



# visionairy

AI Copilot for Eye Doctors

 Realtime Summarization and Chat

•  Diagnostic Assistance

•  Automated Documentation

## Executive Team



**Mac Singer, MD**  
Co-Founder  
Ophthalmology Resident and AI  
Researcher



**Qingyu Chen, PhD**  
Scientific Co-Founder  
Assistant Professor of Biomedical  
Informatics and Data Science

## Advisory Team



**Lucila Ohno-Machado MD, MBA, PhD**  
Chair, Department of Biomedical Informatics  
and Data Science



**Hua Xu, PhD**  
Vice Chair, Department of  
Biomedical Informatics and Data  
Science

## Execution Team



**Zhenyue Qin, PhD**  
Leading Multimodal AI  
Postdoctoral Associate



**Anran Li, PhD**  
Leading Trustworthy AI & Federated  
Learning  
Postdoctoral Associate



**Xuguang Ai, MS**  
Leading Software Development  
Software Engineer



**Luciano V. Del Priore, MD, PhD**  
Chair, Ophthalmology

# Team Experience

3

patents for AI assisted eye diagnosis and visual detection

## Foundation Models

5+ foundation language models for medicine

20+

tools for medical professionals and biologists

## Publications

Published in top journals including:  
Nature, Nature Medicine, Nature Machine Intelligence,  
Nature Aging, NPJ Digital Medicine

10+

AI models developed for eye care

## Clinical Validation

Randomized controlled trial with large language model  
Implementation in 10 sites with 2.6k participants

## Schedule

	Time	Age/Gender	Visit Type	EC Status	YM Eye Events
	7:45 AM	62 y.o. / M	Post Op	Sch	Scheduled
	8:00 AM	74 y.o. / F	New Catara...	Sch	Scheduled
	8:15 AM	50 y.o. / M	Post Op	Sch	Scheduled
	8:15 AM	50 y.o. / M	New Patient	Sch	Scheduled
	8:30 AM	76 y.o. / F	Return Dilation	Sch	Scheduled
	8:30 AM	39 y.o. / M	Return	Sch	Scheduled
	8:45 AM	64 y.o. / F	Return	Sch	Scheduled
	8:45 AM	67 y.o. / M	Return Dilation	Sch	Scheduled
	9:00 AM	66 y.o. / F	Post Op	Sch	Scheduled
	9:00 AM	72 y.o. / F	Post Op	Sch	Scheduled
	9:15 AM	85 y.o. / F	Post Op	Sch	Scheduled
	9:15 AM	79 y.o. / F	Return	Sch	Scheduled
	9:30 AM	75 y.o. / F	Return	Sch	Scheduled
	9:30 AM	59 y.o. / M	New Patient	Sch	Scheduled
	9:45 AM	84 y.o. / F	Return Dilation	Sch	Scheduled
	9:45 AM	76 y.o. / M	Return Dilation	Sch	Scheduled
	10:00 AM	83 y.o. / F	Return	Sch	Scheduled
	10:15 AM	73 y.o. / M	Return Dilation	Sch	Scheduled
	10:15 AM	71 y.o. / M	Post Op	Sch	Scheduled
	10:30 AM	81 y.o. / M	Return	Sch	Scheduled
	10:30 AM	76 y.o. / F	Post Op	Sch	Scheduled
	10:45 AM	61 y.o. / M	Return	Sch	Scheduled
	12:15 PM	78 y.o. / F	Mychart Vid...	Sch	Scheduled
	12:45 PM	80 y.o. / F	Post Op	Sch	Scheduled
	12:45 PM	75 y.o. / F	Post Op	Sch	Scheduled
	1:00 PM	86 y.o. / F	Post Op	Sch	Scheduled
	1:00 PM	84 y.o. / F	New Patient	Sch	Scheduled
	1:15 PM	84 y.o. / M	New Patient	Sch	Scheduled
	1:15 PM	69 y.o. / F	Post Op	Sch	Scheduled
	1:30 PM	41 y.o. / M	Return	Sch	Scheduled
	1:30 PM	77 y.o. / M	Return	Sch	Scheduled
	1:45 PM	84 y.o. / M	New Patient	Sch	Scheduled
	2:00 PM	72 y.o. / F	Return	Sch	Scheduled
	2:15 PM	64 y.o. / F	Return Dilation	Sch	Scheduled
	2:30 PM	71 y.o. / M	Return	Sch	Scheduled
	2:45 PM	20 y.o. / F	Return Dilation	Sch	Scheduled
	3:00 PM	62 y.o. / F	Return	Sch	Scheduled
	3:15 PM	62 y.o. / M	Return	Sch	Scheduled
	3:15 PM	84 y.o. / F	Return	Sch	Scheduled
	3:30 PM	56 y.o. / M	Return	Sch	Scheduled

# Typical clinic schedule for eye doctor

After entering the patient's room...

