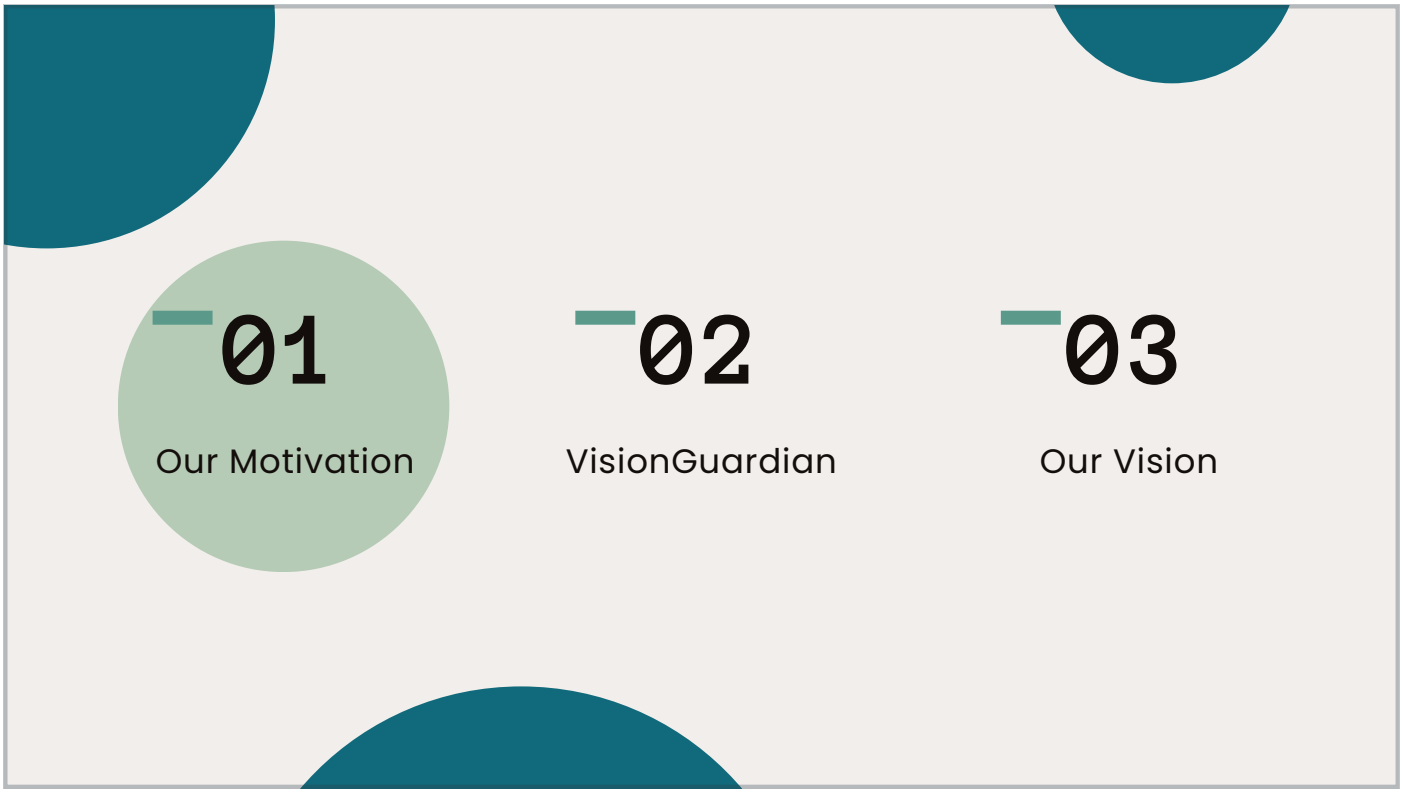
Team 11
AI/ML Track 3

We present our product
Vision Guardian,
an app designed to help you assess your eye health conveniently and on time.

This is our team

I'm Jiwoo,
my teammates are Tameem, Macro, Emily, Thomas, and our mentor Deahan.

Our theme was Physical Health and Mental Well-being management.



