# The Intelligent future of dermatology

Liz Asai – CEO
3Derm Systems, Inc.

**+2 billion** people live with dermatological conditions

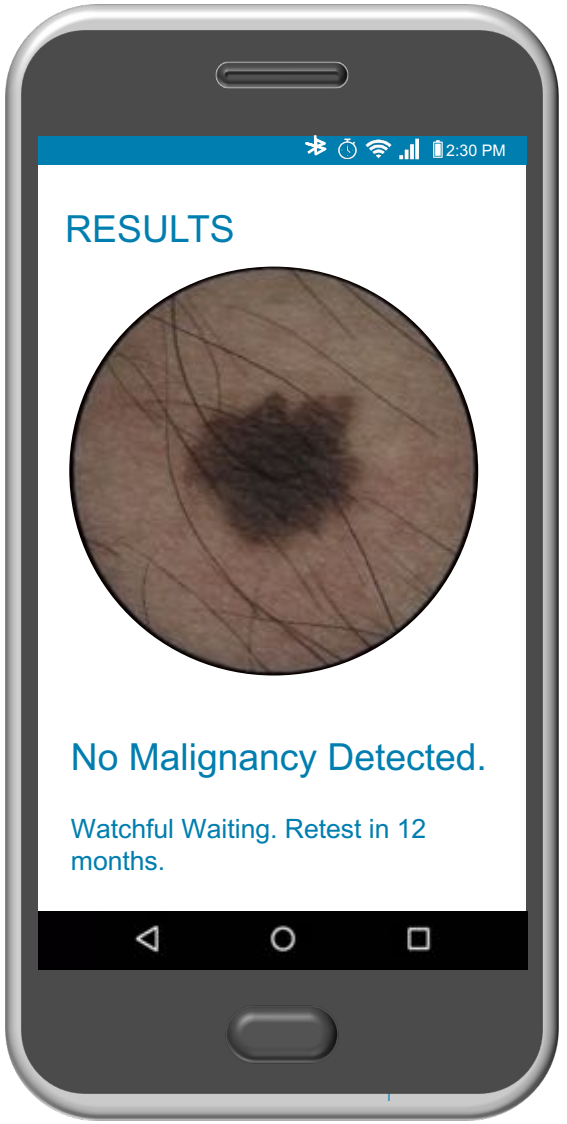
On average there are **2.6 dermatologists** per 100,000 people

1. International Alliance of Dermatology Patient Organizations (n.d.). Mission and Vision. Accessed May 26, 2019. Retrieved from: https://globalskin.org/about/mission-vision.
2. 24th World Congress of Dermatology. ILDS Member Societies. Accessed May 26, 2019. Retrieved from: https://www.wcd2019milan.org/news/ilds-member-societies/.

We’re enabling access to care with automation.