1. Review patient chart
2. Take history
3. Perform exam
4. Review imaging
5. Determine plan
6. Document



# Problem: Eye Diseases are **Missed** by Eye Doctors

## Most Common Causes of Blindness

### Macular Degeneration

196M globally (288M by 2040)

**25% missed**

### Diabetic Retinopathy

103M globally (160M by 2045)

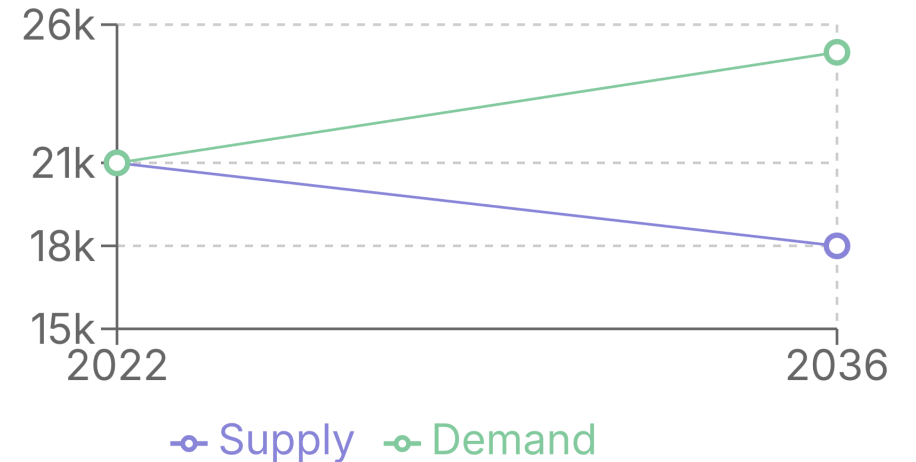
**17% missed**

### Glaucoma

76M globally (112M by 2040)

**19% missed**

## Growing Shortage of Eye Doctors



## Consequences



Delayed Diagnoses



Visual Impairment



Economic Burden

# visionairy

AI Copilot for Eye Doctors

## Input Data

### Clinical Notes

Structured and unstructured clinical documentation

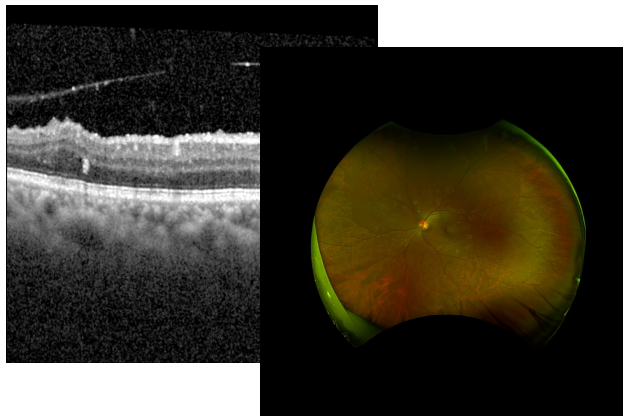
Slit Lamp Exam	
Lids/Lashes	no
Conjunctiva/Sclera	Wh
Cornea	Cle
Anterior Chamber	De

Fundus Exam	
Disc	Right
C/D Ratio	Normal
Macula	0.3
Vessels	Exudates, Hemorrhage, Microaneurysms
Periphery	Preretinal hemorrhages in macula, areas of NVE along superior/inferior arcade, NVE superonasal with venous looping. Attenuation
	Dot blot hemorrhages, flat and attached, Cotton wool spots

### Medical Imaging

OCT, fundus photos, and other diagnostic images



## Comprehensive AI Assistance

Interprets clinical data and imaging to provide real-time diagnostic support and **guardrails to limit missed diagnoses**



### EMR Integration

Integrates directly into EMR and PACS



### Multi-center Training

Generalizable model trained on data from multiple locations



### Enterprise Security

Minimize data leakage, end-to-end encryption

# Diagnostic Support and Efficiency Gains

## Intelligent Assistance



### Real-time Disease Detection

AI analysis of imaging data to catch early signs of disease



### Smart Summarization & Chat

Instant patient history synthesis and clinical decision support



### Automated Documentation

Structured note creation with billing optimization

## Key Benefits



### Enhanced Accuracy

Reduced missed diagnoses with AI support

40%

### Time Savings

Improved efficiency in patient care



### Higher Patient Volume

Safe scaling of practice capacity



### Base Eye Exam

#### Visual Acuity (Snellen - Linear)

	Right	Left
Dist cc	20/40 +2	20/20 -1
Correction: Glasses		

#### Pupils

	Pupils	APD
Right	PERRL	None
Left	PERRL	None

#### Tonometry (Applanation, 8:57 AM)

	Right	Left
Pressure	15	15

#### Visual Fields

	Right	Left
	Full	Full

#### Pachymetry (12/8/2015)

	Right	Left
Thickness	543	537

#### Extraocular Movement

	Right	Left
	Full	Full

#### Gonioscopy

	Right	Left
Temporal	3/ss/1+pig	3/ss/1+pig
Nasal	3/ss/1+pig	3/ss/1+pig
Superior	3/ss/1+pig	3/ss/1+pig
Inferior	3/ss/1+pig	3/ss/1+pig

