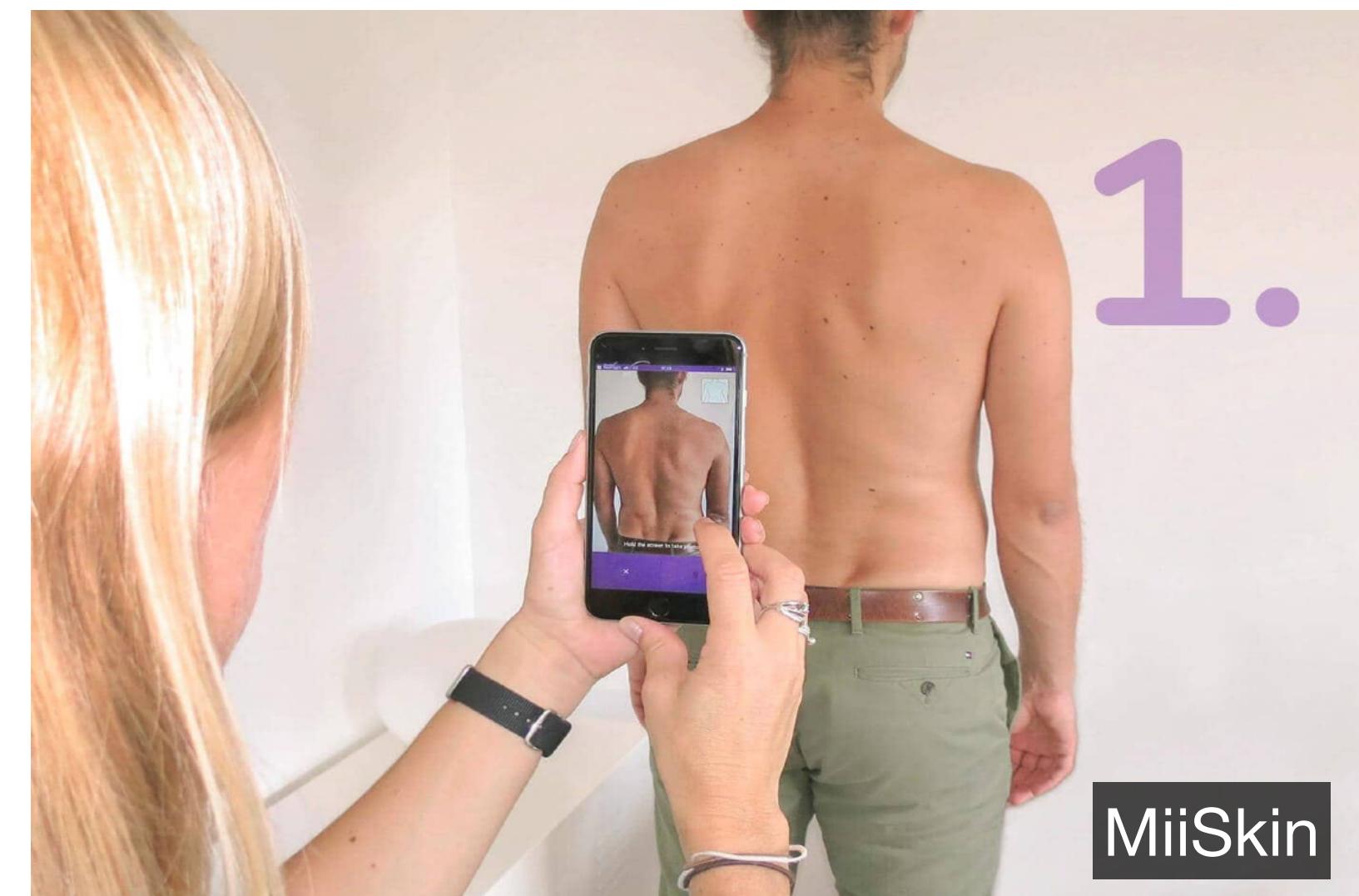
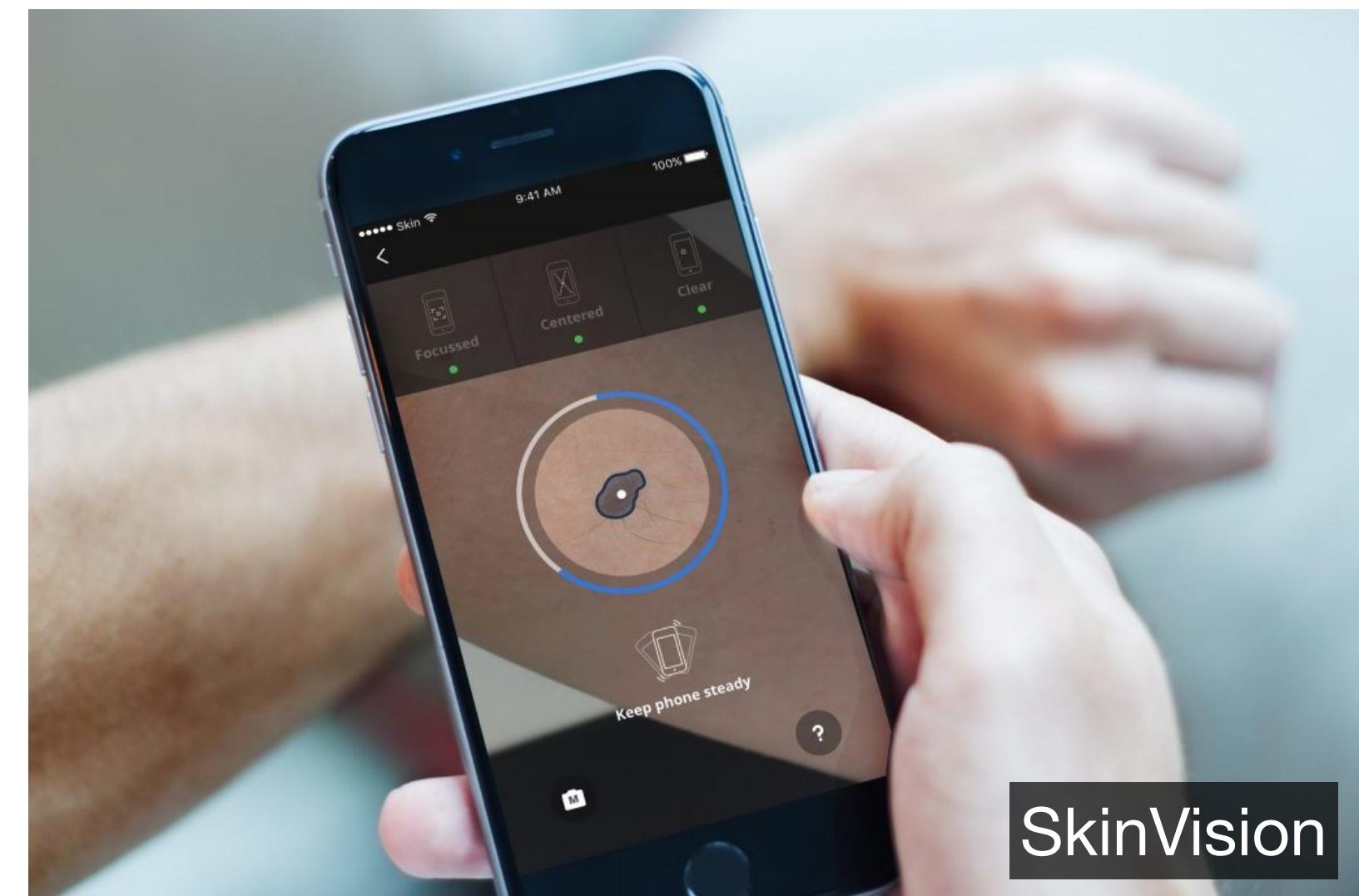
Yang Zhang

A close-up photograph of a person's shoulder and hair. A hexagonal grid is overlaid on the skin, containing five images of moles of different types and stages of development.

5-year survival rate is **10%**
can be **95%** if detected early

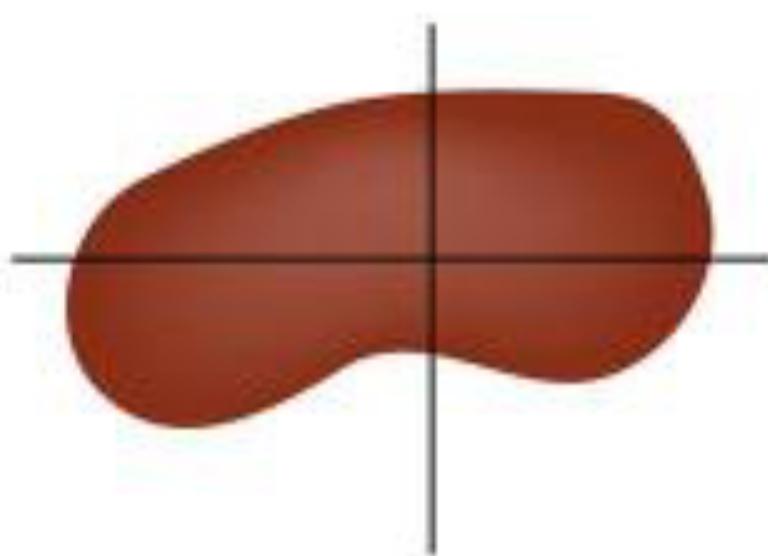


Credit: Science Friday



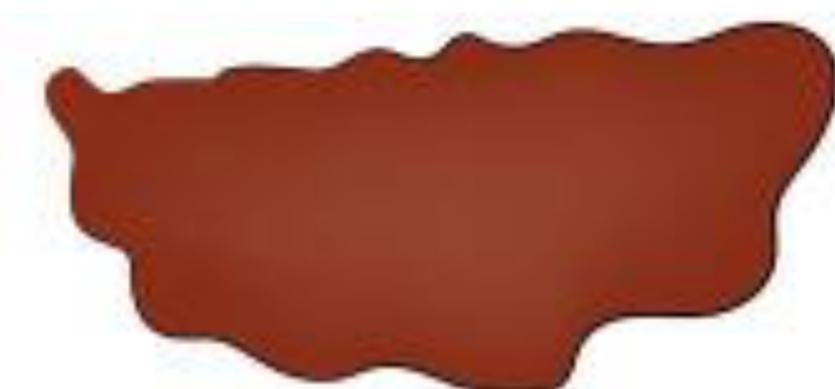
ABCDE

rule for the early detection of melanoma



A

Asymmetry



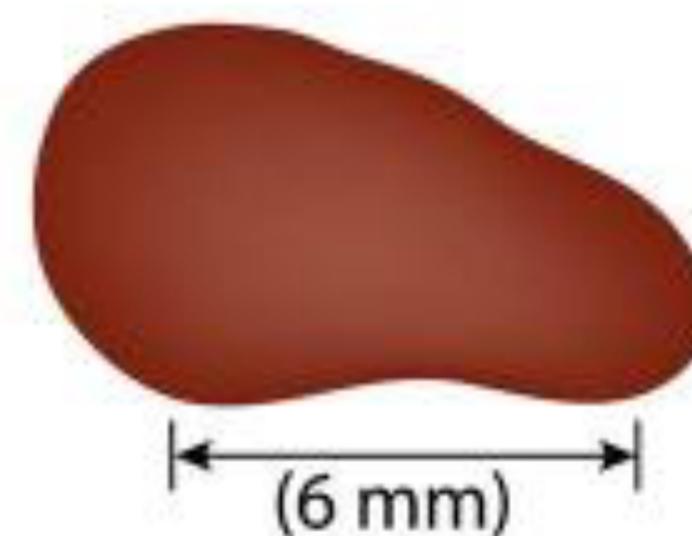
B

Borders
(the outer edges
are uneven)