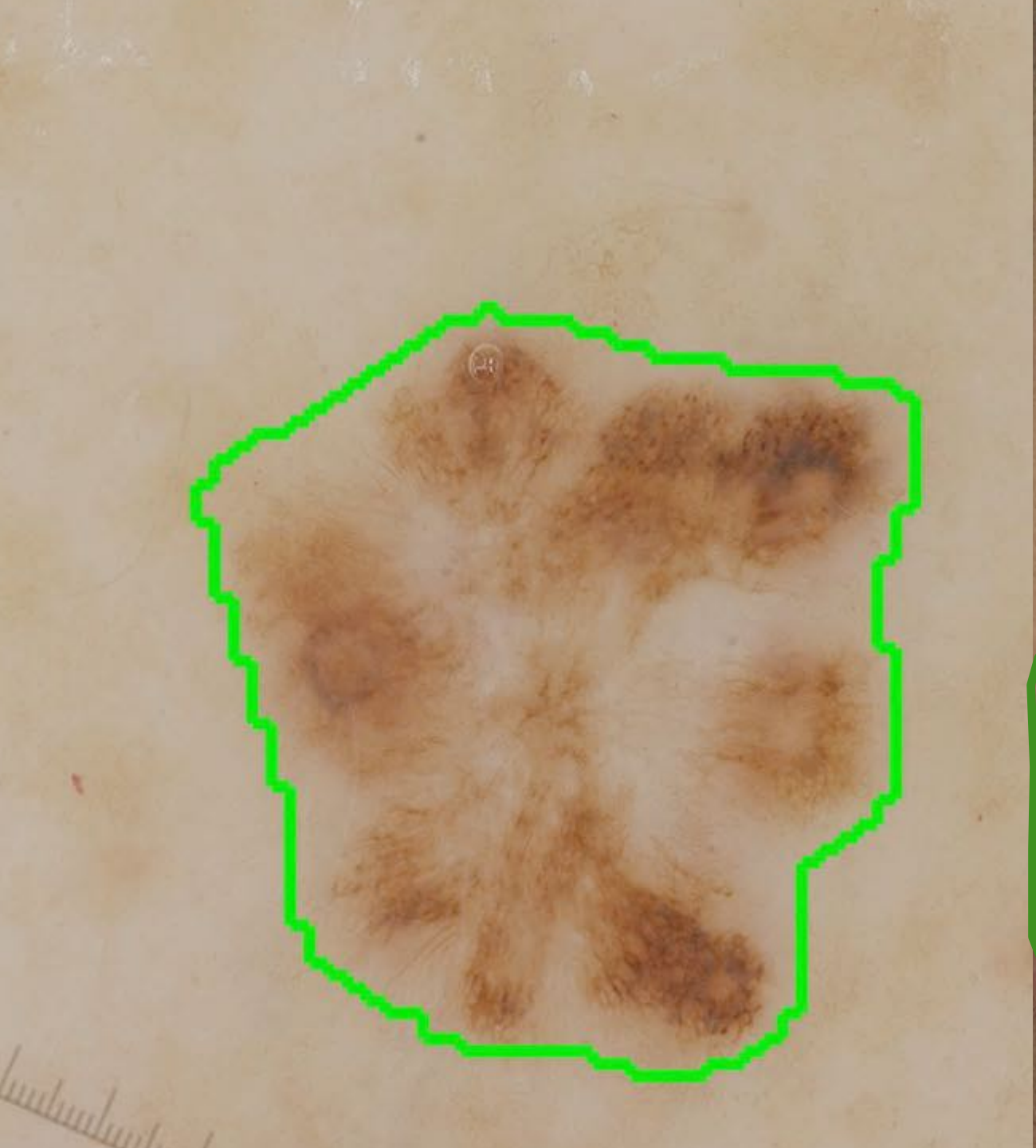
Image


Answer



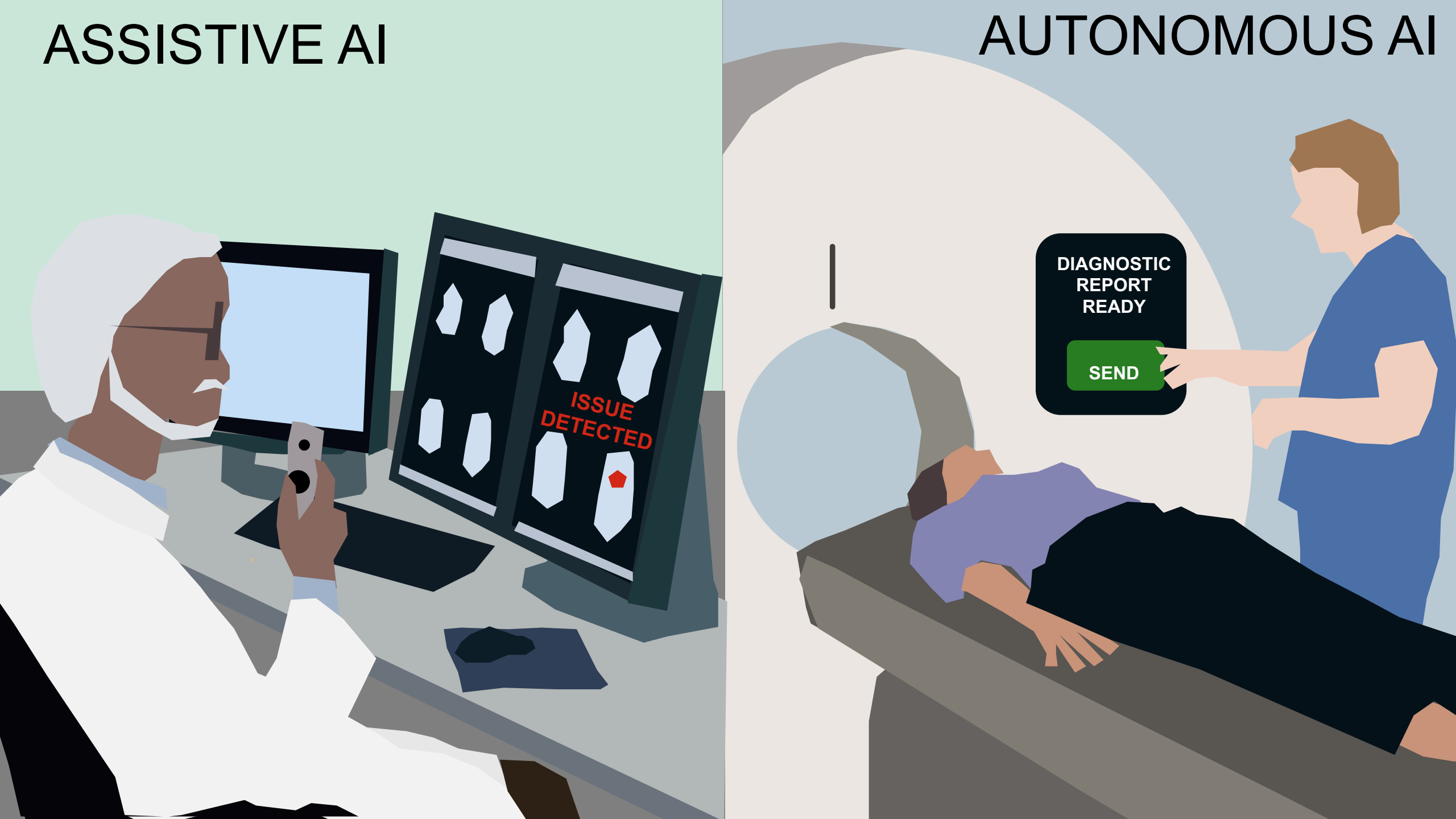
# Overview of 3Derm Dermatological AI Program