#### Neuro/Psych

Oriented x3: Yes  
Mood/Affect: Normal

#### Dilation

Both eyes: 2.5% Neo Synephrine, 1.0% Mydracyl, 2.5% Phenylephrine @ 9:24 AM

### Progress Note

# New Patient

## Base Eye Exam

### Visual Acuity (Snellen - Linear)

	Right	Left
Dist cc	20/40 +2	20/20 -1
Correction:	Glasses	

### Tonometry (Applanation, 8:57 AM)

	Right	Left
Pressure	15	15

### Pachymetry (12/8/2015)

	Right	Left
Thickness	543	537

### Gonioscopy

	Right	Left
Temporal	3/ss/1+pig	3/ss/1+pig
Nasal	3/ss/1+pig	3/ss/1+pig
Superior	3/ss/1+pig	3/ss/1+pig
Inferior	3/ss/1+pig	3/ss/1+pig

### Pupils

	Pupils	APD
Right	PERRL	None
Left	PERRL	None

### Visual Fields

	Right	Left
	Full	Full

### Extraocular Movement

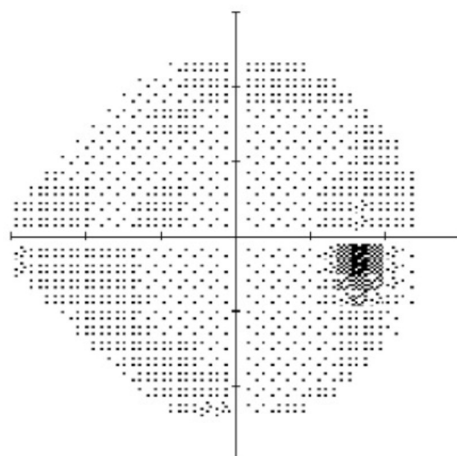
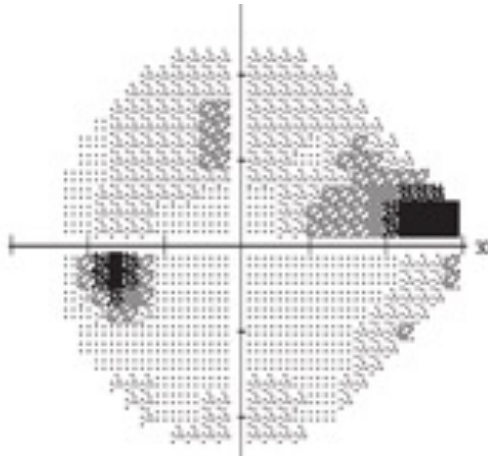
	Right	Left
	Full	Full

### Neuro/Psych

Oriented x3: Yes  
Mood/Affect: Normal

### Dilation

Both eyes: 2.5% Neo Synephrine, 1.0%  
Mydracil, 2.5% Phenylephrine @ 9:24 AM



## visionairy chat



Hi, what question do you have about eye care?

What is the differential diagnosis for a red painful eye? ➤



# Value Proposition to Eye Care Practices

## Optimize billing

**\$58**

Average reimbursement for  
vision insurance

Medical eye condition



**\$150**

Average reimbursement for  
medical insurance

**\$44K**

Annual revenue increase per practice from catching missed diagnoses on routine visit

## Improve efficiency to support higher volume

AI assistance for eye diseases improves clinician diagnostic accuracy and efficiency with  
time saving up to 40%<sup>7</sup>