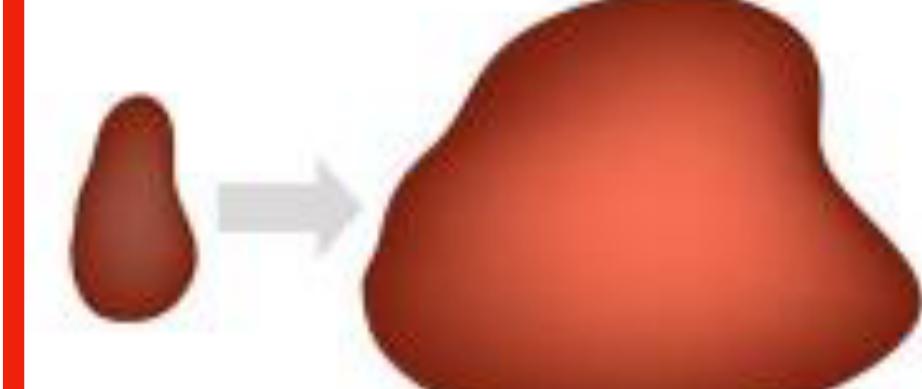
C

Color
(dark black or
have multiple
colors)



D

Diameter
(greater than
6mm)



E

Evolving
(change in size,
shape and color)

Depth Sensing

- Low-Cost
- High-Resolution

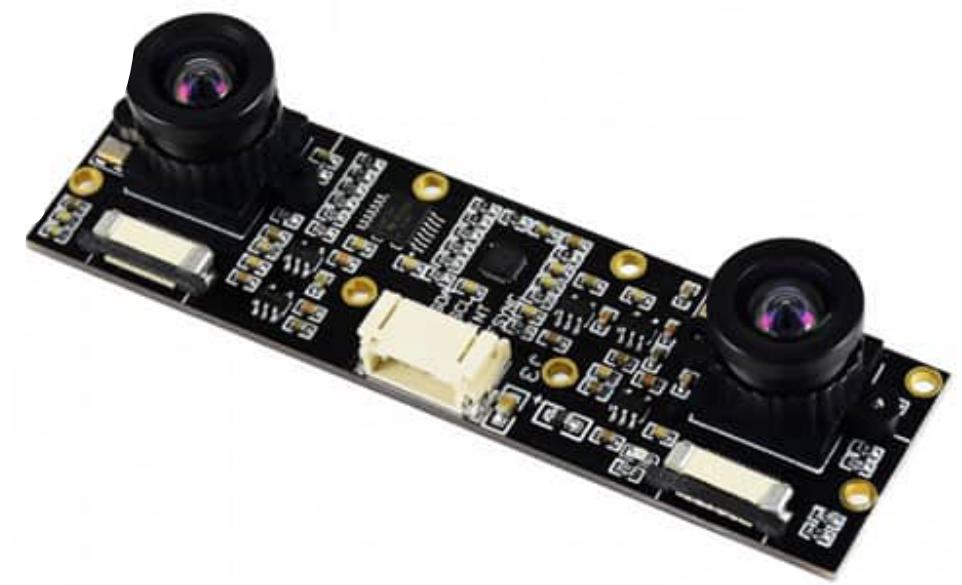
Depth Sensing



Time-of-Flight (ToF)

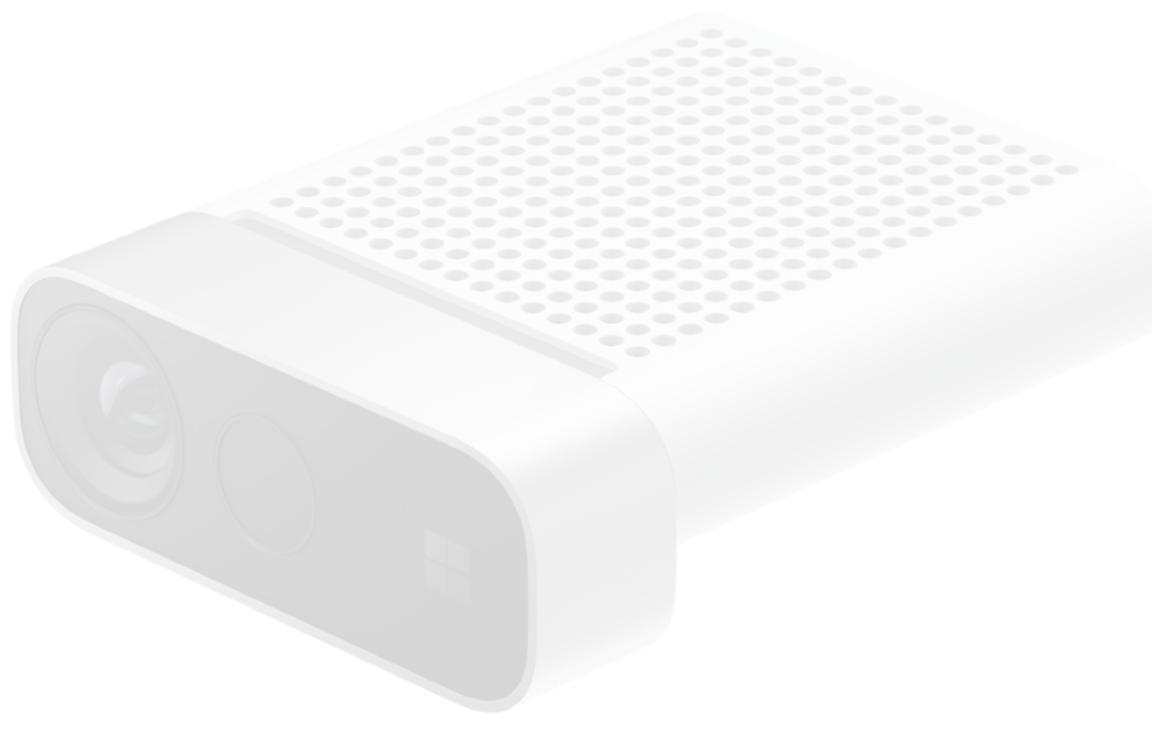


Structured-light

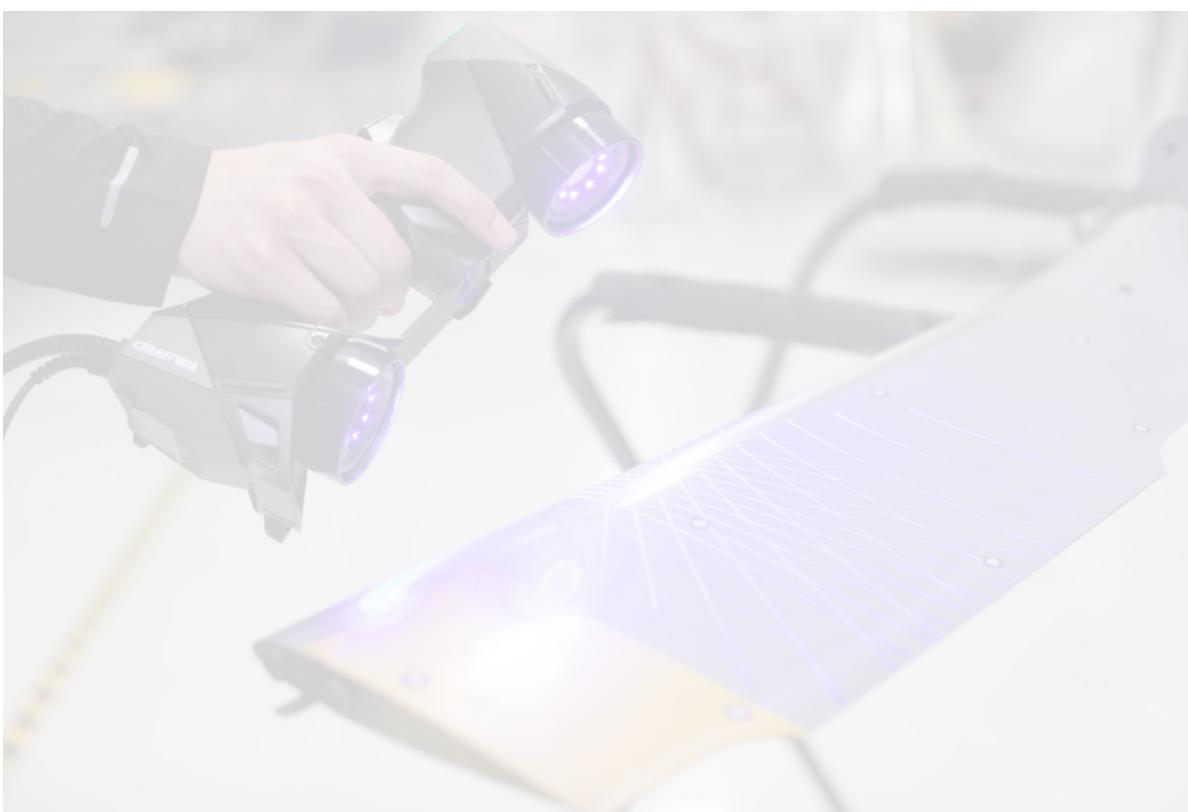


Stereo Vision

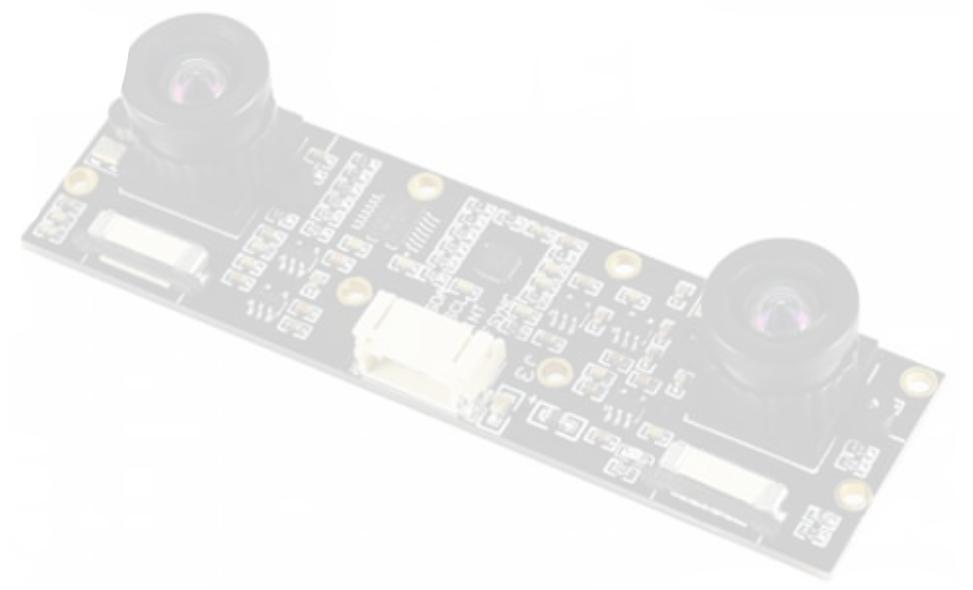
Depth Sensing



Time-of-Flight (ToF)