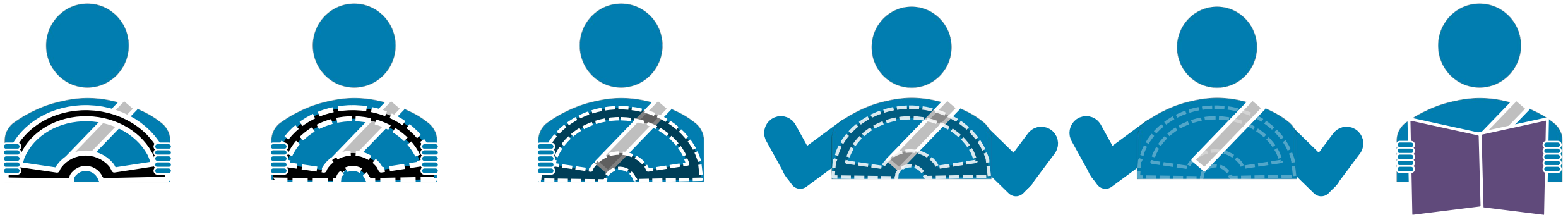

Log Out
Teledermatology



- ✓ Image Quality Threshold
- ✓ Hair Removal
- ✓ Segmented
- ✓ Hundreds of thousands of 300 x 300 images
- ✓ Algorithm determines features of interest
- ✓ Train on clinically valid features

# Assistive vs. Autonomous AI


ASSISTIVE AI
ISSUE DETECTED
AUTONOMOUS AI
DIAGNOSTIC REPORT READY
SEND



| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| No Automation | Driver Assistance | Partial Automation | Conditional Automation | High Automation | Full Automation |

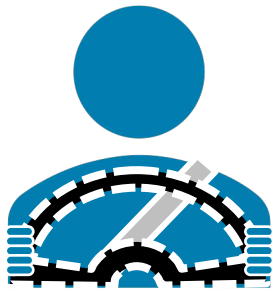
**Human** Monitors Driving Environment

**AI** Monitors Driving Environment

SAE International (2014) Automated Driving – J3016. Retrieved from: https://web.archive.org/web/20170903105244/https://www.sae.org/misc/pdfs/automated_driving.pdf.