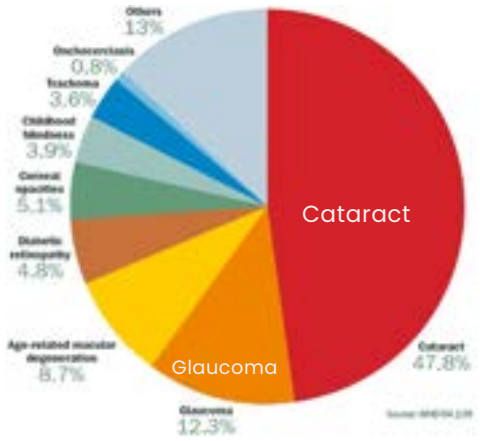
- Grandfather lost vision due to age-related macular degeneration,
he having a hard time
doing basic daily tasks, like walking, calling, etc.

- Since eye issues are genetic, my mom took tests although she did not have any symptoms

- Glaucoma, which will ultimately lead to vision loss unless it is slowed down after early detection

- Is there a way people can easily check eye-health status whenever they can?

OUR THREATS



Disease responsible for both-eyes blindness.

285M+
globally suffer from visual impairment

75%+
blindness could be prevented

76M+
People are affected by **glaucoma**, globally.

Nearly **50%**
Of blindness cases, caused by **cataract**

Source: 2020 Vision Initiative

Let's talk about numbers

Visual Impairment is a significant global issue that affects over 285 million people, which makes sense.
- smartphone, laptop, from morning to night, threats are inevitable.

YET,
75% of blindness cases are preventable upon early detection including cataract and glaucoma.

We'd like to promote the early detection of these issues.

GLAUCOMA AND CATARACTS

GLAUCOMA?

Group of Diseases
Fluid Pressure
Silent Killer

Healthy

Glaucoma

CATARACT?

Cloudiness of eyes
Variety of Causes
Treatable with surgery

Healthy

Cataract

Around 50% of glaucoma cases remain undiagnosed globally due to lack of awareness and access to eye care.

Regular eye exams can help detect glaucoma early

Cataracts are when proteins in the eye's lens clump together and block light from reaching the retina

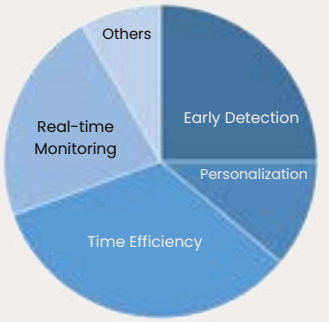
This causes vision to be hazy and blurry, and aging is the primary cause. However, things like UV Exposure, smoking and diabetes can accelerate the development.