Structured-light

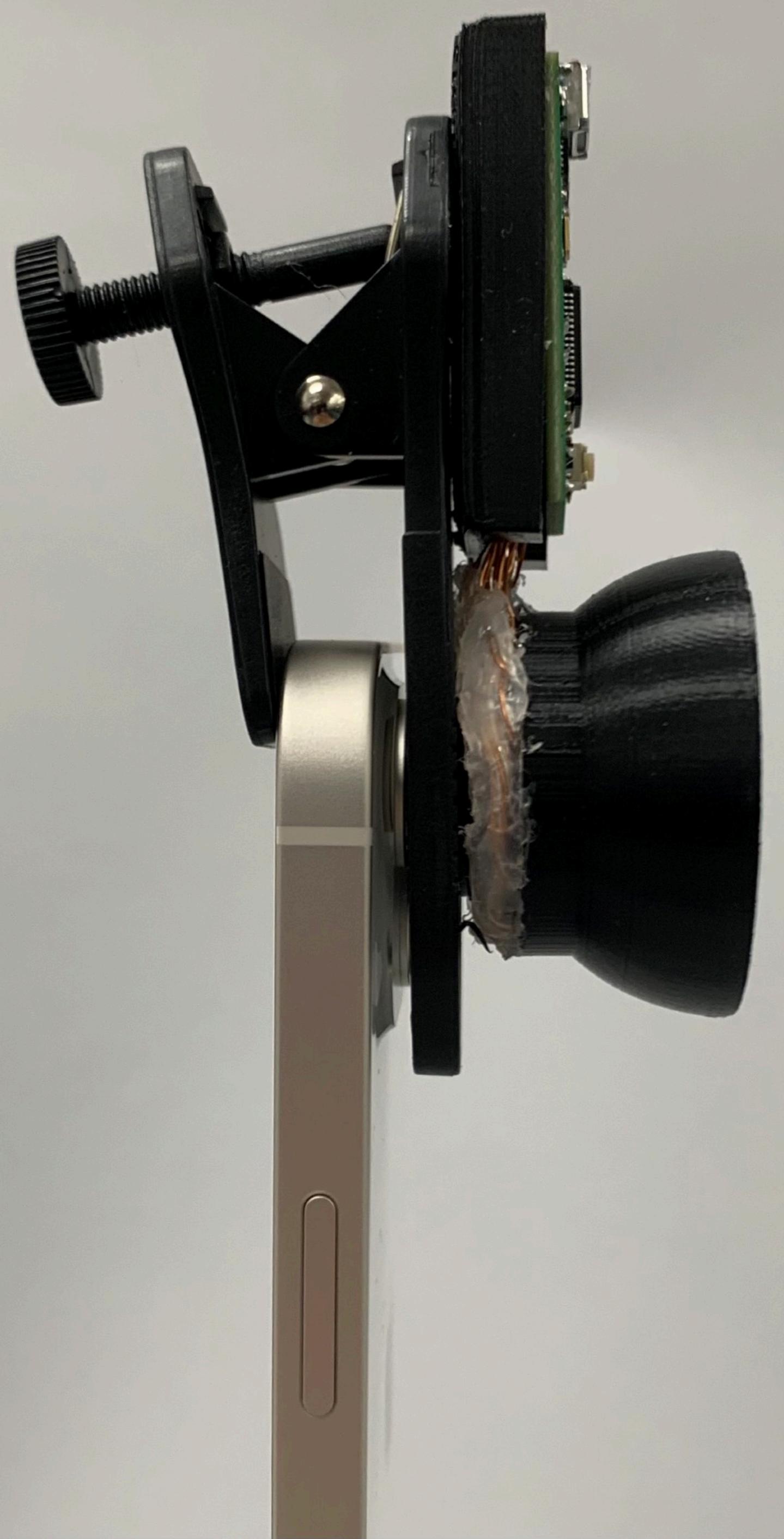


Stereo Vision

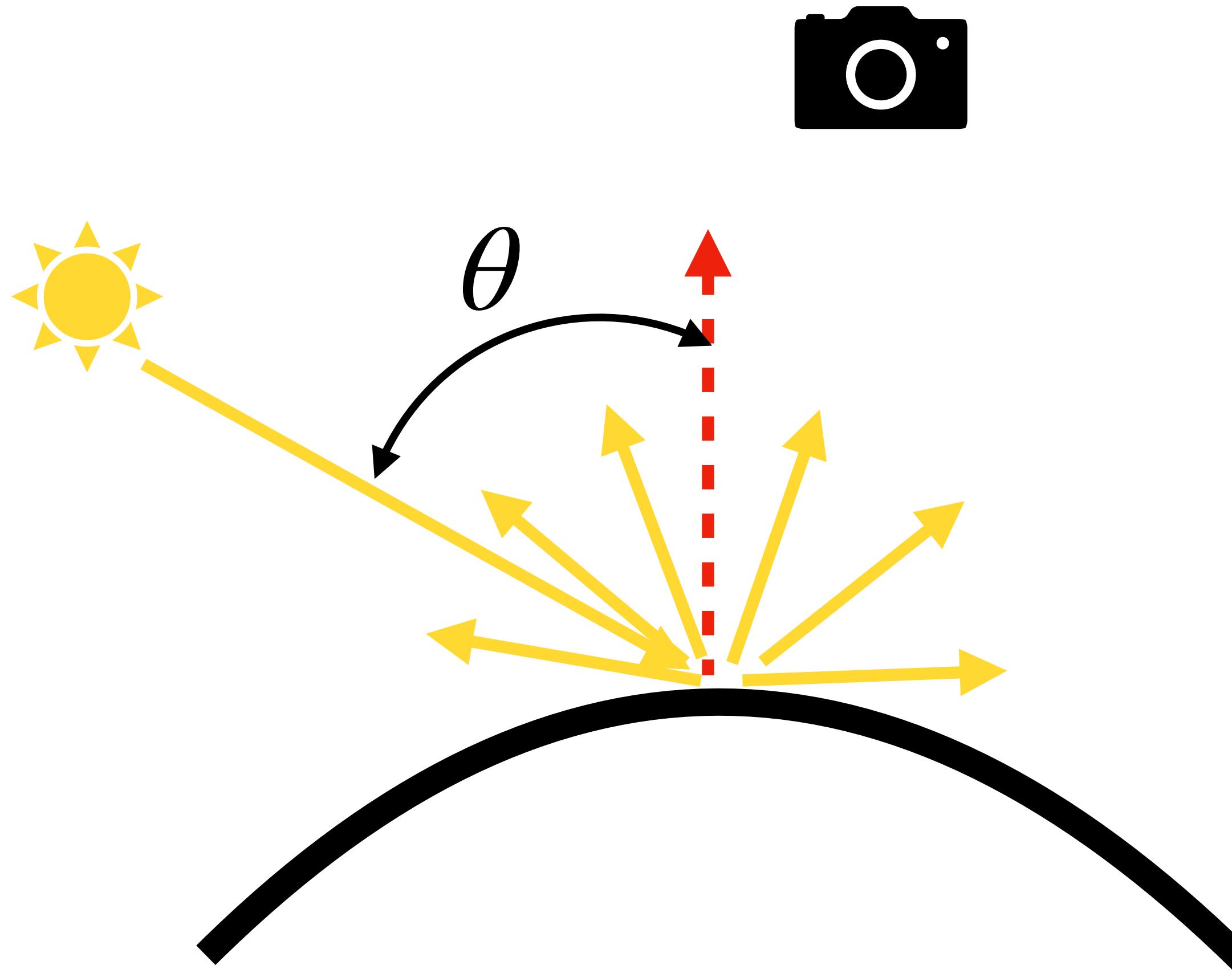


Malzbender 2006

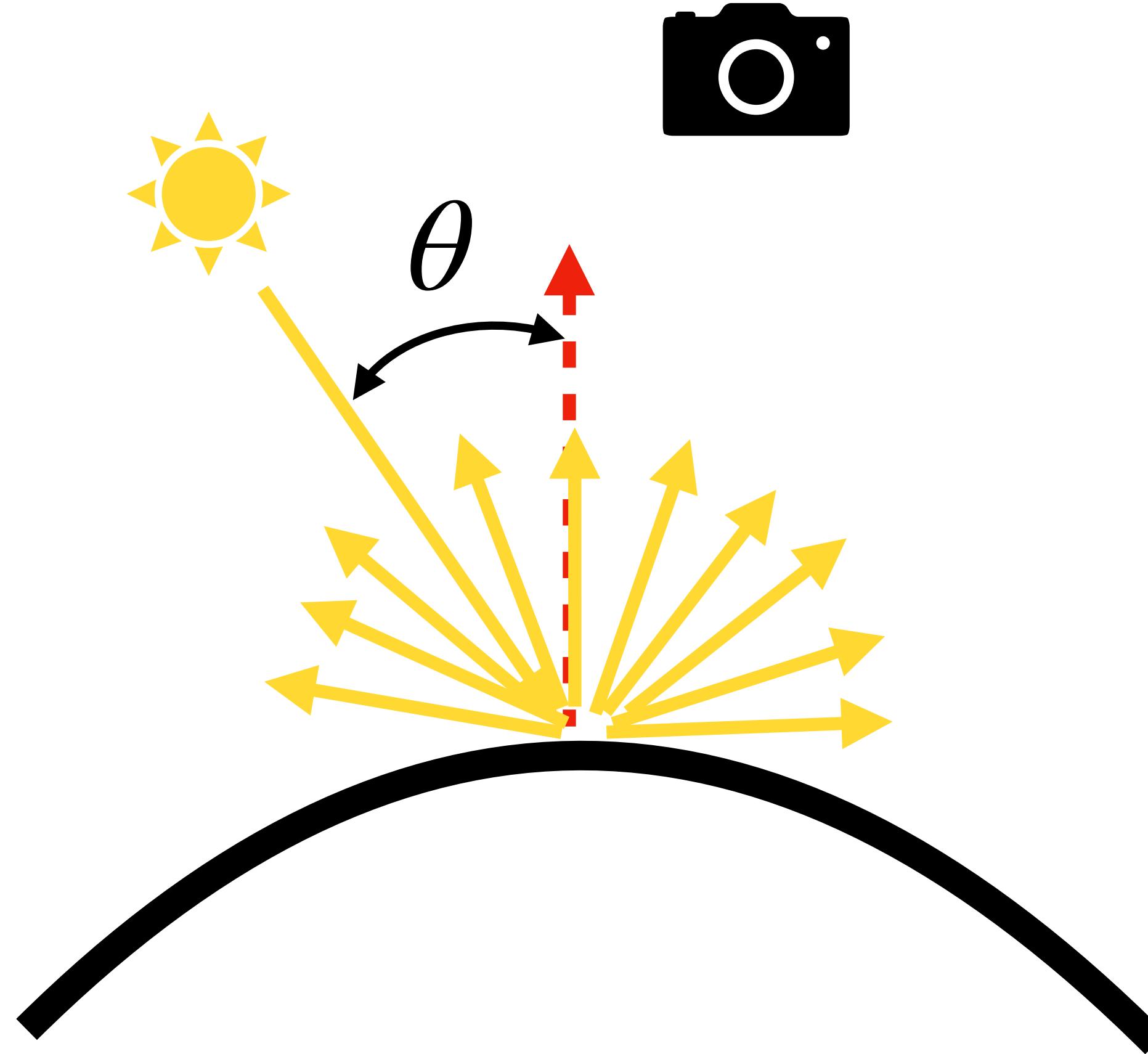
Photometric Stereo



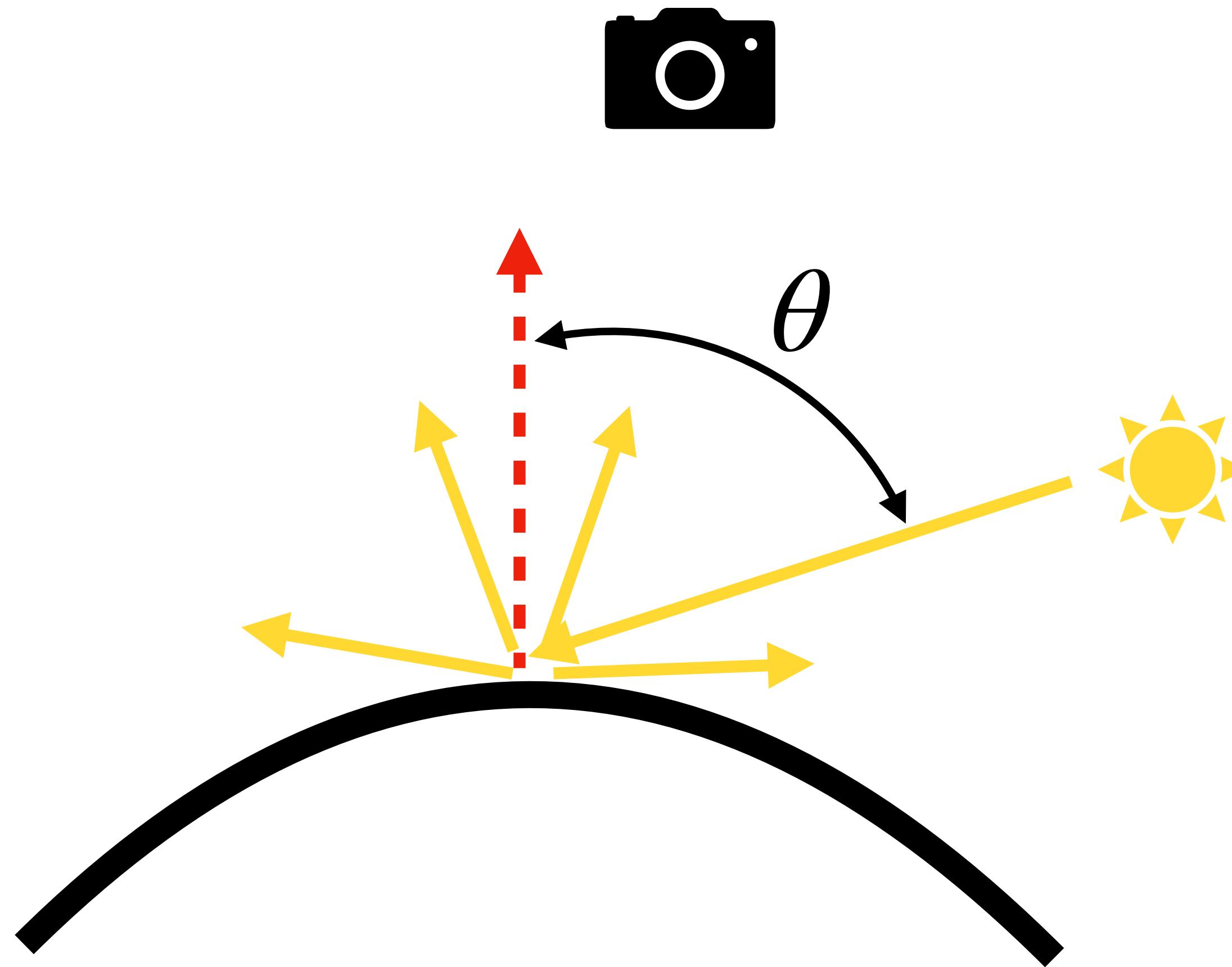
Lambertian Surface



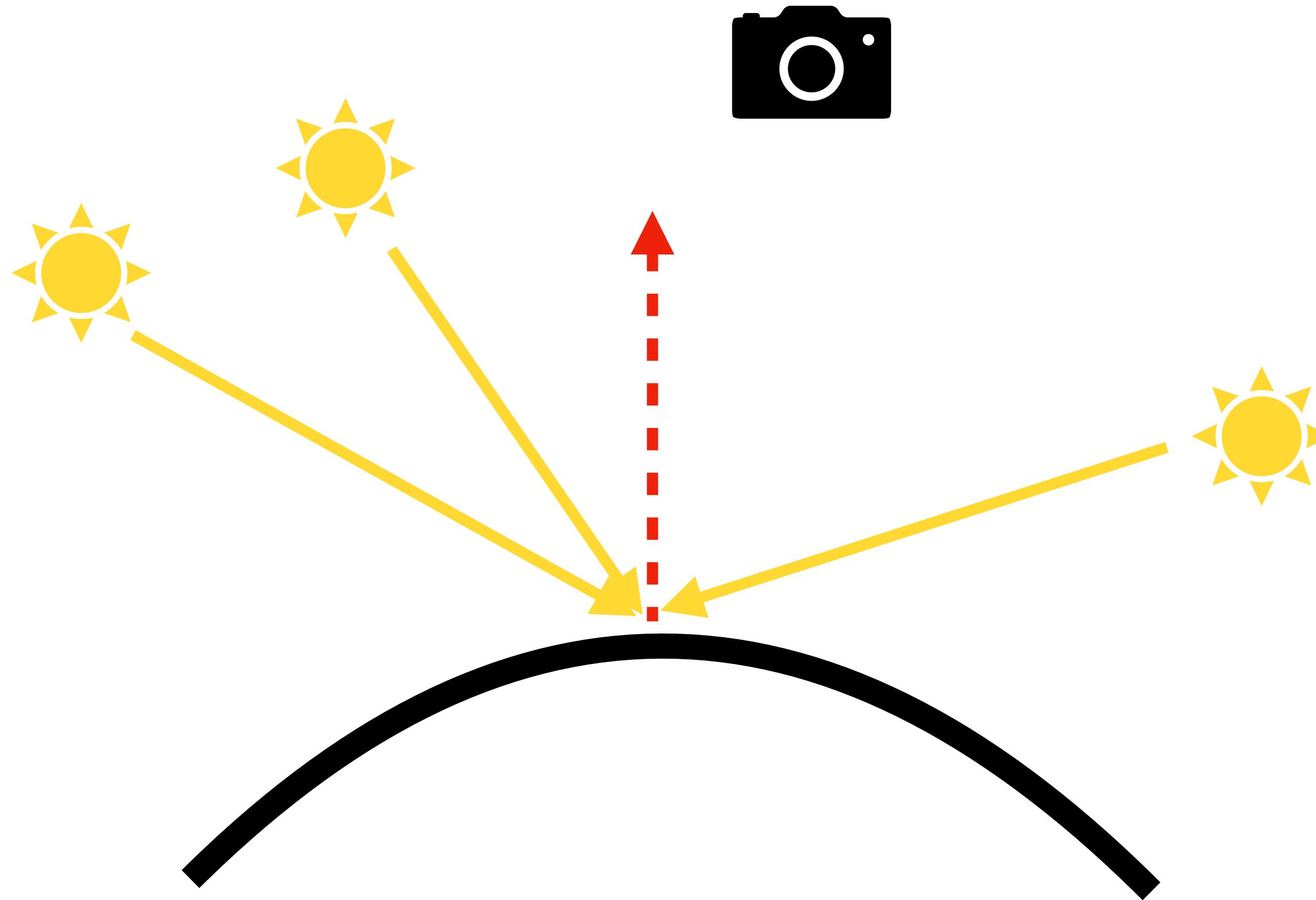