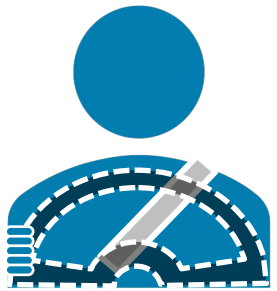
0

No Automation



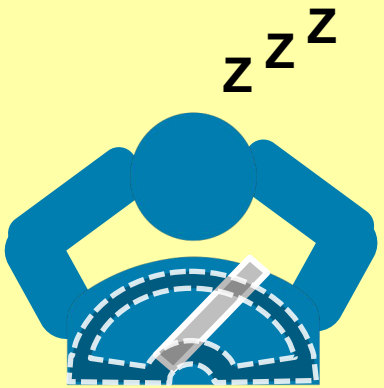
1

Driver Assistance



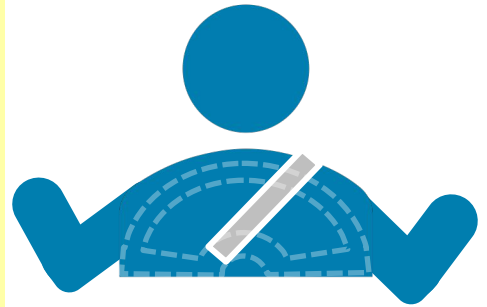
2

Partial Automation



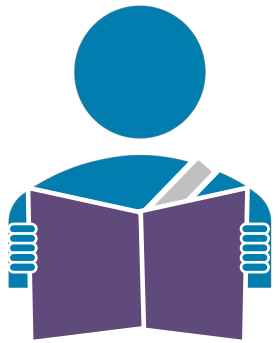

3

Conditional Automation



4

High Automation



5

Full Automation

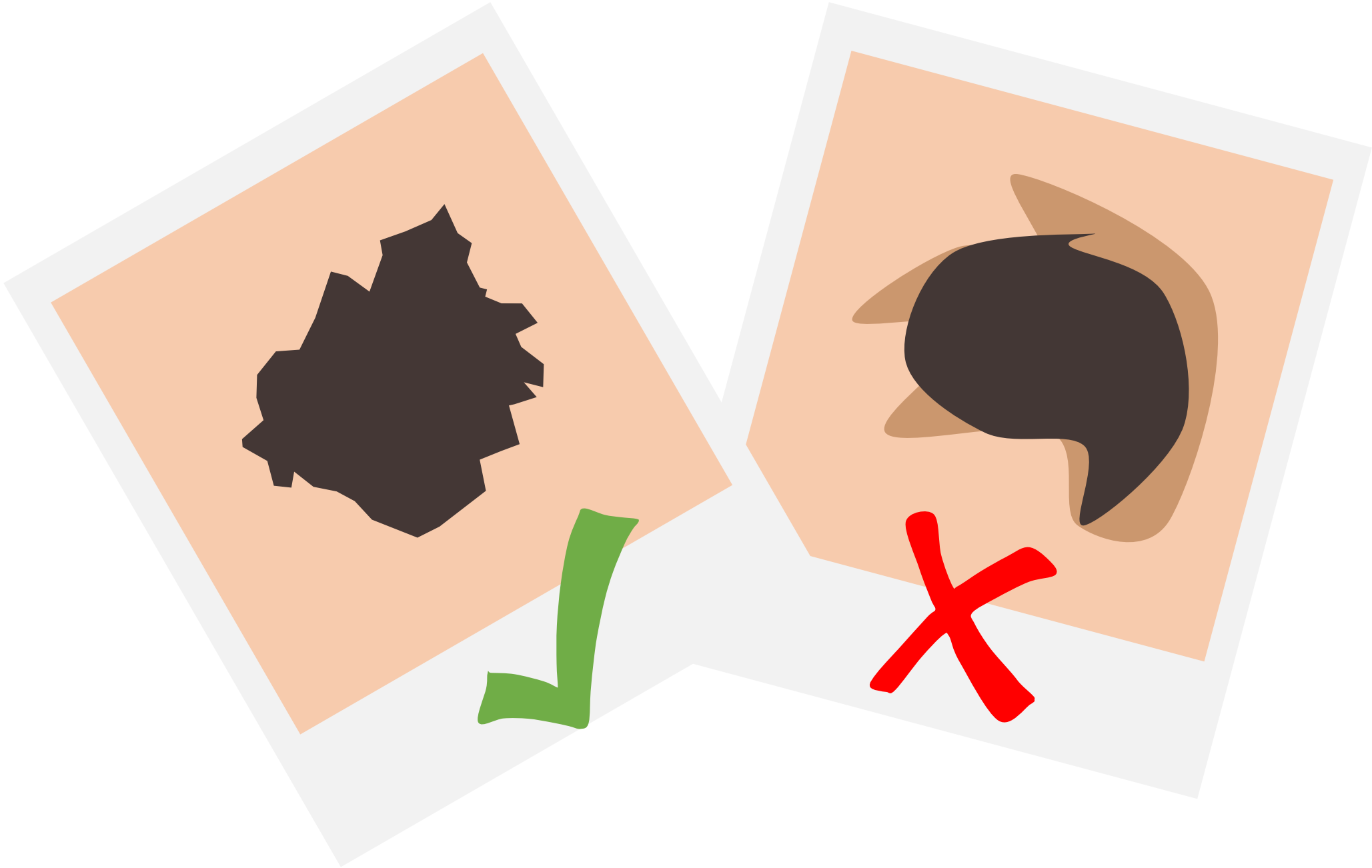
**Human** Monitors Driving Environment

**AI** Monitors Driving Environment

SAE International (2014) Automated Driving – J3016. Retrieved from: https://web.archive.org/web/20170903105244/https://www.sae.org/misc/pdfs/automated_driving.pdf.

# How Do We Avoid This?

# Sensitivity and Specificity

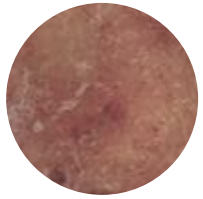


# Good

Cellular Blue Nevus

Angioma

Lentigo



Eczema

Acne Vulgaris

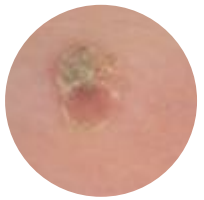
Pyogenic Granuloma

Mild Dysplasia

Dermatofibroma

Moderate Dysplasia

# Bad



Actinic Keratosis

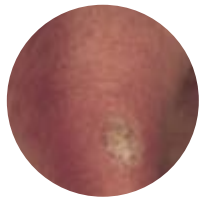
Basal Cell Carcinoma

Seborrheic Keratosis

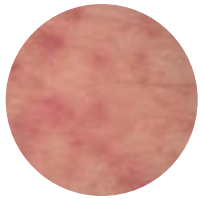
Keratoacanthoma

Melanoma

Severe Dysplasia



Squamous Cell Carcinoma

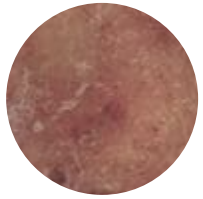


Leukocytoclastic Vasculitis

# Good

Cellular Blue Nevus

Angioma



Eczema

Acne Vulgaris

Pyogenic Granuloma

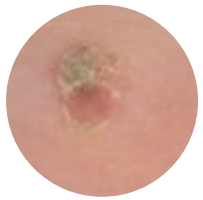
Mild Dysplasia

Dermatofibroma

Moderate Dysplasia

# Bad

Lentigo



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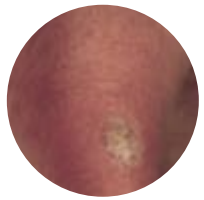
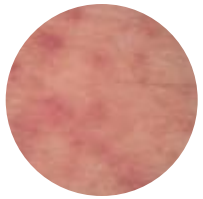