MARKET RESEARCH

Strong Trust in AI-based diagnosis

80% said "confident" in accuracy & reliabilty

End-user Expectation



OUR COMPETITORS

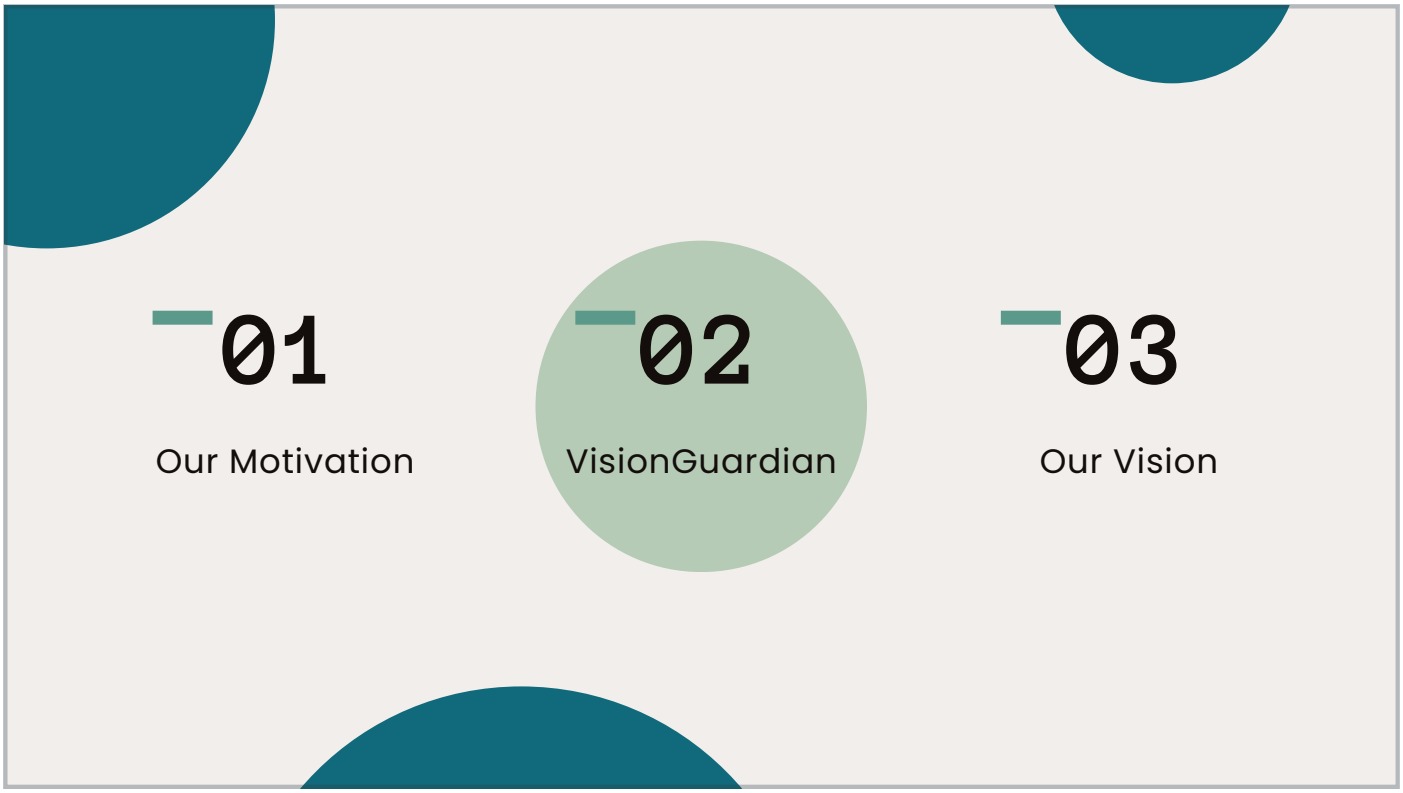
- Acuity Tests
- ScanMyEye
- Empty Market

80% of individuals consider time efficiency as the primary benefit of our app.

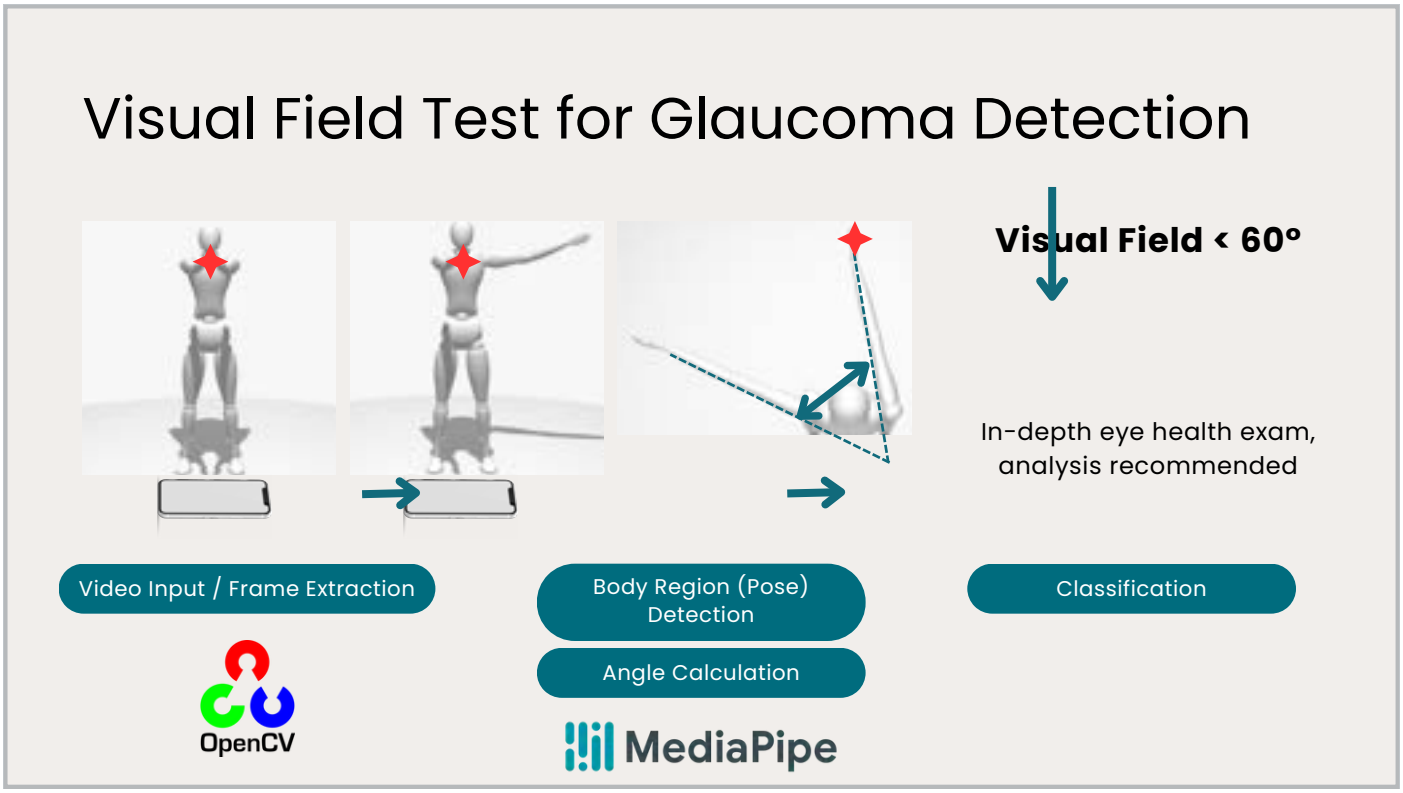
60% of respondents view early detection as a crucial concern, and 53.3% prioritize real-time monitoring.