Lambertian Surface



Lambertian Surface



Lambertian Surface



$$I = \rho L^T \hat{N}$$

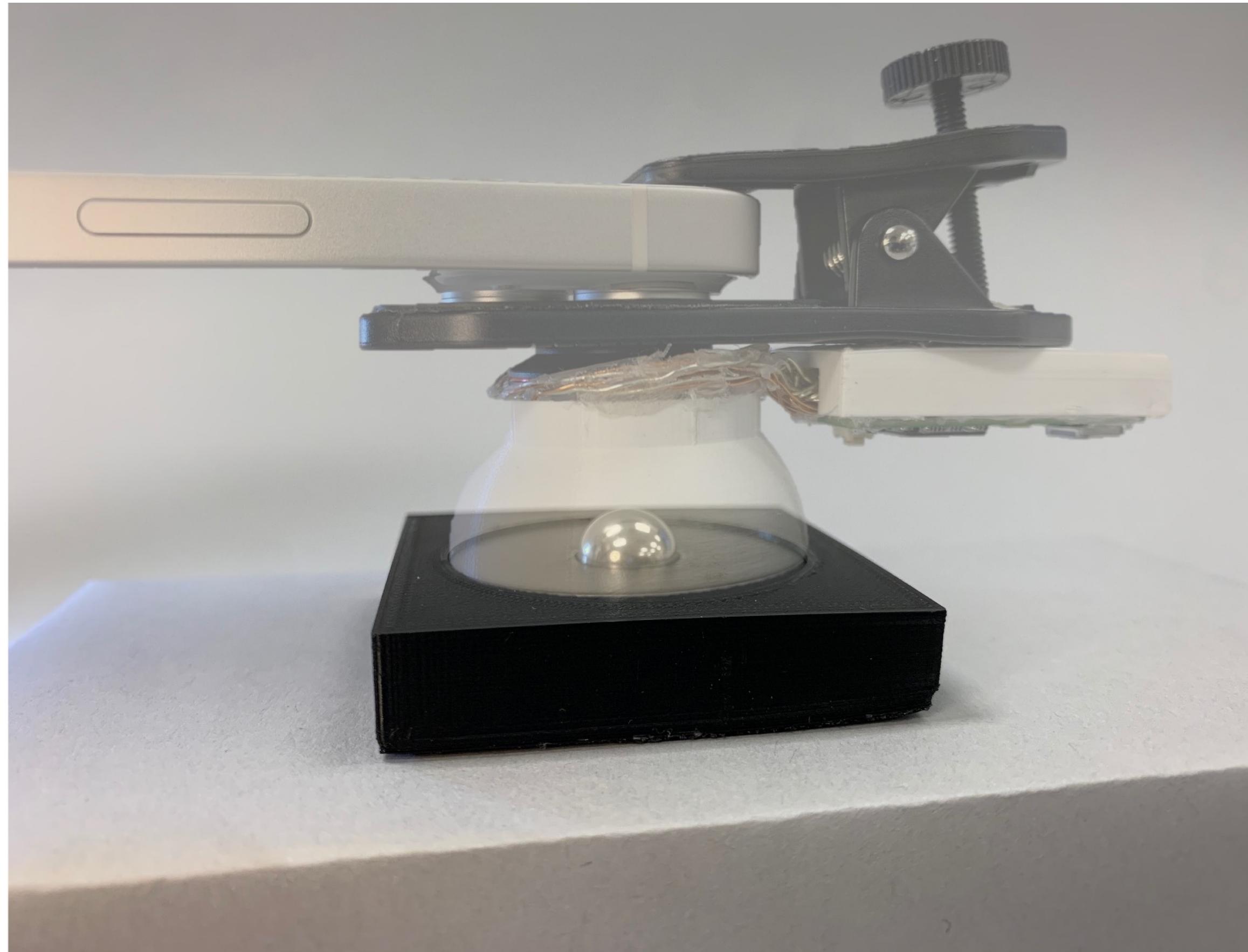
I Intensity maps

ρ Albedo

L Light directions

\hat{N} Estimated surface normals

Algorithm



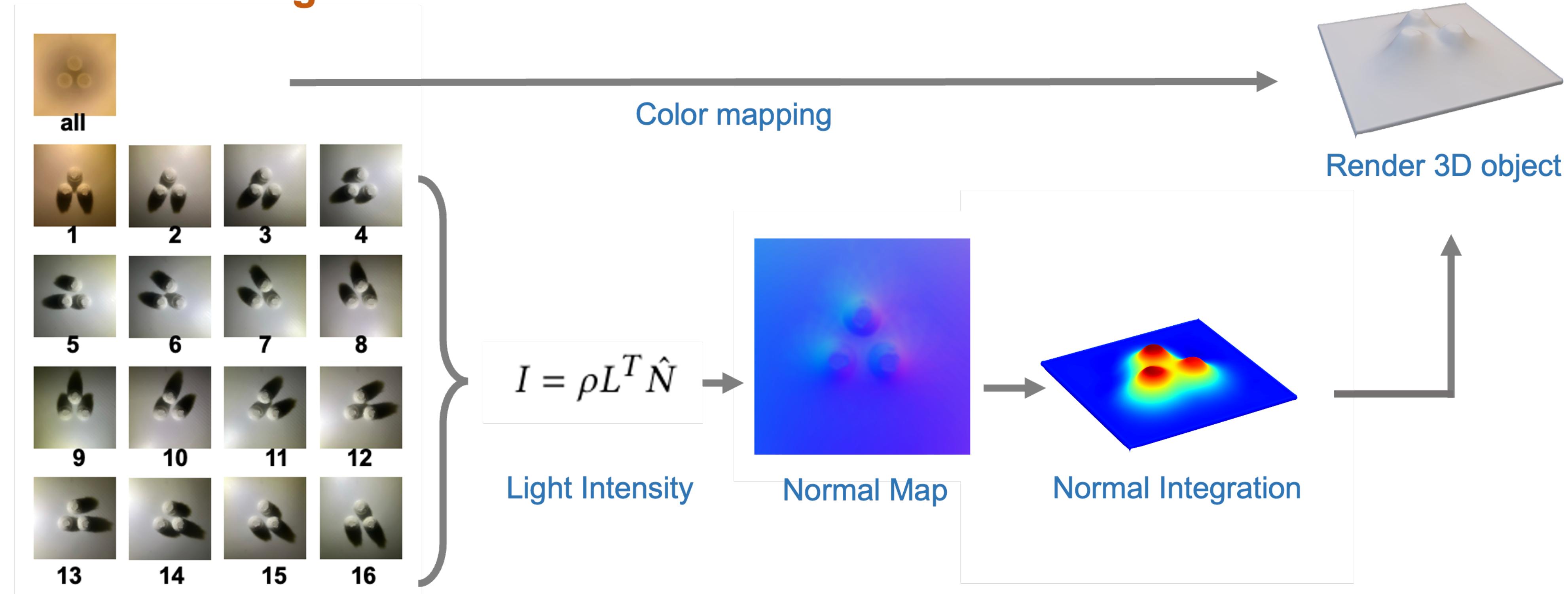
$$L = 2(N \cdot R)N - R$$