Squamous Cell Carcinoma



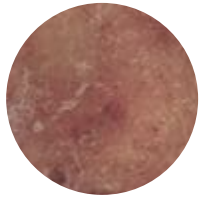
Leukocytoclastic Vasculitis

# Good


Cellular Blue Nevus


Angioma


Lentigo


Eczema


Acne Vulgaris


Pyogenic Granuloma

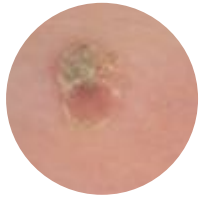

Mild Dysplasia


Dermatofibroma


Moderate Dysplasia

# Bad


Basal Cell Carcinoma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Seborrheic Keratosis


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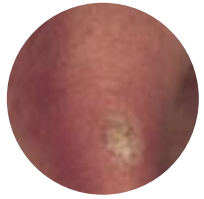
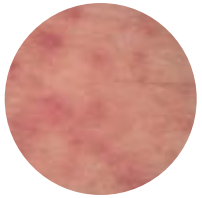
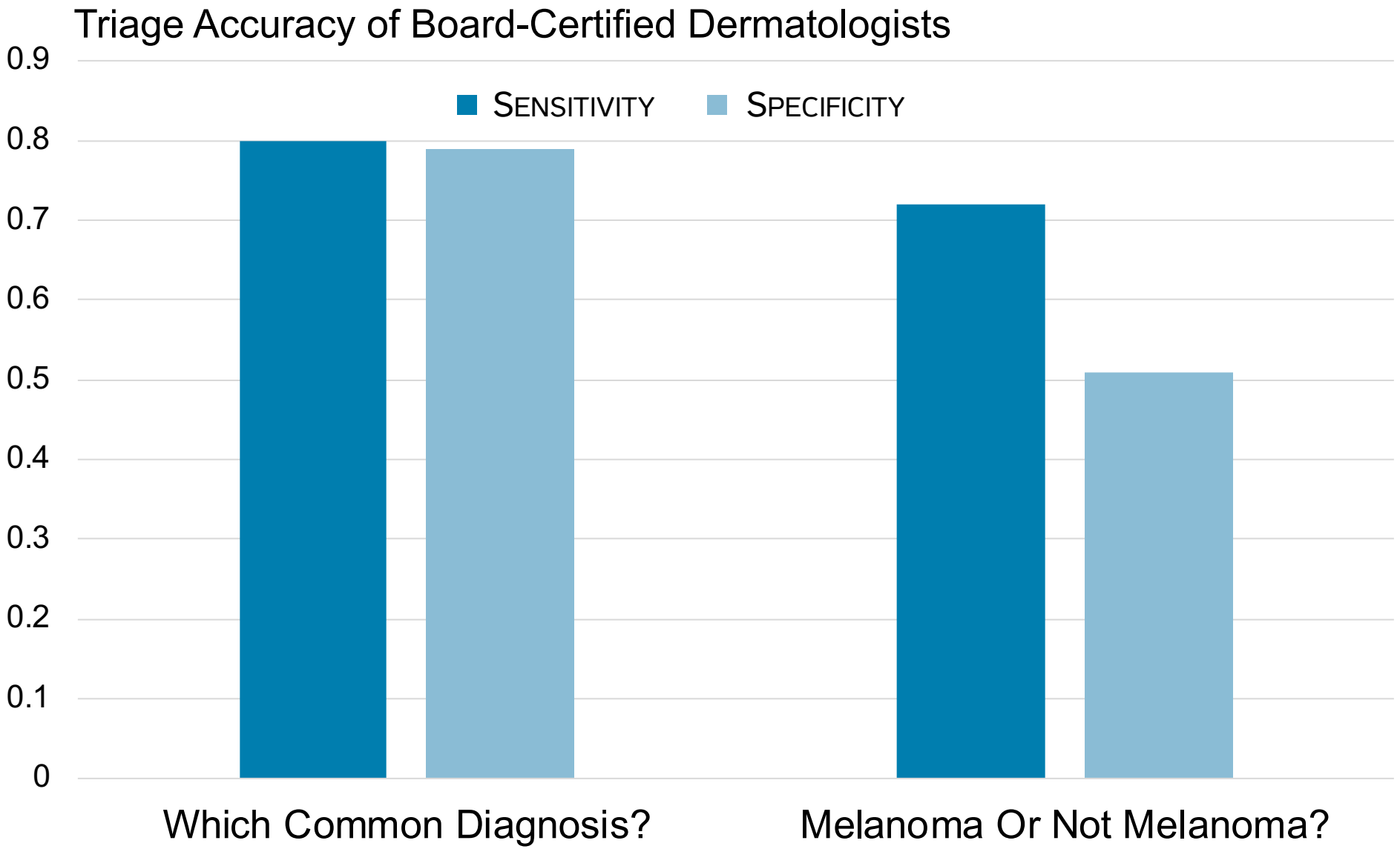
Melanoma


