Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Andrew Pun

Artificial intelligence in medical field
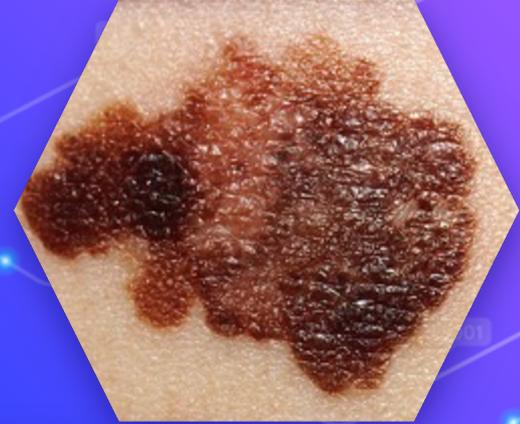
- Diagnosis of disease
- Dermatology
  - Early detection
  - Melanoma and other skin cancers
 - Early detection is very important

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Melanoma

95%

Accuracy with validated datasets

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Problems:

- Only accurate under ideal circumstances:
  - Lighting
  - Clarity
  - Angle
- Best recognizes images from clinical datasets (ex. Harvard HAM10000)
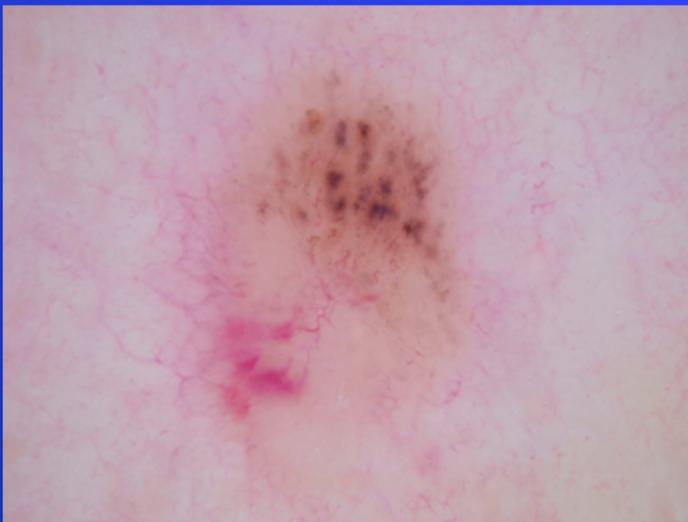
Skin lesion taken professionally using a dermoscope

Skin lesion taken by me using an iPhone

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Polarized Dermoscopy

- Uses polarized imaging
- Reduces glare
- Reveals subsurface structures

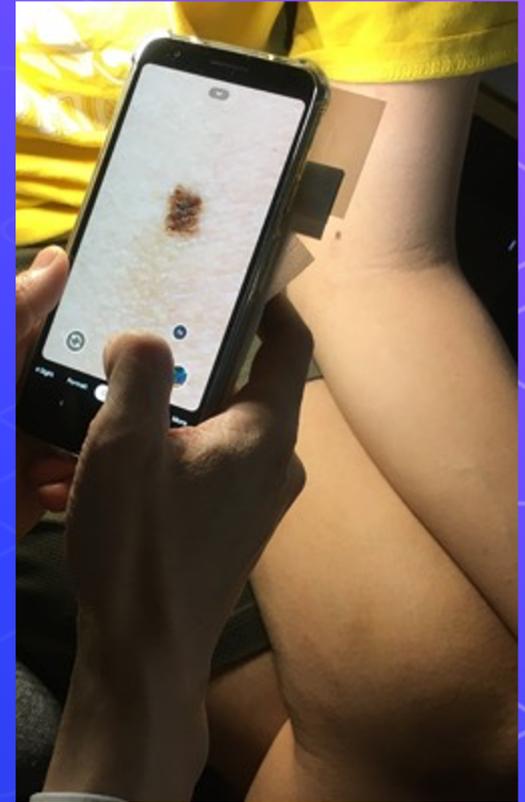Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection
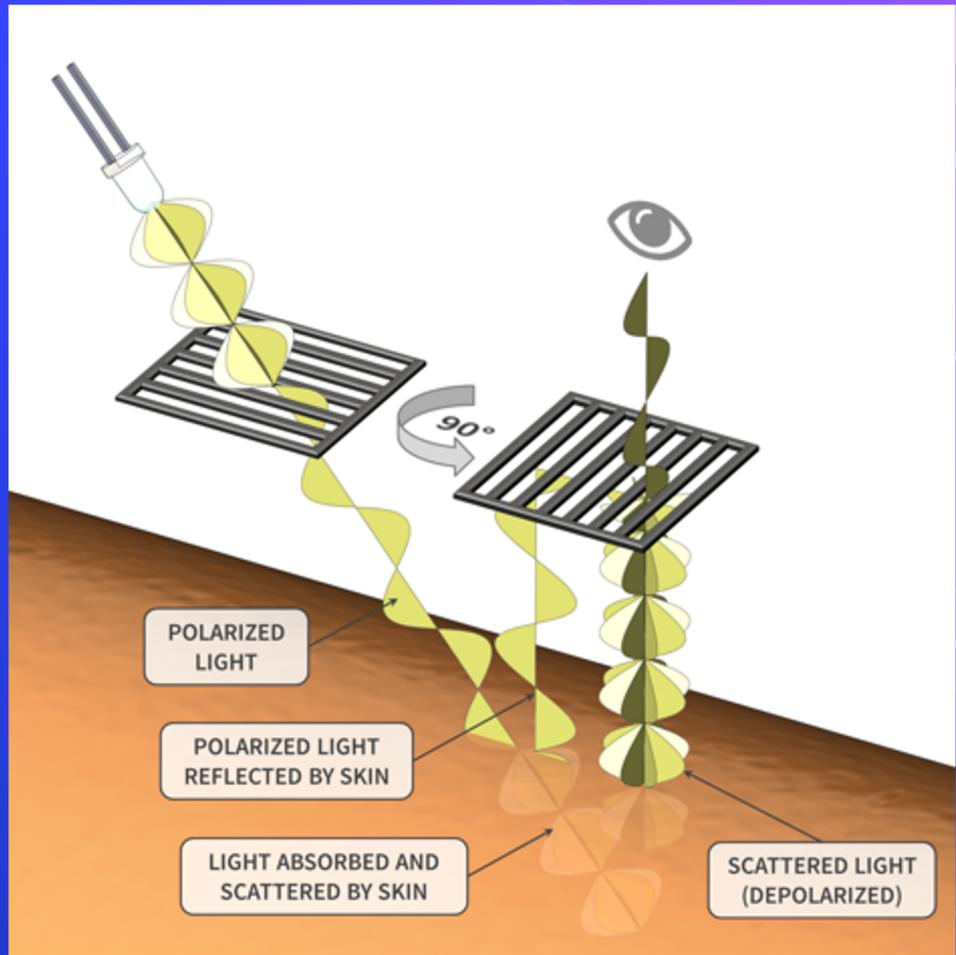
Purpose of Experiment