# Charge Per Patient Visit

## Simple Value Proposition

**\$** ~\$24 value per patient visit - billing & efficiency

**↗** Tiered Pricing Per Patient:

\$1 for documentation assistance alone

\$4 for full clinical support

**||** Practice keeps 80+% of created value

## Clear Market Size

Optometrists **\$480M**

40,000 × 3,000 patients/year × \$4

Ophthalmologists **\$560M**

20,000 × 7,000 patients/year × \$4

## Advantages of Pricing Model

### Simplicity

Easy to understand, track, and project

### Alignment

Both parties benefit from practice growth/efficiency

### Low Risk

No fixed costs or commitments

### Cost Parity

Documentation tier on par with AI scribes

# Market Penetration Strategy

**TAM: \$1B**

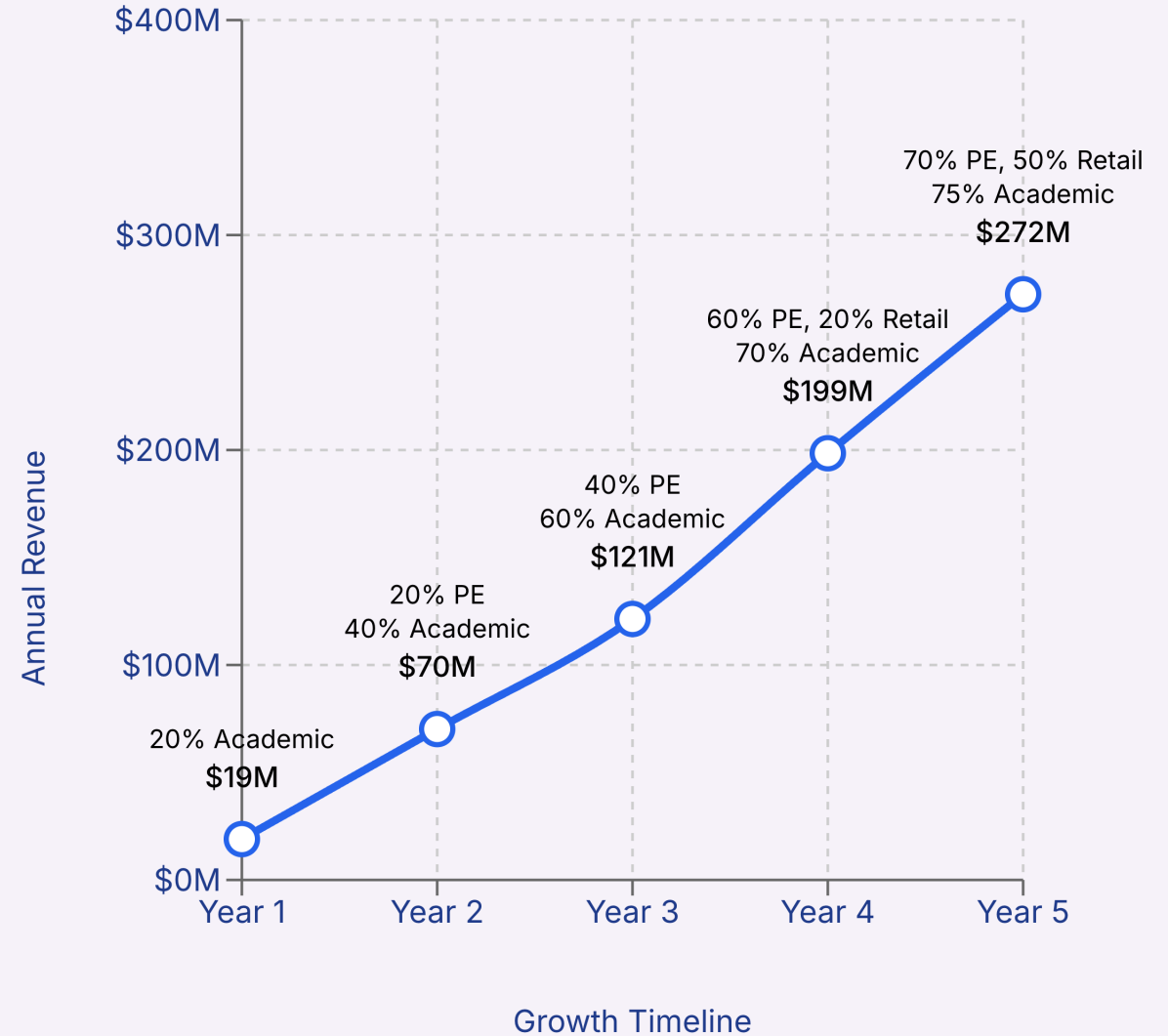
Total Market

**SAM: \$750M**

Large Practices with Advanced IT (75%)

**SOM: \$433M**

Academic Centers - Early Adopters  
Private Equity - Revenue Optimizing  
Large Optical - Standard Purchasing



# Competitive Analysis

Company	Function	Interactive	Integrated into EMR	Integrated into PACS	Specialty Specific Multimodal Foundation Model
Digital Diagnostics AEYE Health Eyenuk	Detects diabetic retinopathy in retinal photographs	✗	✗	✗	✗
Suki, Nabla Nuance, Ambience Abridge	AI scribe through ambient listening	✗	✓	✗	✗
<b>visionairy</b>	Clinical foundation model for eye care	✓	✓	✓	✓

## visionairy advantage

Interactive co-pilot for eye doctors, with efficiency value of automated documentation and clinical value of specialty specific intelligence to assist decision making

# Competitive Positioning

## Data Access

Yale + Partners  
Established Pipeline

## Method

Multimodal  
Foundation Model  
Federated Learning  
Multicenter

## Team

Domain Leading Researchers  
30 Eye Clinician Collaborators

## Patent

Patent Experience  
Writing Provisional Patent

## Technical Advantage - Key Progress

- ✓ **First open-source large language model for eye care**
  - Instruction-tuned Llama model using 4.7k cases reports, 100k abstracts
  - Outperformed GPT-4 and 7 other language models
- ✓ **First large multimodal model ophthalmology benchmark**
  - Benchmark of 5 eye imaging modalities with free-text note
  - Existing models show close-to-random performance
- ✓ **Establishing pipeline to collect data for federated learning from Yale and partners**
  - Yale: 135k patients, University of Florida: 82k, University of Washington: 12k, Stanford: 200k
  - Additional testing site at Harvard
- ✓ **Developing first multimodal model for eye care**