Severe Dysplasia


Squamous Cell Carcinoma


Leukocytoclastic Vasculitis

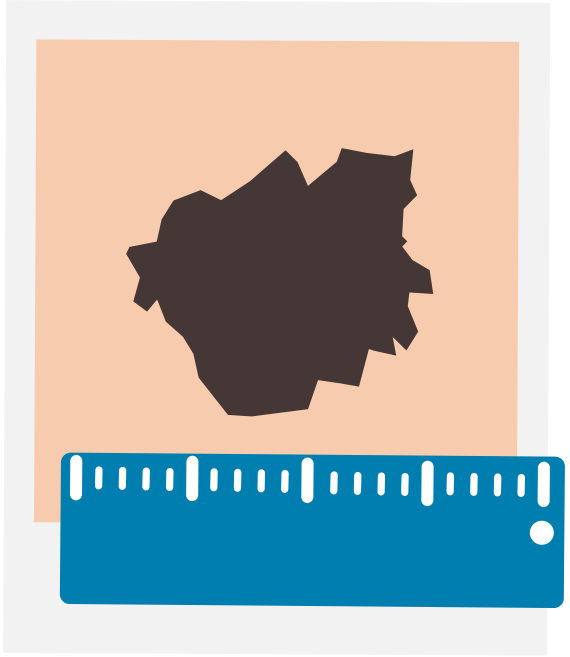
# What Accuracy is the Right Accuracy?




Sources: (1) Esteva et al. Dermatologist-level classification of skin cancer w/ deep neural networks. *Nature* **542**, 115-118 (2017); (2) MelaFind Package Insert. October 31, 2011.