- To investigate whether or not accuracy of artificial intelligence model improves when analyzing polarized images compared to non-polarized images.

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Polarizer Device

○ Low cost biomedical device that allows physicians to take a picture using polarized imaging with their smartphone.

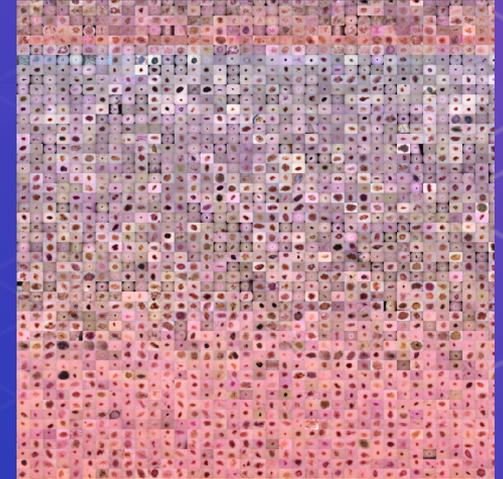Polarizer Device (left) and a physician using the device on me (right)

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Artificial Intelligence Model

Google Tensorflow

HAM10000 Dataset

Data Collection and Preparation

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection
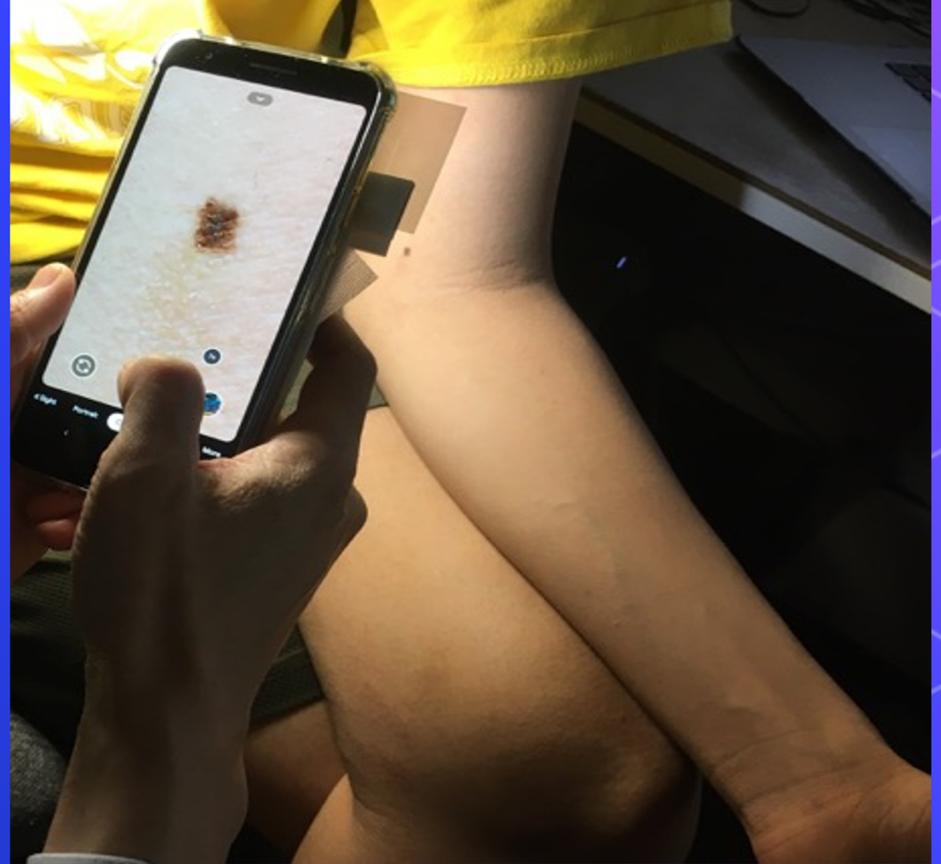
Results