# Roadmap and Budget



## Milestone 1 (9 months)

**\$72,000**

### Yale development and testing

- Computational resources: \$20,000
- Post doc fellow: \$52,000



## Milestone 2 (1 year)

**\$190,000**

### Federated learning

- Computational resources: \$30,000
- Post doc fellow: \$70,000
- Integration dev: \$70,000
- Regulatory: \$20,000



## Milestone 3 (1.5 years)

Series A

### EMR integration and external clinical validation (RCT)

Budget to be raised in Series A

**Total Budget (Milestone 1 + 2): \$262,000**

# Our Vision: The Operating System for Eye Care

## Journey

1

### visionairy Copilot

Build the most advanced AI for eye care and implement first product (copilot)

2

### Comprehensive Platform

Expand into full operating system for eye care practices

3

### visionairy in a box

Complete solution for modern eye care practices

## Comprehensive AI-Powered Platform

### Clinical AI

Diagnostic assistance and documentation

### Patient Engagement

Education and compliance tracking

### Revenue Cycle

Billing optimization and management

### Call Center

AI-powered patient support

### Smart EHR

Intelligent medical records

### Patient Portal

Seamless patient interface

## Impact



Transforming private practices with modern AI-driven workflows and improved patient outcomes



Efficiency



Revenue

↓ Admin

Burden



# visionairy

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**Qingyu Chen**



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AI Copilot for Eye Doctors

# References

1. Wong WL, Su X, Li X, Cheung CM, Klein R, Cheng CY, Wong TY. Global prevalence of age-related macular degeneration and disease burden projection for 2020 and 2040: a systematic review and meta-analysis. *Lancet Glob Health*. 2014 Feb;2(2):e106-16. doi: 10.1016/S2214-109X(13)70145-1. Epub 2014 Jan 3. PMID: 25104651.
2. Teo ZL, Tham YC, Yu M, Chee ML, Rim TH, Cheung N, Bikbov MM, Wang YX, Tang Y, Lu Y, Wong IY, Ting DSW, Tan GSW, Jonas JB, Sabanayagam C, Wong TY, Cheng CY. Global Prevalence of Diabetic Retinopathy and Projection of Burden through 2045: Systematic Review and Meta-analysis. *Ophthalmology*. 2021 Nov;128(11):1580-1591. doi: 10.1016/j.ophtha.2021.04.027. Epub 2021 May 1. PMID: 33940045.
3. Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology*. 2014 Nov;121(11):2081-90. doi: 10.1016/j.ophtha.2014.05.013. Epub 2014 Jun 26. PMID: 24974815.
4. Neely DC, Bray KJ, Huisingh CE, Clark ME, McGwin G, Owsley C. Prevalence of Undiagnosed Age-Related Macular Degeneration in Primary Eye Care. *JAMA Ophthalmol*. 2017;135(6):570–575. doi:10.1001/jamaophthalmol.2017.0830
5. Pugh JA, Jacobson JM, Van Heuven WA, Watters JA, Tuley MR, Lairson DR, Lorimor RJ, Kapadia AS, Velez R. Screening for diabetic retinopathy. The wide-angle retinal camera. *Diabetes Care*. 1993 Jun;16(6):889-95. doi: 10.2337/diacare.16.6.889. PMID: 8100761.
6. Grørdum K, Heijl A, Bengtsson B. A comparison of glaucoma patients identified through mass screening and in routine clinical practice. *Acta Ophthalmol Scand*. 2002 Dec;80(6):627-31. doi: 10.1034/j.1600-0420.2002.800613.x. PMID: 12485284.
7. Data from National Center for Health Workforce Analysis of the US Department of Health and Human Services
8. <https://arxiv.org/pdf/2409.15087>

# Appendix



# Sell to Eye Care Practices

## Optimize billing

**\$58**

Average reimbursement for vision insurance

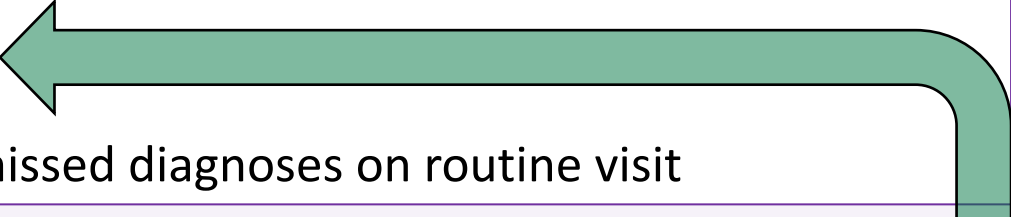


**\$150**

Average reimbursement for medical insurance

Medical eye condition

**\$44K**



Annual revenue increase per practice from catching missed diagnoses on routine visit

**12k**

**x**

**20%**

**x**

**20%**

**x**

**\$92**

Average number of annual patients per practice

Patients with glaucoma, AMD, diabetic retinopathy, or other medical eye condition