$$R = (0,0,1)$$

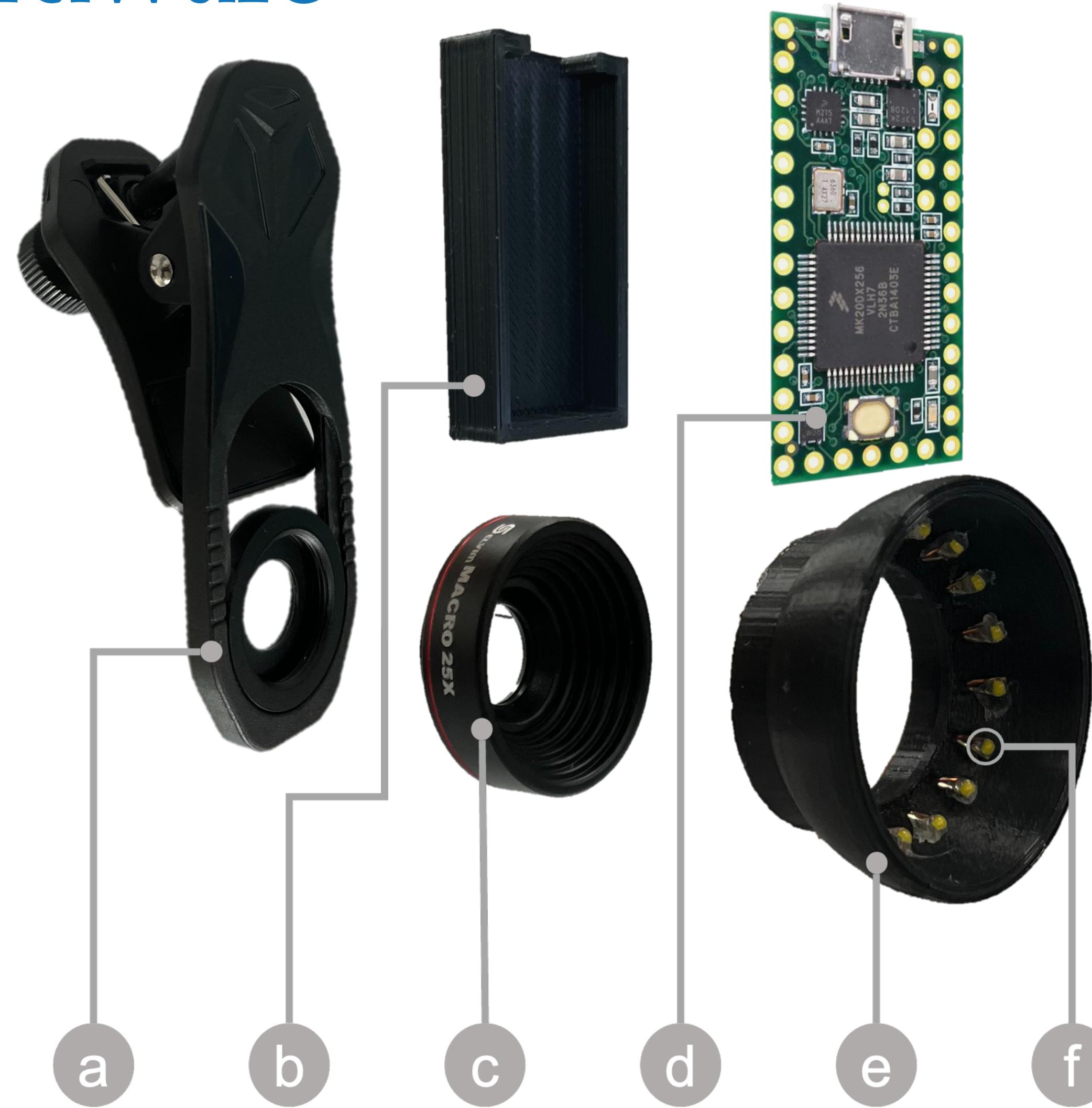
N is the surface normals of the half square

Algorithm

Photometric Algorithm



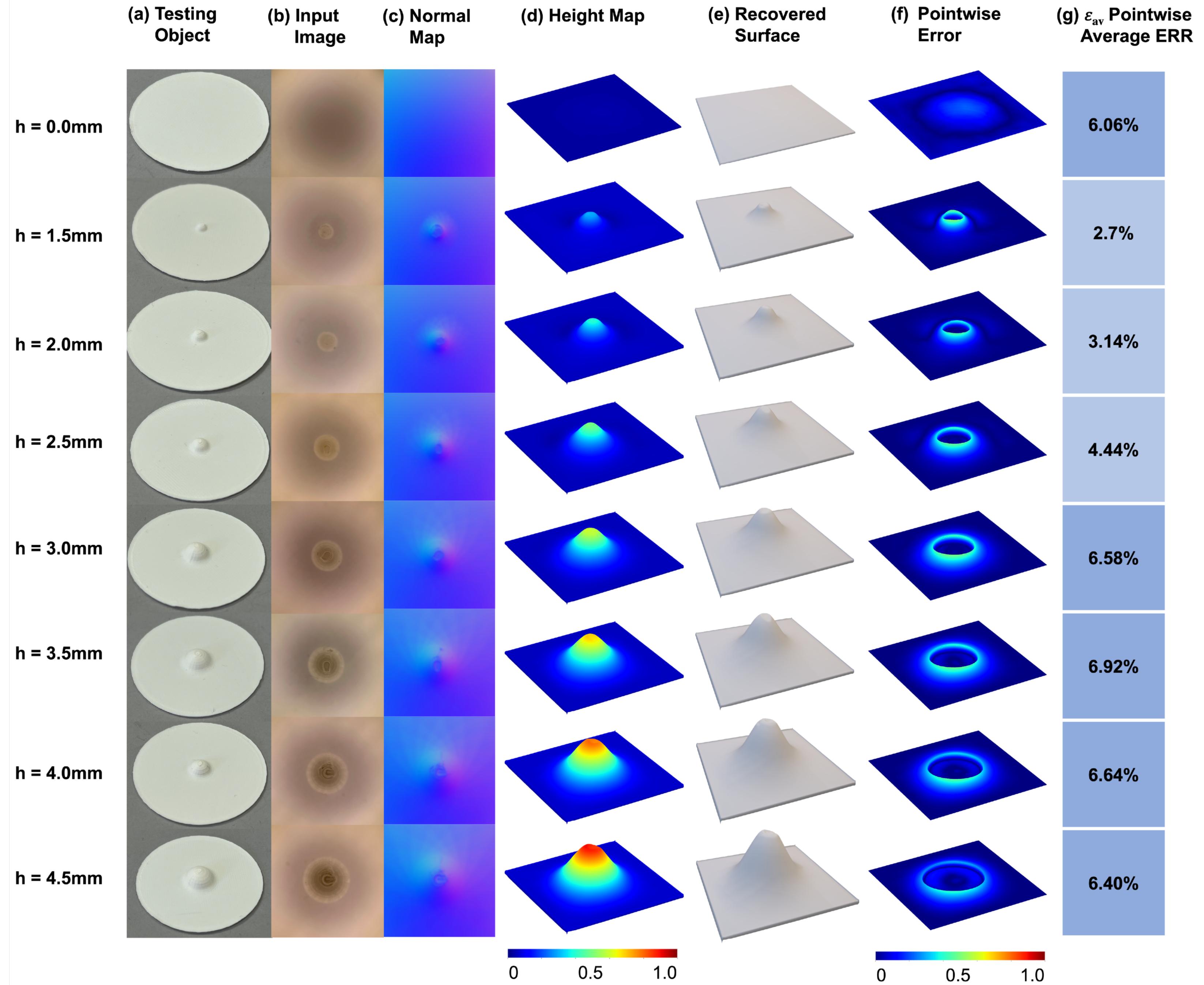
Hardware



- a.**camera clamp,
- b.**teensy holder,
- c.**macro Lens (25x),
- d.**Teensy 3.2,
- e.**light dome,
- f.**white LED.