# Using Systems in the Real World

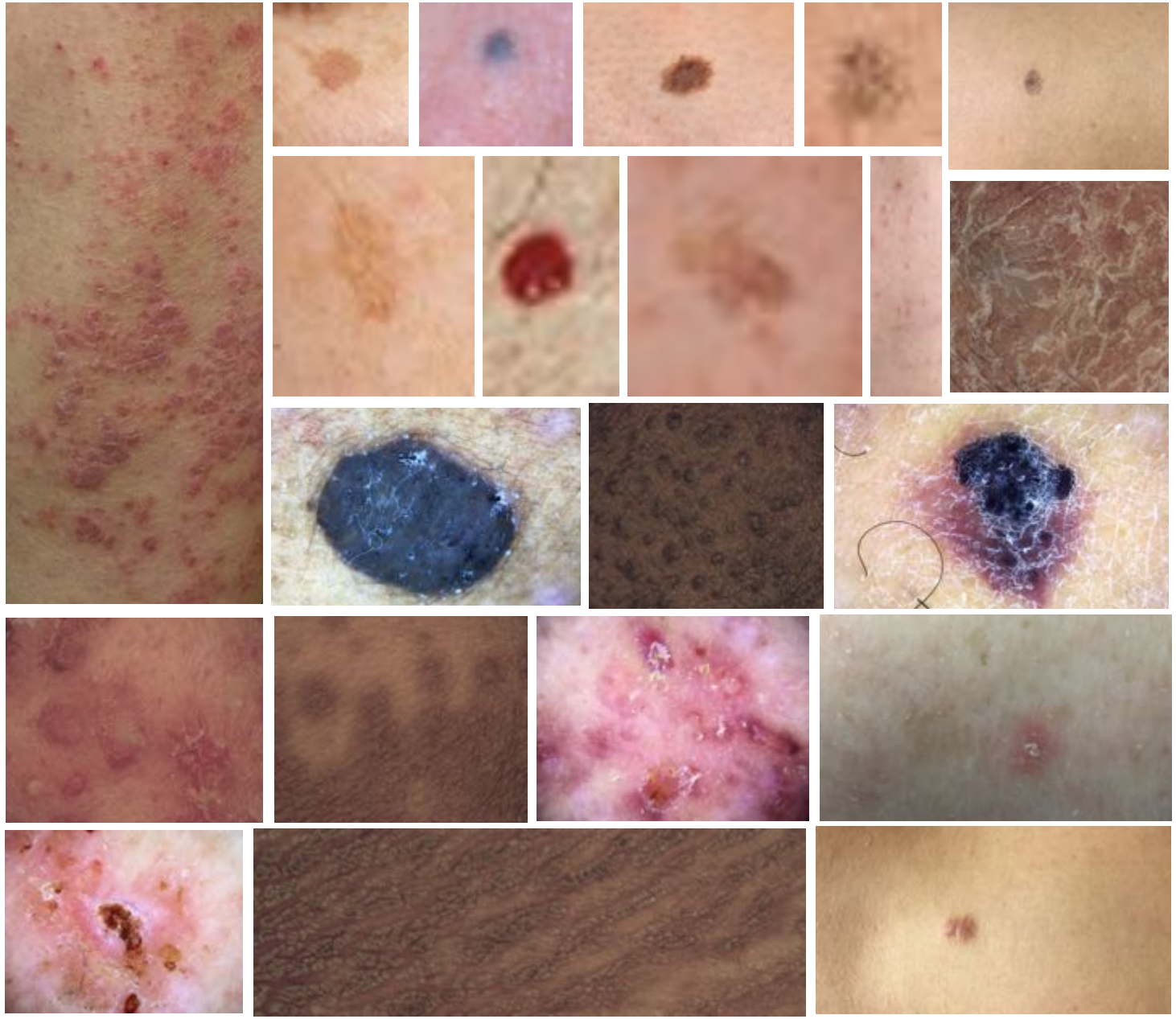
Non-Specialist Users



Real-World Clinical Data

Inclusive Training Data

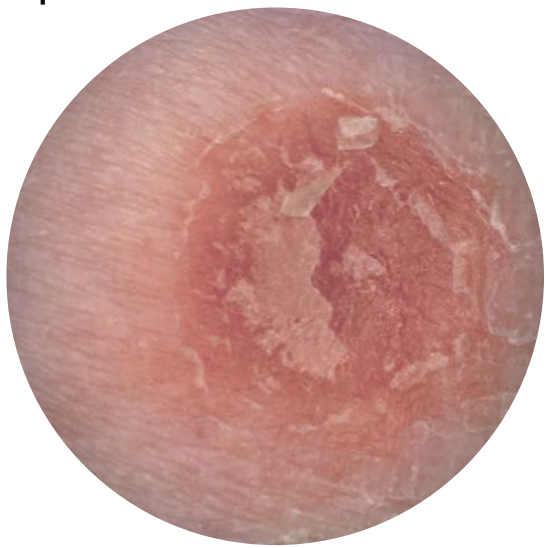
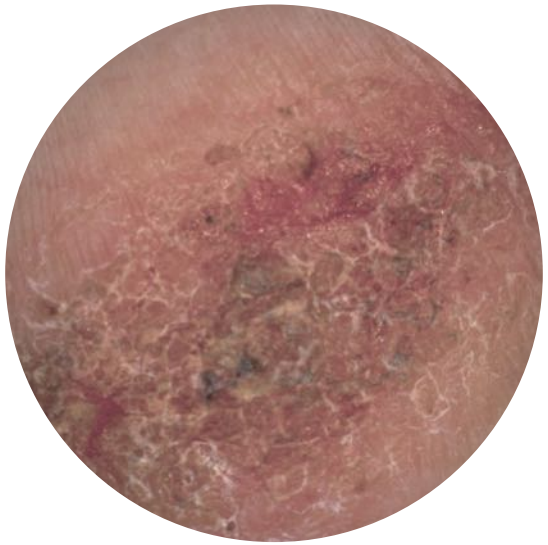
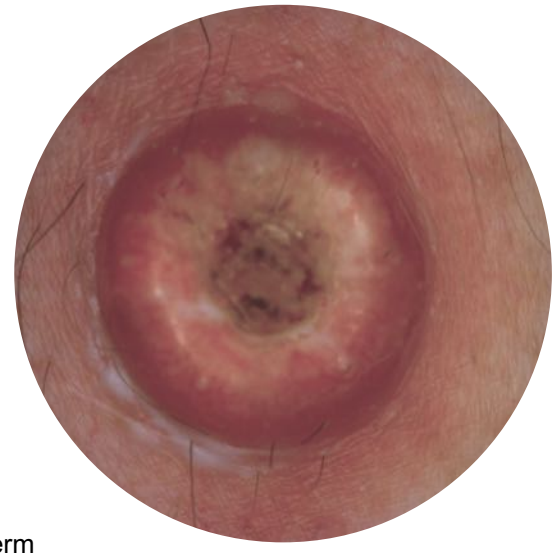
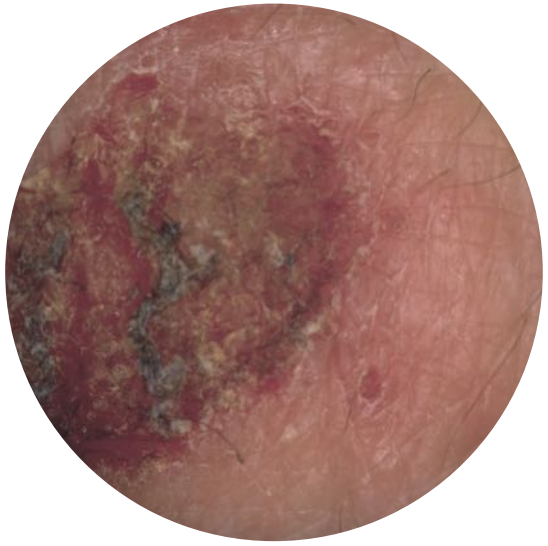
# Non-Specialist User