Missed diagnosis

Higher revenue from medical insurance compared to vision insurance

## visionairy Value Per Patient

Revenue per patient: Optometry: \$141, Ophthalmology: \$180

+10% efficiency gains +5% billing gains = \$21 optometry, \$27 ophthalmology

<https://www.carecredit.com/sites/pc/pdf/optometry-trends-report.pdf>

<https://www.healio.com/news/ophthalmology/20190918/focus-on-officebased-practice-can-significantly-increase-revenue>

## SOM calculations:

17% ophthalmologists in academic medical centers: Market size = 17% x 560M = 95 million

16% optometrists and 15% ophthalmologists practicing under private equity in 2022: Market size = 17% x 480M + 15% X 560M = 161 million

Largest optical retail players = 4500 vision source + 2173 Luxottica + 1354 national vision holdings + 3422 Walmart + 700 eyecare partners + 555 Costco + 852 MyEyeDr + 745 Visionworks + 200 Warby Parker + 284 Keplr = 14785 optometrists \* 3000 patients \* \$4 = 177 million

# Eye care models developed by team

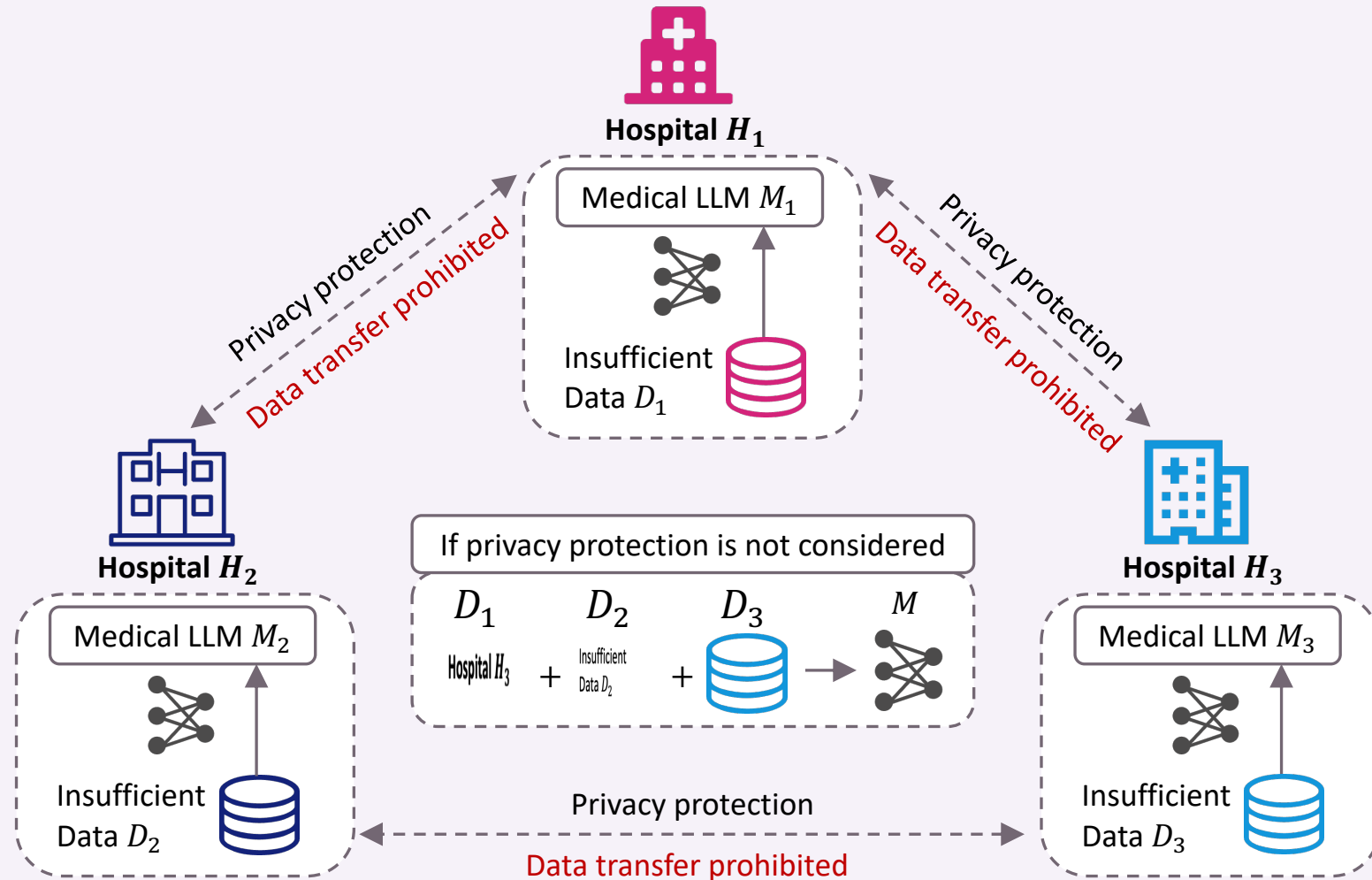
- 2018 DeepSeeNet: First open-sourced AMD severity classification/diagnosis, Ophthalmology, NLM Honor Award
- 2019 DeepAMDPrognosis: AMD prognosis prediction tool, Nature Digital Medicine
- 2020 Multi-Modal RPD-Net for reticular pseudodrusen detection, JAMIA, NIH FARE Award
- 2021 DeepLensNet for Cataract quantitative classification, Ophthalmology
- 2022 Deep-GA-Net for geographic atrophy diagnosis, Ophthalmology Science
- 2022 Retinal scan for predicting myocardial infarction, Nature Machine Intelligence
- 2023 DeepOpacityNet for explainable Cataract diagnosis, Ophthalmology
- 2023 Downstream accountability validation on Cataract diagnosis Nature aging
- 2024 LEME: First open-sourced Language Language Model for Eye Care
- 2024 LMOD: First Large Multimodal Model Ophthalmology Benchmark
- 2024 Clinic workflow implementation on AI-assisted eye disease diagnosis & validation with 24 clinicians from 12 institutions. NLM Honor Award. NIH FARE Award