80% of potential users expressed varying levels of trust. facilitate a connection between you and medical professionals whenever needed.

Other eye scan and eye test apps only provide acuity tests



AI-aided Features



Visual Field test

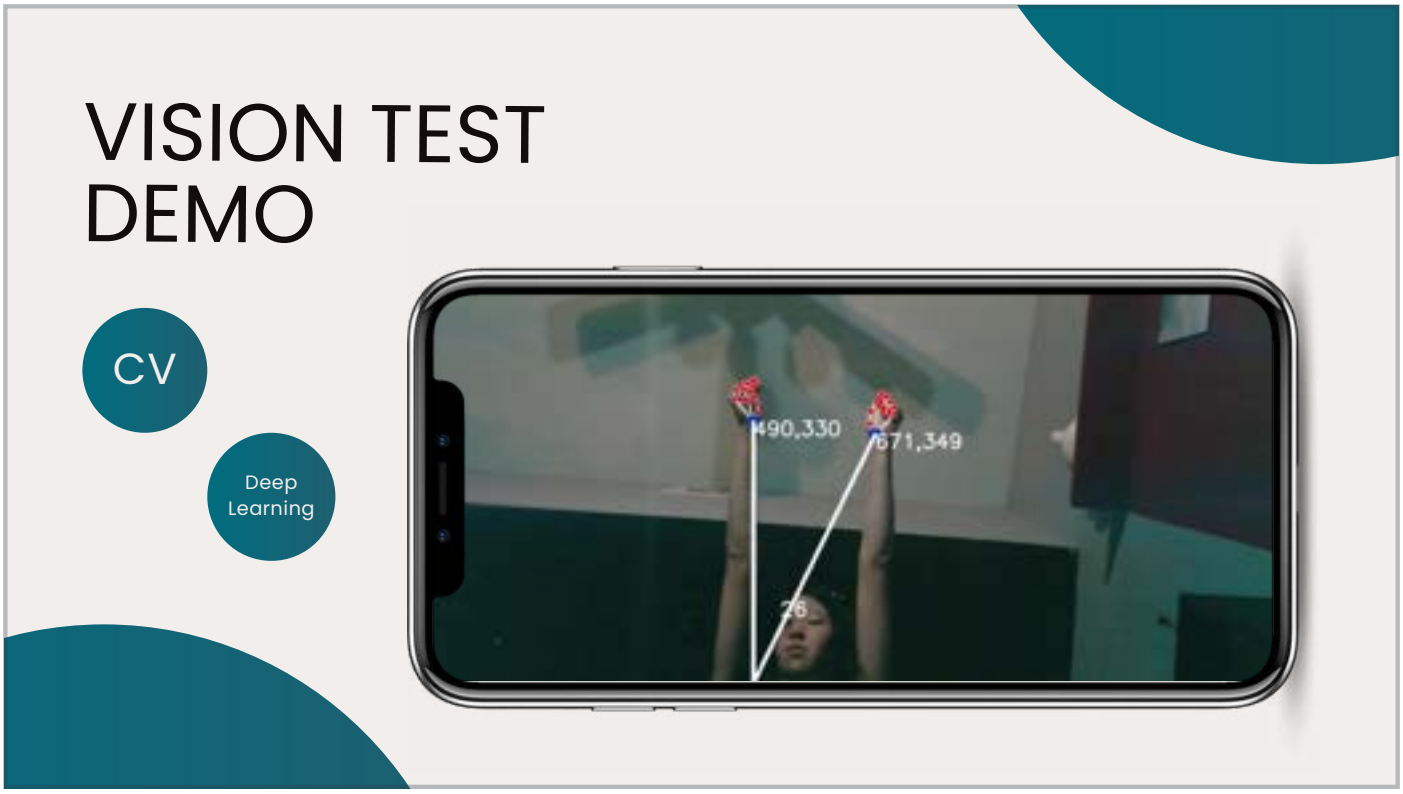
This test could tell the user whether
side vision loss
due to glaucoma has happened or not