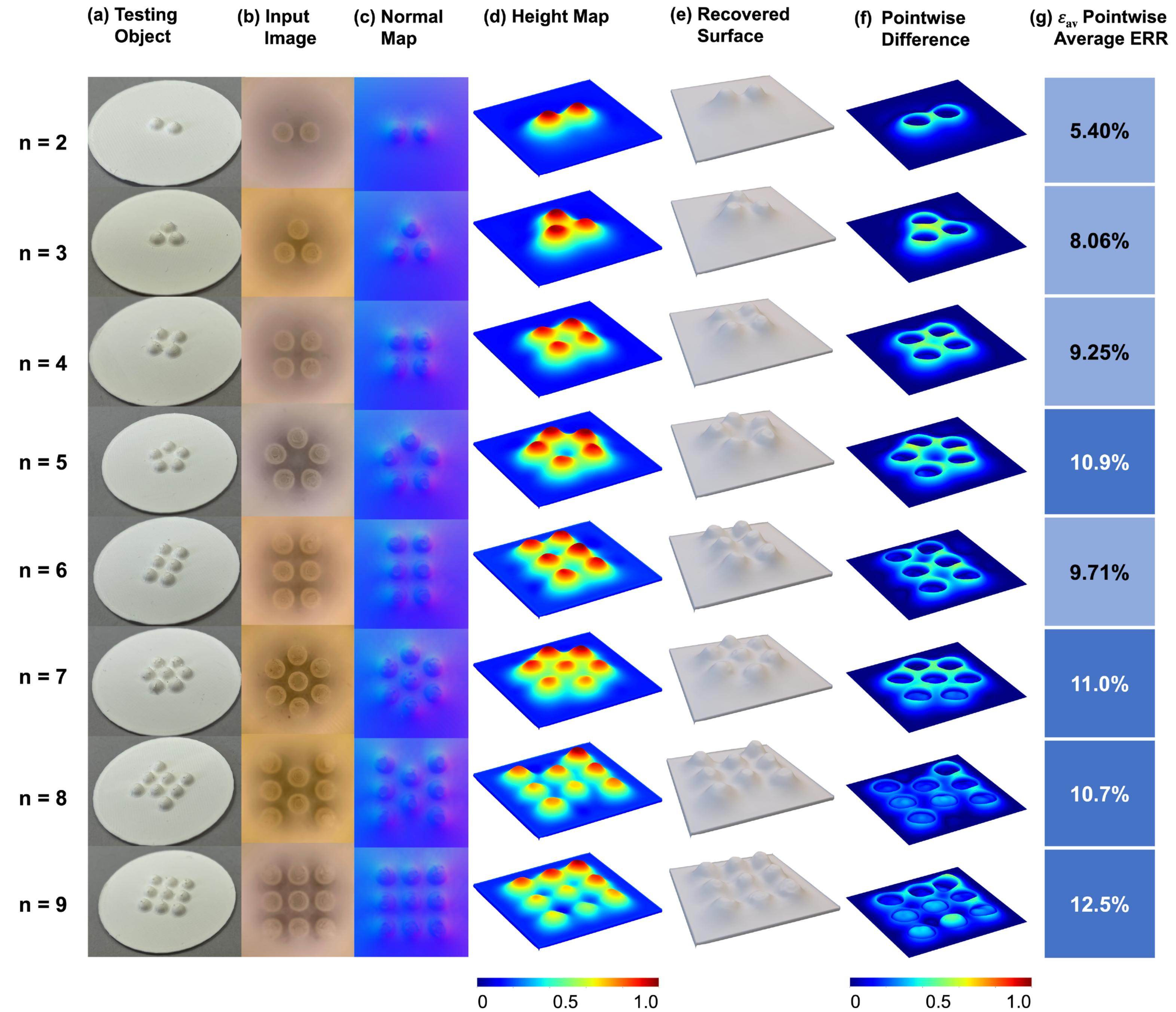
Evaluation

Test 1. change the size



Evaluation

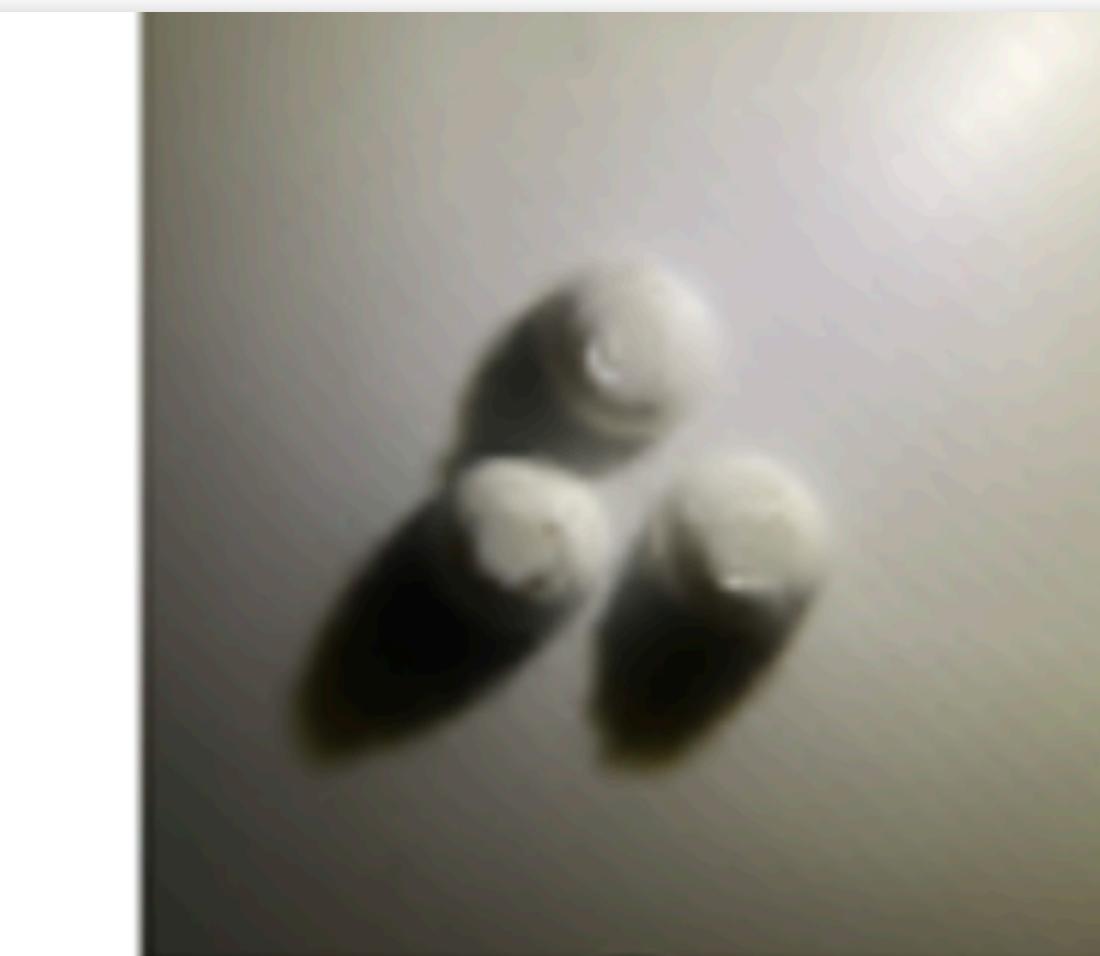
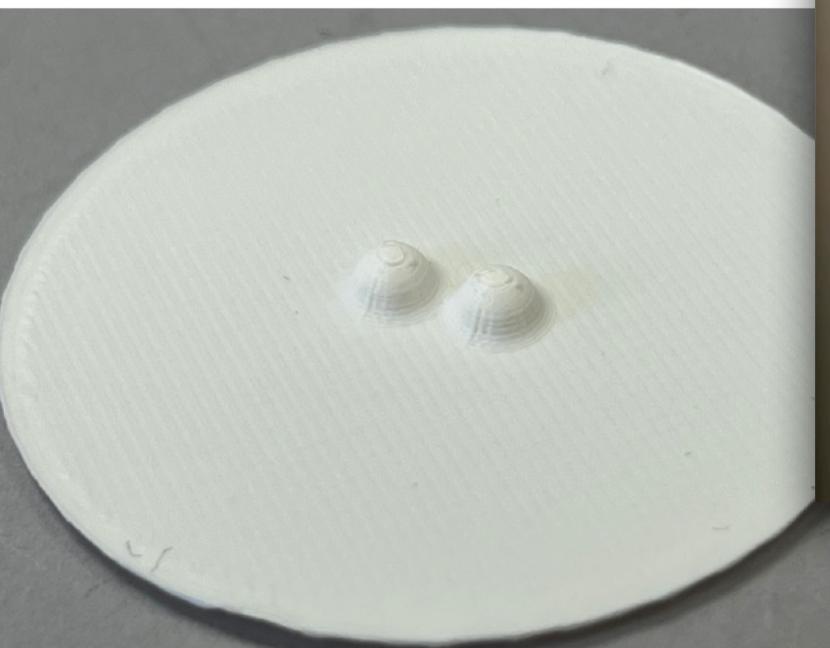
Test 2. change the quantity