# Foundation models developed by team

- Developed first sets of deep learning-based language models for medicine
  - BioWordVec, Scientific Data 2019
  - BioSentVec, IEEE ICHI 2020
  - BioConceptVec, PLOS Computational Biology 2020
  - Multi-task BLUEBERT, ACL BioNLP 2022
  - Bioformer, First efficient transformer in production for processing 35 million literature daily 2024
- Recent LLM development and deployment
  - Me Llama, First LLM pretrained on clinical notes 2024
  - Establish the first systematic evaluation of LLMs in medicine on 12 benchmarks. Nature Communications 2024
  - Developed retrieval augmented generation to reduce the hallucination of LLMs in medicine up to 90%. Bioinformatics. 2024
  - Developed an LLM-Nurse collaboration framework from 10 sites and deployment of with RCT with 2.6K participants, Nature Medicine, 2024
- Four top-ranked performance in medical informatics challenge tasks



# Federated Medical Large Language Models



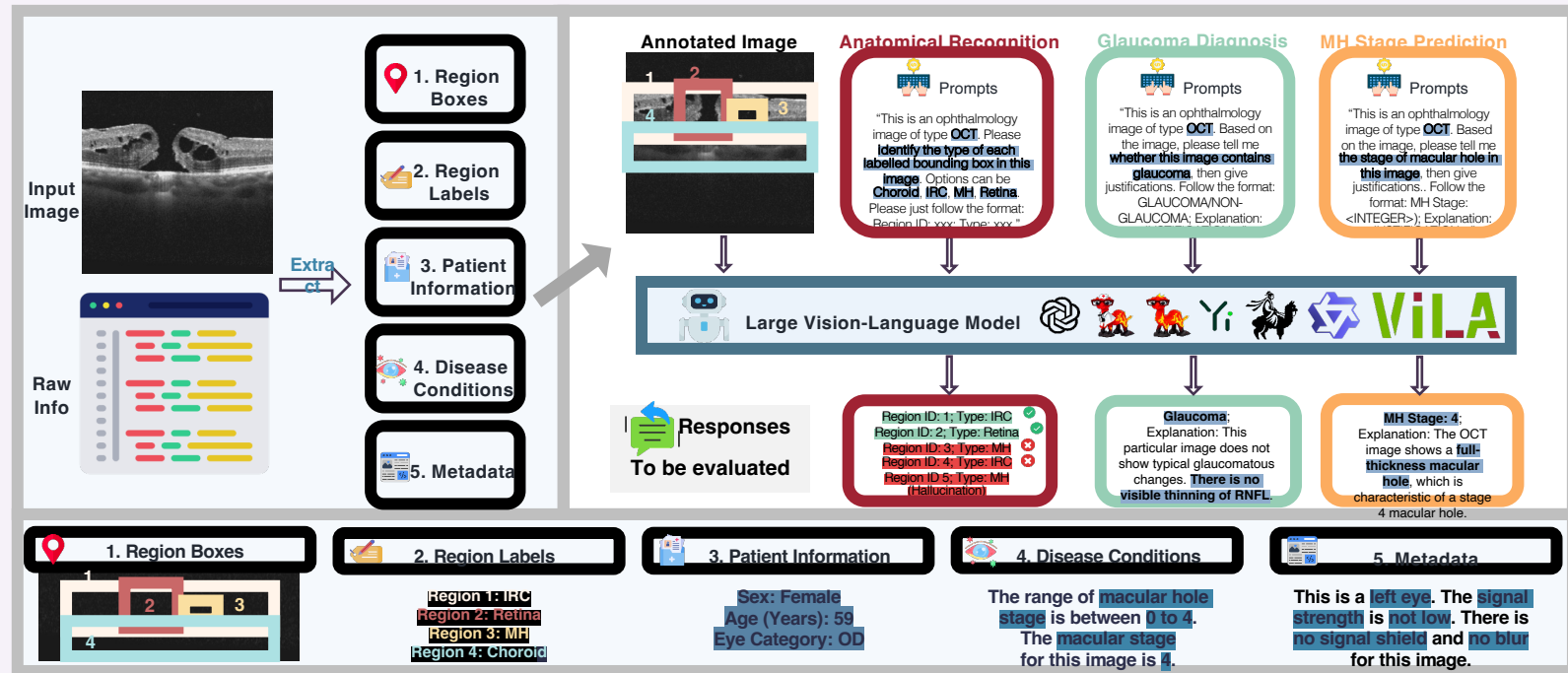
1. Anran Li, Yuanyuan Chen, Mingfei Cheng, Jian Zhang, Yueming Wu, Anh Tuan Luu, Han Yu, Historical Embedding-Guided Efficient Large-Scale Federated Graph Learning, ACM SIGMOD 2024.