We prompt users to
- Stretch two arms in front, thumbs up
- Close one eye
- fan out one arm until they can't see the thumb anymore

- Angle between two arms = visual field, normally 60 degs
- If <<, user may suspect glaucoma

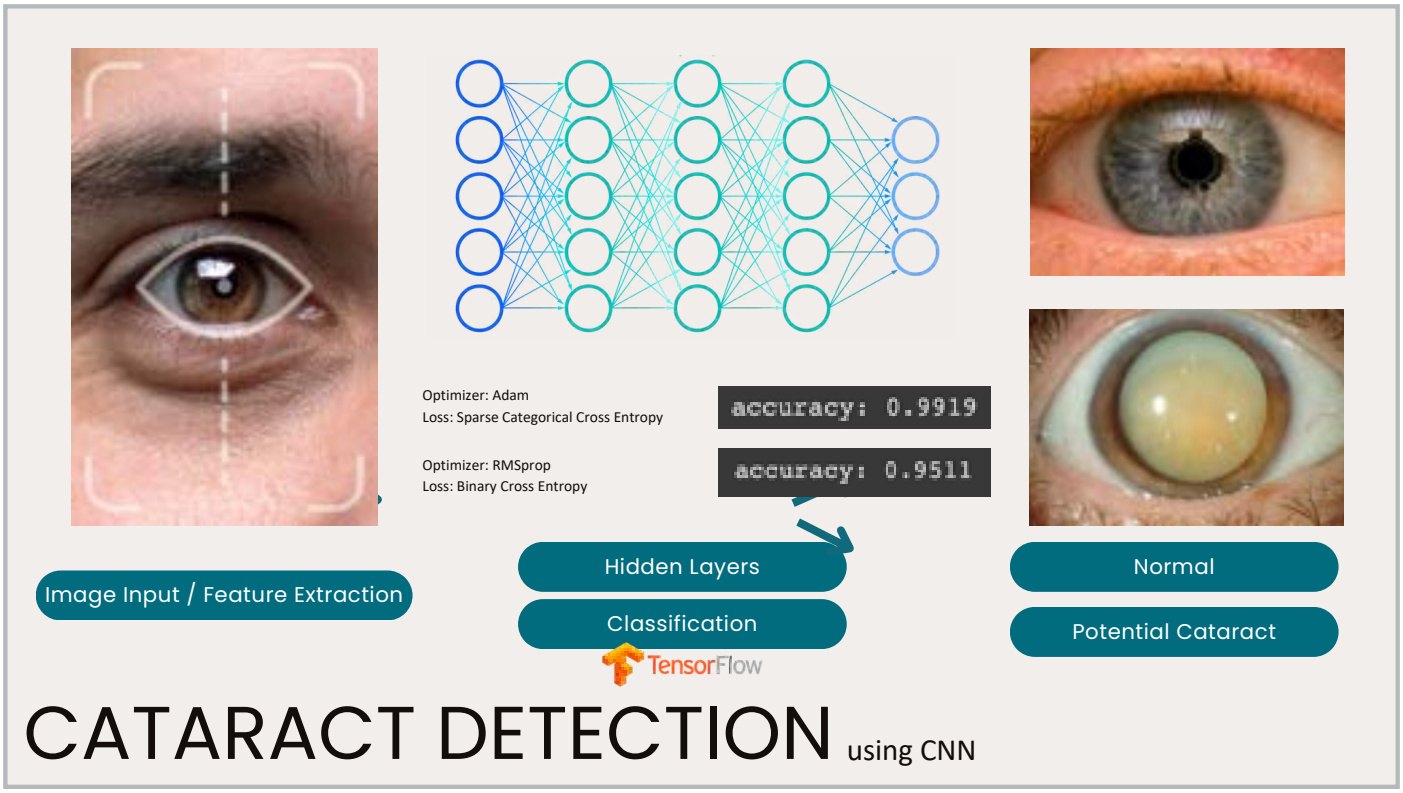
To implement algo,
first
- Processed real-time video data from a camera placed on the ground