# Textbook Quality




Source: (1) https://en.wikipedia.org/wiki/Melanoma; (2) Esteva et al. Dermatologist-level classification of skin cancer w/ deep neural networks. *Nature* **542**, 115-118 (2017); (3) 3Derm

| Different Visually<br>Same Diagnosis | Same Visually<br>Different Diagnosis | Different Visually Based on Epidemiological Factors<br>Same Diagnosis |
| --- | --- | --- |
| Squamous Cell Carcinoma | Nummular Dermatitis | T-Cell Lymphoma |
|  |  |  |
| Squamous Cell Carcinoma | Impetigo | T-Cell Lymphoma |
|  |  |  |

Source: 3Derm

HEALTH

# AI-Driven Dermatology Could Leave Dark-Skinned Patients Behind

Machine learning has the potential to save thousands of people from skin cancer each year—while putting others at greater risk.

ANGELA LASHBROOK AUG 16, 2018

"'If you don't teach the algorithm with a diverse set of images, then that **algorithm won't work out in the public that is diverse**,' says Adamson. "So there's risk, then, for **people with skin of color to fall through the cracks**."

Lashbrook, A. (2018, August 16). AI-Driven Dermatology Could Leave Dark-Skinned Patients Behind. The Atlantic. Retrieved from: https://www.theatlantic.com/health/archive/2018/08/machine-learning-dermatology-skin-color/567619/

# FITZPATRICK SCALE

I II III IV V VI

# Controlling for the Entire Optical System

JAMA Dermatology

Consensus Statement

May 2017

# Proposed Technical Guidelines for the Acquisition of Clinical Images of Skin-Related Conditions

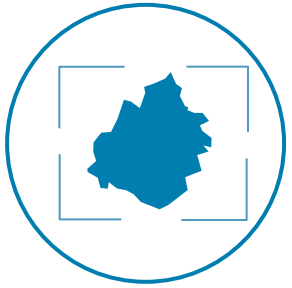
Anna Finnane, PhD[1,2]; Clara Curiel-Lewandrowski, MD[3,4]; Glen Wimberley, BDES[1]; et al

» Author Affiliations

*JAMA Dermatol.* 2017;153(5):453-457. doi:10.1001/jamadermatol.2016.6214

## Standardized Images

Overview



Macro images

Dermatoscope for pigmented lesions

## Standardized Protocols

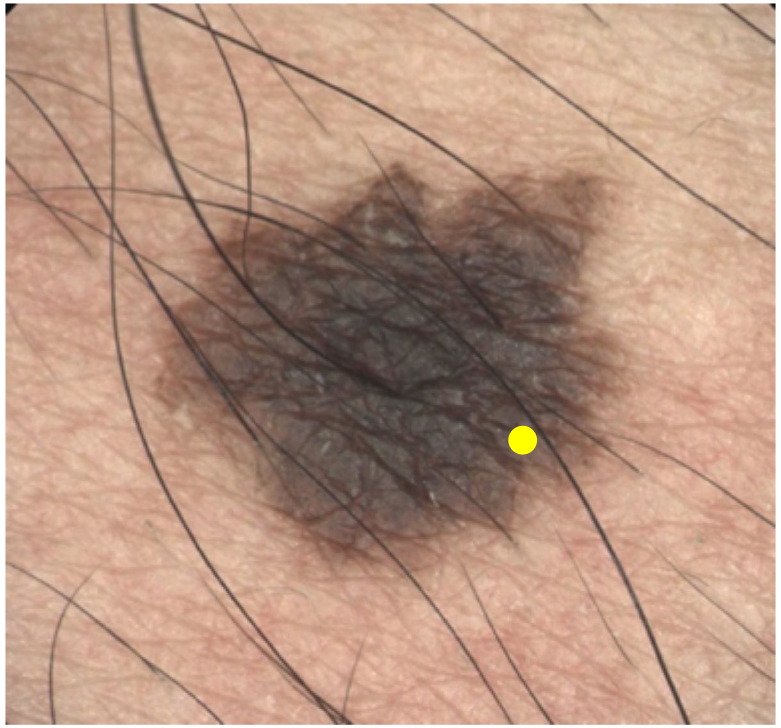
Anatomic diagrams

Customized per condition type

Reducing shadows

# Algorithms require tight constraints on input

No Malignancy Detected



Malignancy Detected

# Future

BUSINESS NEWS MAY 20, 2019 / 1:38 PM / 6 DAYS AGO

# Tesla stock and bonds tumble as investors fret about costs and safety

Noel Randewich

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## Wall Street is split on self-driving cars


THE WALL STREET JOURNAL.

# Self-Driving Cars Encounter Political Roadblocks

New York City raises safety concerns, delaying GM tests; Pittsburgh tightens oversight of the vehicles

Los Angeles Times

AUTOS BUSINESS

# The American public is still very afraid of self-driving cars, survey finds

By KEITH NAUGHTON | BLOOMBERG | MAR 15, 2019 | 1:55 PM