2. Anran Li, Guangjing Wang, Ming Hu, Jianfei Sun, Lan Zhang, Luu Anh Tuan, Han Yu, Joint Client-and-Sample Selection for Federated Learning via Bi-level Optimization, IEEE TMC 2024.

3. Anran Li, Yue Cao, Jiabao Guo, Hongyi Peng, Qing Guo, Han Yu, FedCSS: Joint Client-and-Sample Selection for Hard Sample-Aware Noise-Robust Federated Learning, ACM SIGMOD 2023.

4. Anran Li, Hongyi Peng, Jiahui Huang, Lan Zhang, Qing Guo, Han Yu, Yang Liu, FedSDG-FS: Efficient and Secure Feature Selection for Vertical Federated Learning, IEEE INFOCOM 2023.

# MULTIMODAL LARGE MODEL BENCHMARK

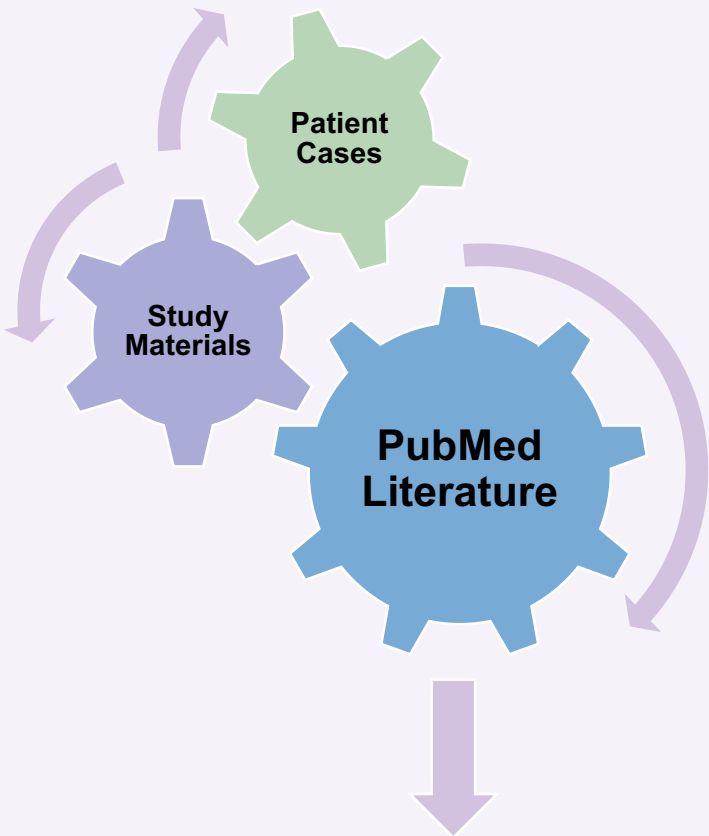


We systematically benchmark **13** state-of-the-art large vision-language models on more than **21,000** ophthalmic images across **diverse modalities**, such as OCT, SLO, CFP.

# MULTIMODAL LARGE MODEL BENCHMARK

Benchmarks	Modalities		Image Types			Evaluation Perspectives			
	Images	Texts	Surgical Scenes	SLO	OCT	Eye Photos	Fundus Images	Anatomical Understanding	Diagnosis Analysis
General-Domain Benchmarks									
MMMU	✓	✓	X	X	X	✓	✓	X	X
MME-RealWorld	✓	✓	X	X	X	X	X	X	X
UNK-VQA	✓	✓	X	X	X	X	X	X	X
MMCBench	✓	✓	X	X	X	X	X	X	X
MathVista	✓	✓	X	X	X	X	X	X	X
SEED-Bench	✓	✓	X	X	X	X	X	X	X
Ophthalmology-Specific Benchmarks									
Bench-Nephrology	X	✓	X	X	X	X	X	X	X
Eval-GPT-Ophth	X	✓	X	X	X	X	X	X	X
Bench-Myopia	X	✓	X	X	X	X	X	X	X
OphNet	✓	✓	✓	X	X	X	X	X	X
LMOD (ours)	✓	✓	✓	✓	✓	✓	✓	✓	✓

We evaluated the models' performance on **anatomical recognition** and **diagnosis analysis**. Existing models show **close-to-random** performance. We are currently working on developing an **ophthalmology-specialized** large vision-language model.



**LEME:**  
Language Enhanced  
Model for Eye Care