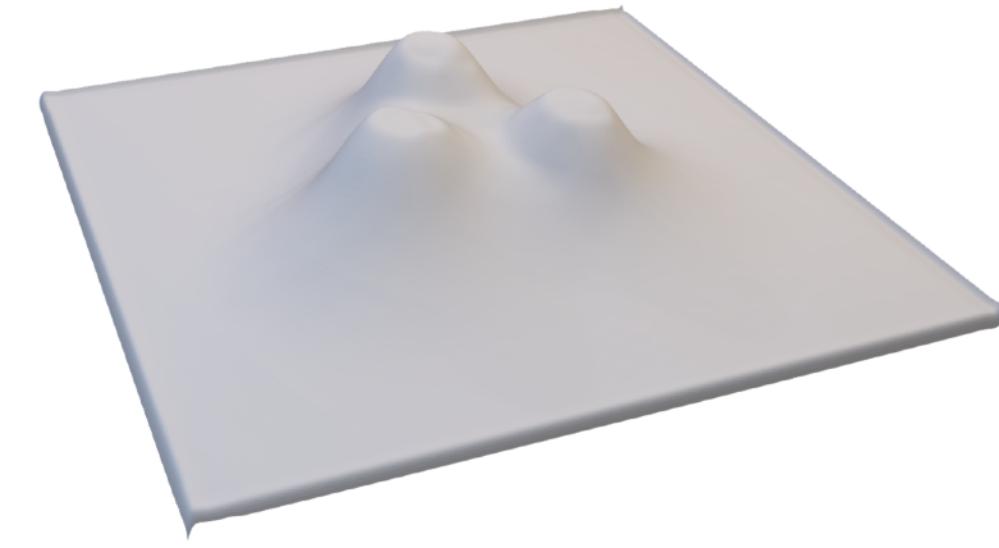
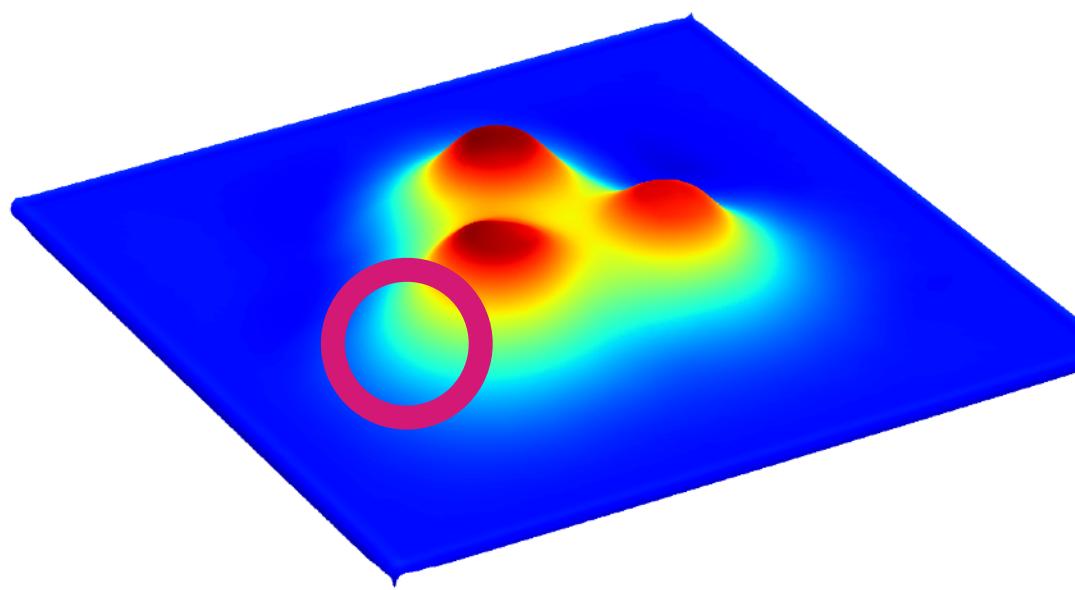
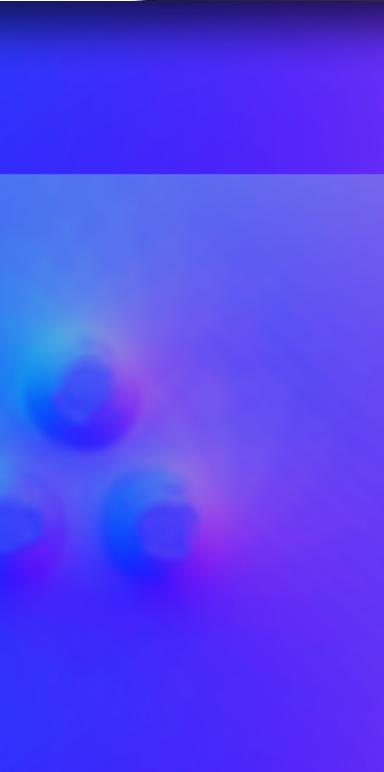
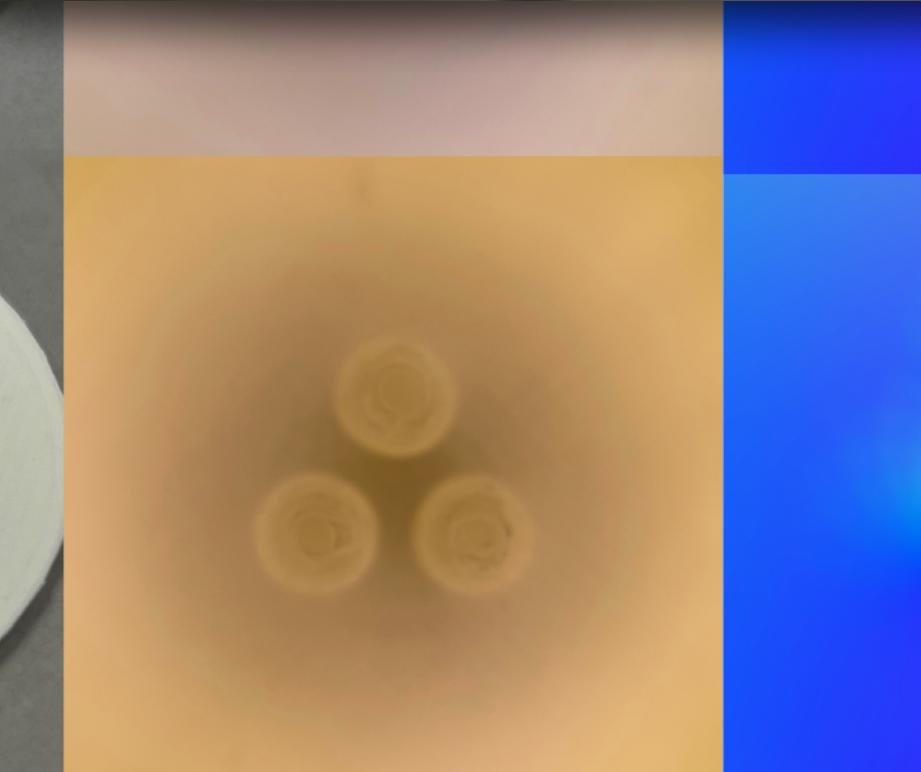
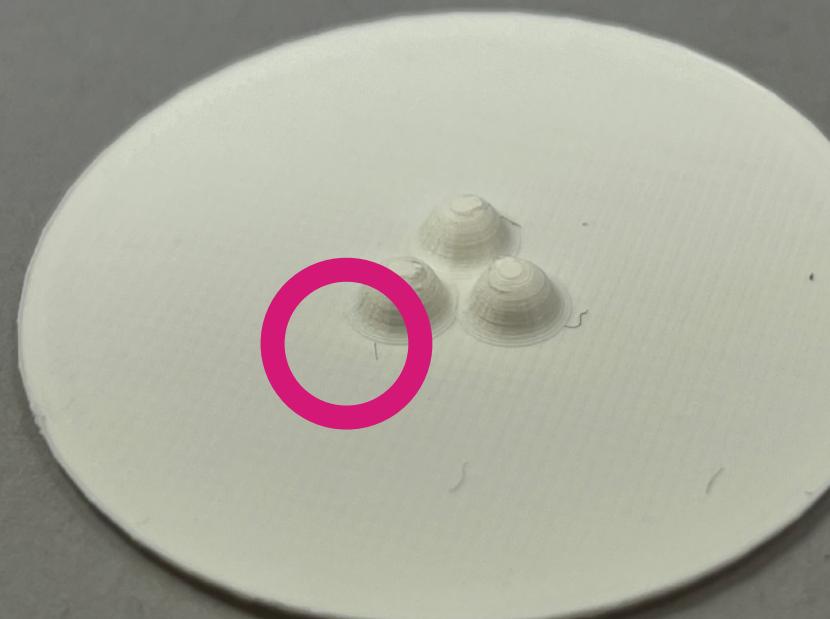
Test 2. change the quantity

(a) Testing Object

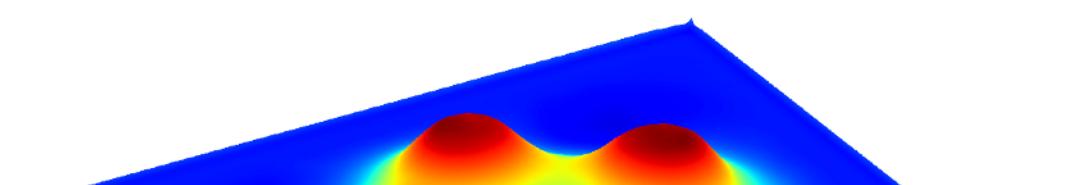
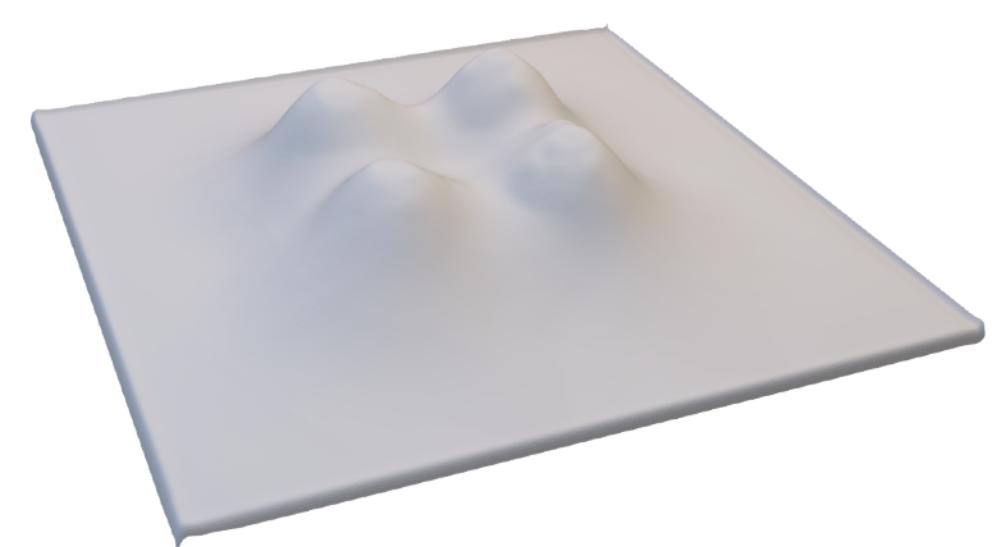
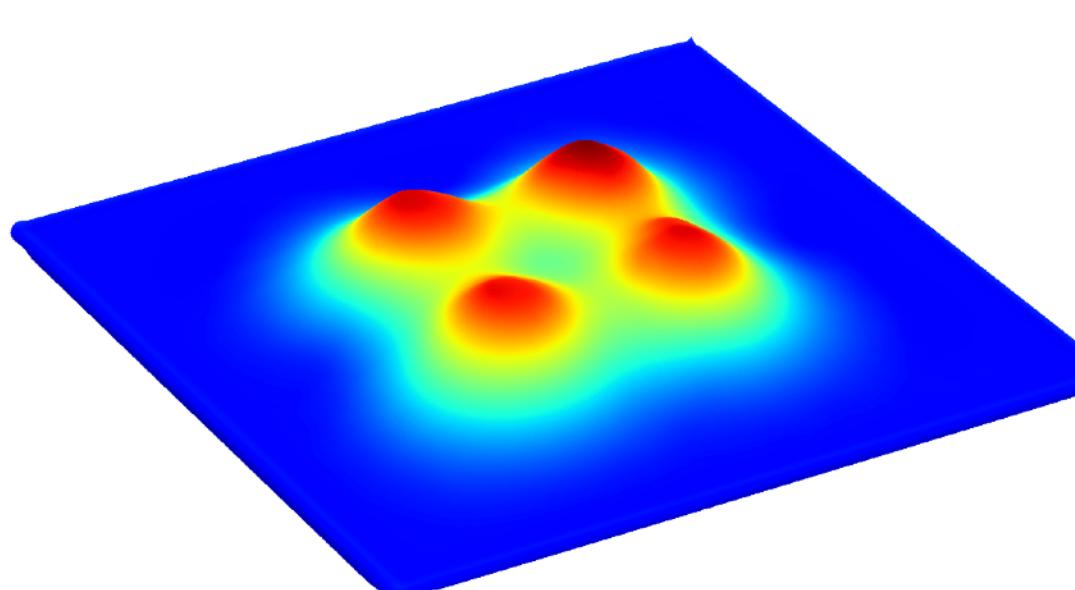
$n = 2$