second
- the model
detected and tracked hand to get coordinates for angle calculation



Open Computer Vision Library
- image data processing

body/ hand region detection
- Convolutional NN based Deep Learning model
Google ML Solution library MediaPipe



features
1. user takes a picture of eye
2. machine learning model using Adam optimizer and sparse cross-entropy using tensorflow

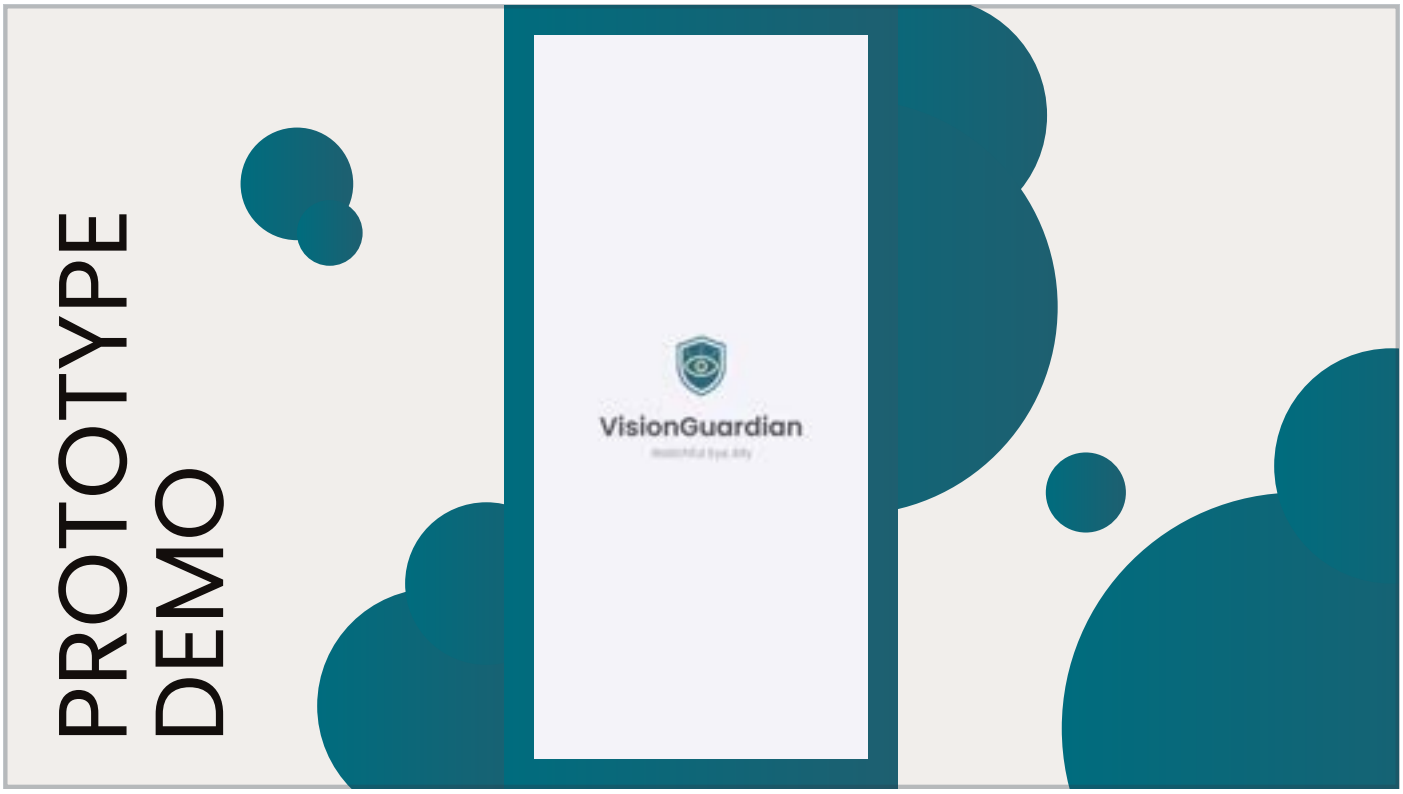
convolutional neural network
3. detection can differentiate between normal and cataract