- ⬡ 57 skin lesions
- ⬡ Rotated 4 times and polar/non polar (total 228)
- ⬡ 12 benign keratosis
- ⬡ 5 dermatofibroma
- ⬡ 37 melanocytic nevi
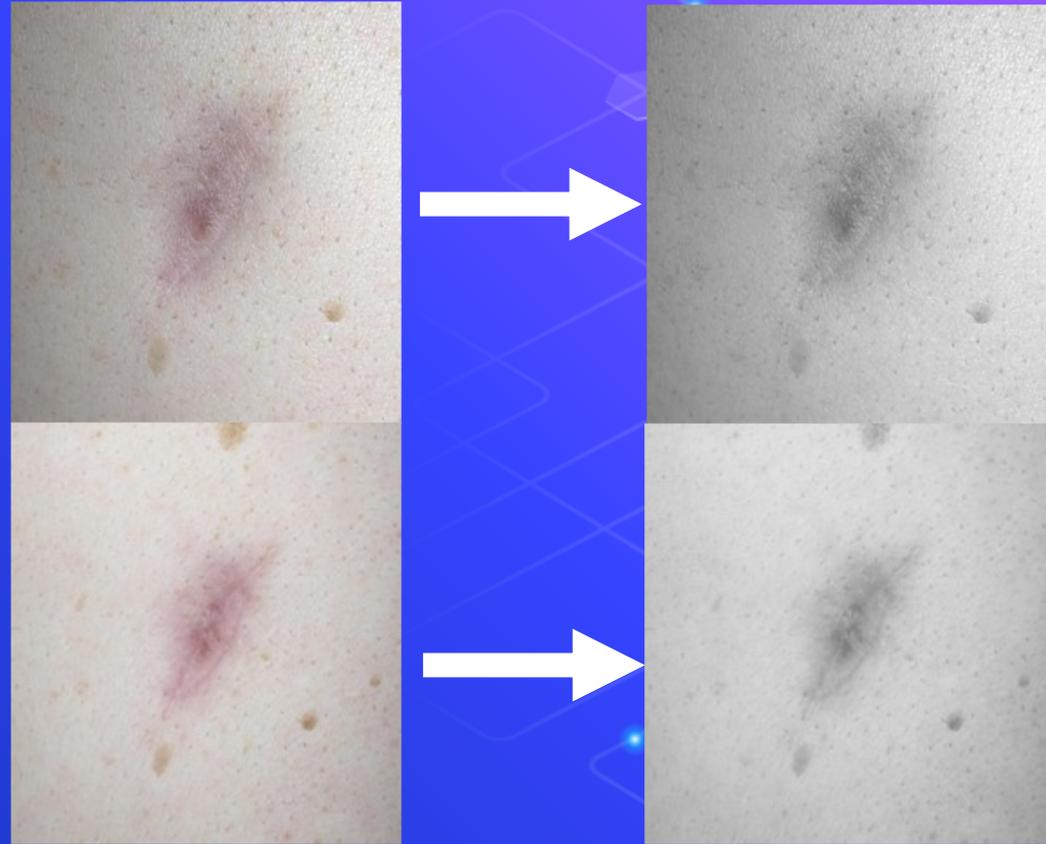- ⬡ 3 vascular lesions

Non-polarized

Polarized

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Lesion Data

Diagnosis	Total	Instances with higher polarized confidence than non-polarized confidence		Non-Polarized		Polarized	
		# of Lesions	% of Lesions	$\bar{x}$	σ_x	$\bar{x}$	σ_x
Benign keratosis	48	24	50.0%	0.15	0.2	0.1	0.1
Dermatofibroma	20	13	65.0%	0.01	0.02	0.009	0.008
Melanocytic nevi	148	101	68.2%	0.7	0.2	0.8	0.2
Vascular skin lesion	12	11	91.7%	0.3	0.4	0.6	0.5

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Conclusion

- Hypothesis partially supported.

- Most lesions had more confidence in polarized images than non-polarized images.

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

Non-polarized

Polarized

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection

AI as a tool

○ AI is not meant to replace a physician

○ Diagnosis of a pathologist, dermatologist, or physician should supersede that of an AI.

Andrew Pun: Using AI and Polarized Imaging to Assist Physicians with Early Skin Cancer Detection