$n = 3$



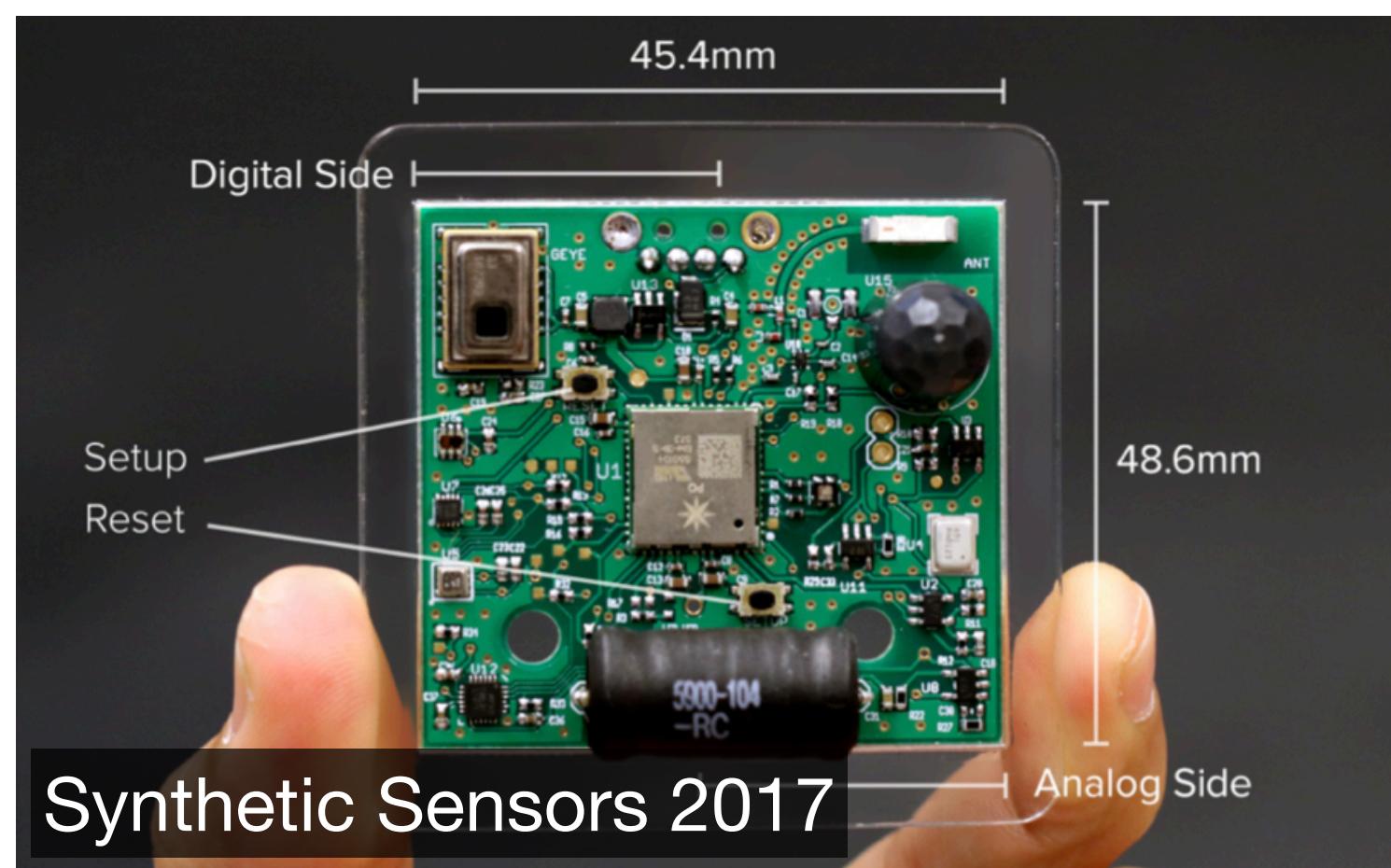
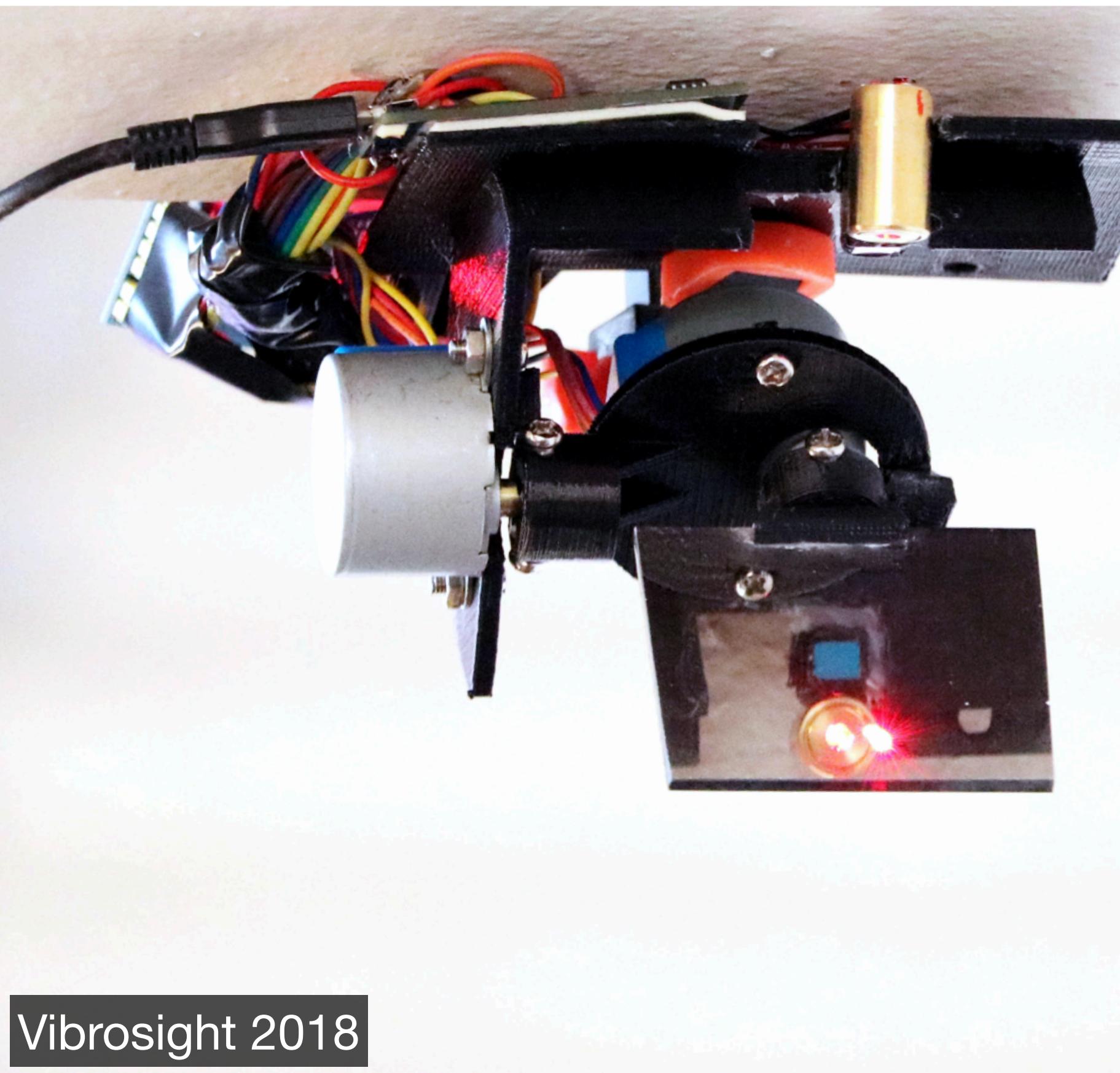
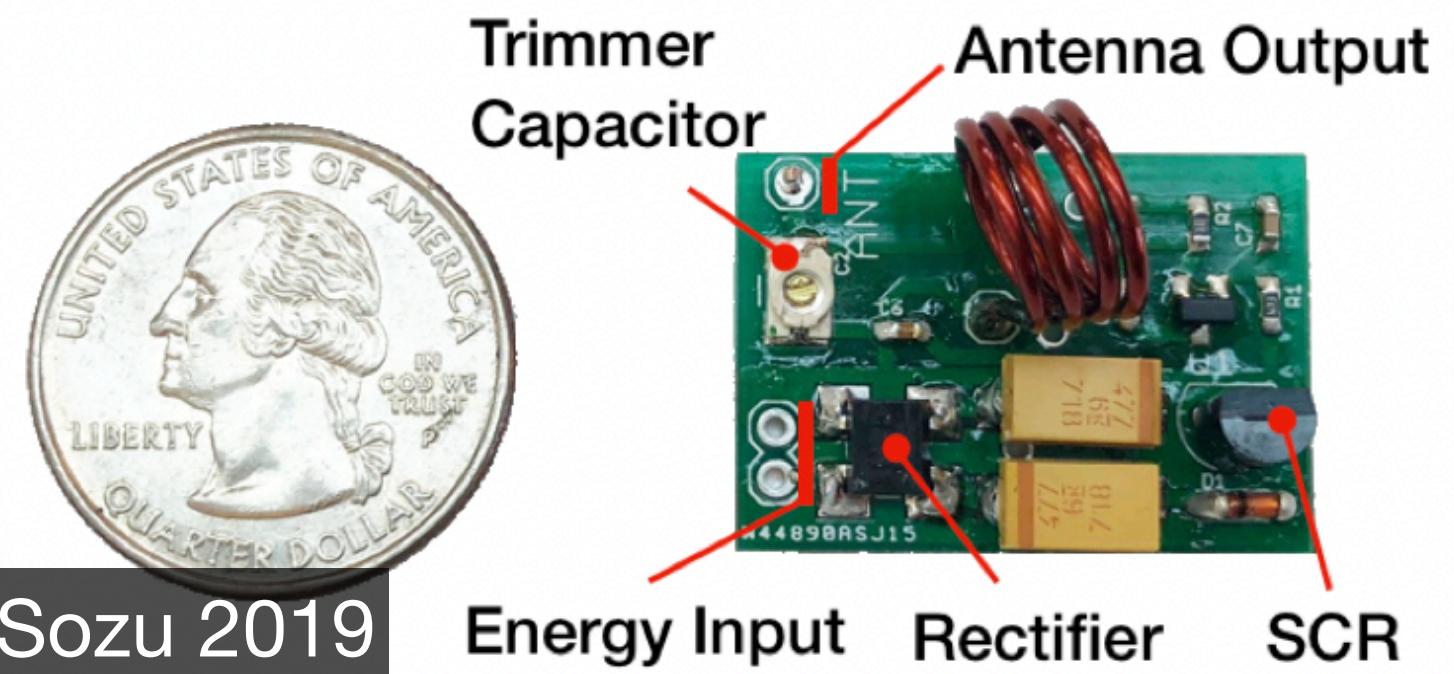
$n = 4$



Future Work

- On-skin tests
- Interview dermatologists
- Study with patients
- Improve system performance
- Long-term deployment study

Future Work





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Phone App