- can detect potential cataracts for those who cannot afford optometrists
- users can obtain information and can take preventative measures and have

Marco explains different models and accuracy rates .99 adam + cross 0.95 rmsprop + binary

So here's a preview of our product cover image.

Now let's go ahead and move on to the next slide to see a demo video of our mobile app prototype.



Upon opening up the app, the user will be greeted with a nice, friendly onboarding screen. This gives a brief overview of the app and its features.

Now moving on to the homepage, since this is a hypothetical new user, there will be a prompt to begin a new scan. Let's go ahead and do that.

Here, we're given a modal with instructions on how the scanning process words. On this step, we will be scanning the eyes for cataracts

We'll start with a picture of our left eye, followed by our right eye.

And now for the second part, the user will be doing a screening test for glaucoma. There will be more instructions for what the user needs to do along with a little animation up top.

So first, we'll need to place our phone on the ground and click next.

Now we'll need to start recording and step in frame.

Afterwards, we'll need to move our left arm away from the center until it's no longer visible.

Followed by the right arm.

And once we're done, we can step away and stop the recording.

Here, we can optionally review the recording or redo it if necessary.

Now the app will take some time to process the information.

And finally, we'll be back on the main page showing a quick summary of the results, where we may optionally click on the cards for more details.

ETHICAL CONSIDERATIONS

Privacy and Transparency

- VisionGuardian does not require users to create an account
- Users will be fully informed what types of data will be collected

Confidentiality

- Data collected from users will not be shared with any other third parties or without consent
- If data is shared, it will remain anonymous

Accessibility and Bias

- Completely free
- Larger training data
- Quality datasets from trustworthy sources

The Ethical Matrix

Group (users)	Wellbeing	Autonomy	Fairness
Youth (under 25)	Health maintenance	Automation bias	Data quality and representativeness
Adults (25-50)	Preventative care and pre-diagnosis	Confidentiality	Privacy and transparency
Elderly (50 older)	Quality preventative care	Non-discriminatory	Ease of usage and accessibility

unlike real doctors, HIPAA which protects sensitive patient health information from being disclosed without the patient's consent or knowledge, does not apply to AI

1) transparency (like users will be fully informed what types of data will be collected

2) confidentiality (like data collected from users will not be shared with any other third parties or without consent.)

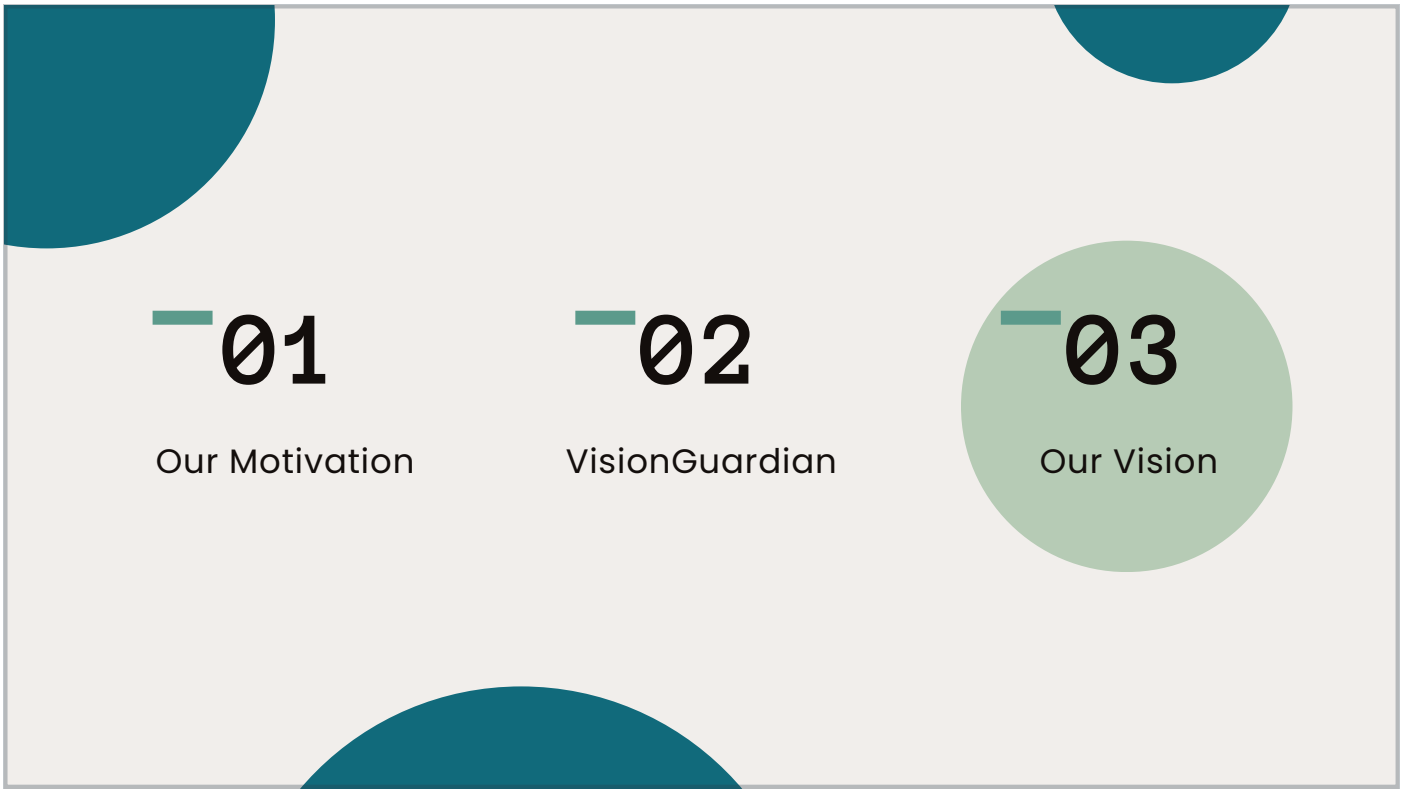
if data are shared, we will de-identify all the data according to PHI (personal identifiable information: examples are names, MRNs, addresses, phone numbers, etc) as well as the image data like masking the face

IMPACT

- Under Privileged Communities
- Third World Countries
- Heavy Economic and Social Impacts

"When I got an eye infection from a local water fountain on a run, I didn't know what to do. Something like VisionGuardian would've been helpful in alerting me of potential causes and calming my anxiety about the fact that I didn't know what was happening. Instead, Google was telling me that I was dying and I had cancer."

- Danelle, High School Senior, Avid Runner



Introduce our future directions

such as providing suggestions by relating available user data to the result.

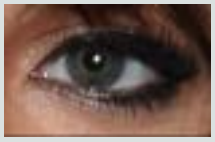
- for cataract

CATARACT DETECTION

FUTURE: IN DEPTH

Now

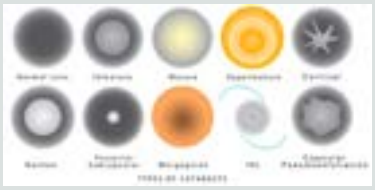
Cataract



Normal

Binary Classification

Future



Stages of Cataract

Regression

THANK YOU!

VisionGuardian

Watchful Eye Ally