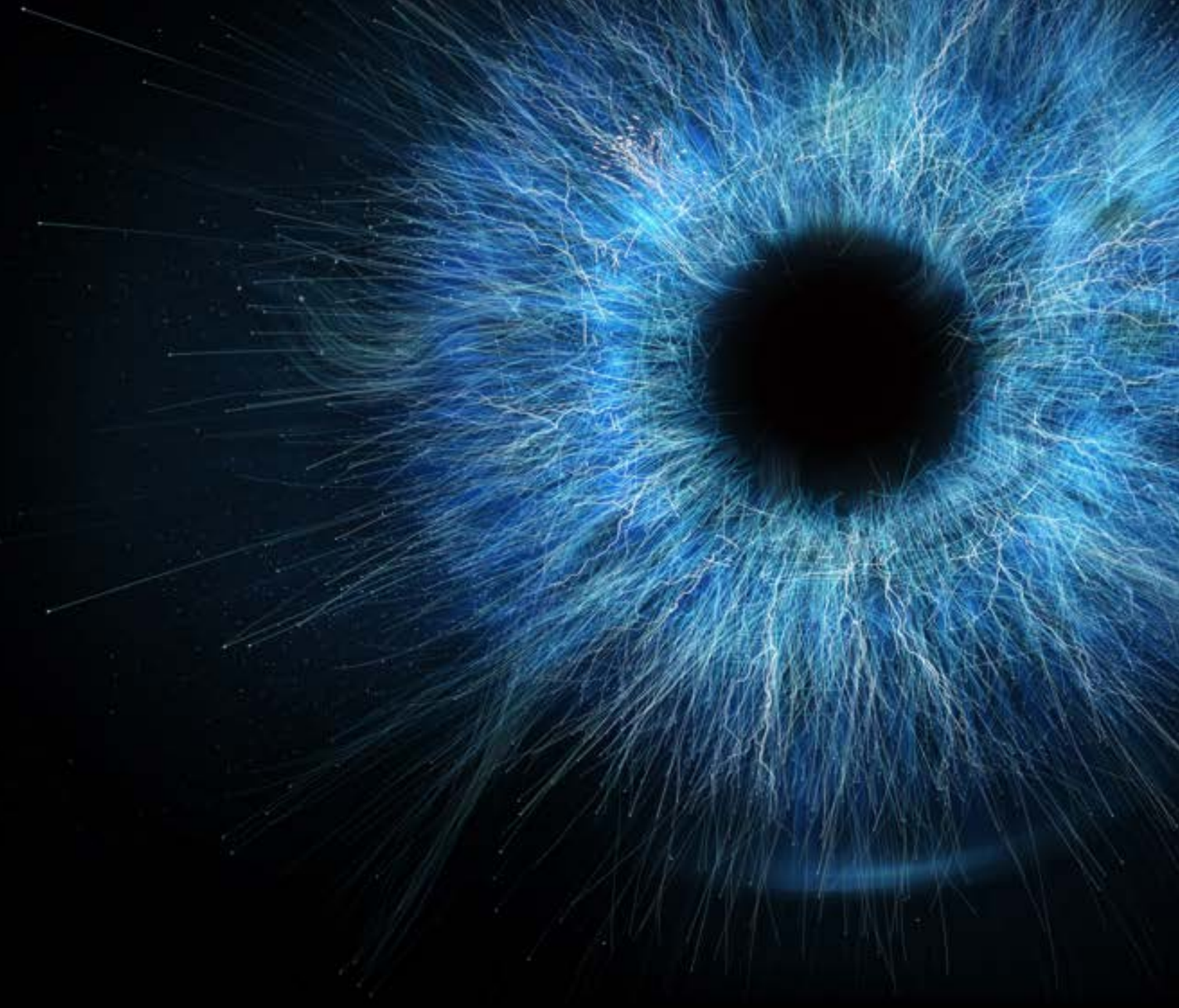

VUNO Med®-Fundus AI™

# VUNO Med®
# Fundus AI™

AI-based Screening Solution
for Various Abnormalities in the Fundus

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VUNO®

VUNO Med®-Fundus AI™

**VIEW** THE INVISIBLE

**KNOW** THE UNKNOWN


# Impacts of Vision Impairment

Globally, the leading causes of vision impairment and blindness include age-related macular degeneration (AMD), diabetic retinopathy (DR), glaucoma and cataract.

> 170 million individuals are affected by AMD globally, which affects the central vision and impacts quality of life making carrying out daily activities difficult

> 415 millions adults globally were living with diabetes in 2015 and it is estimated that approximately 93 million people worldwide have DR and one third of diabetic population will develop some form of retinopathy in their lifetime

> It is estimated that 57.5 million people are affected by primary open-angle glaucoma (POAG) worldwide and by 2020 the numbers will rise to 76 million and further rising up to 111.8 million by 2040

Governments around the world are banning together to address the global magnitude of preventable blindness and implement policies to address and manage visual impairments. Early intervention, effective and accessible eye care services, like eye screening, is key for effectively preventing visual impairments and vision loss.

Eye screening is being integrated as a core part of overall eye and/or disease management and care. Fundus examinations allow early detection of pre-symptomatic eye disease and subsequently allows patients to receive early treatments before vision loss becomes irreversible.



# Effective Fundus Screening is Not Easy

### Shortage of ophthalmologists
There is not enough ophthalmologists to treat and perform fundus screening for increasing number of patients due to population growth and aging

### Challenge for ophthalmologists to reach high risk patients
Diabetic and hypertensive patients who are at risk of developing eye complications visit primary care clinics or GP first before getting referred to ophthalmologists

### Lack of screening tool and knowledge in primary care settings
Primary care practices usually are not equipped with eye screening tool (in this case, fundus camera) and image interpretation knowledge

### Unnecessary referrals lead to increased workload and cost
Without proper knowledge and consultation in primary care settings, even normal patients are sometimes referred to ophthalmology

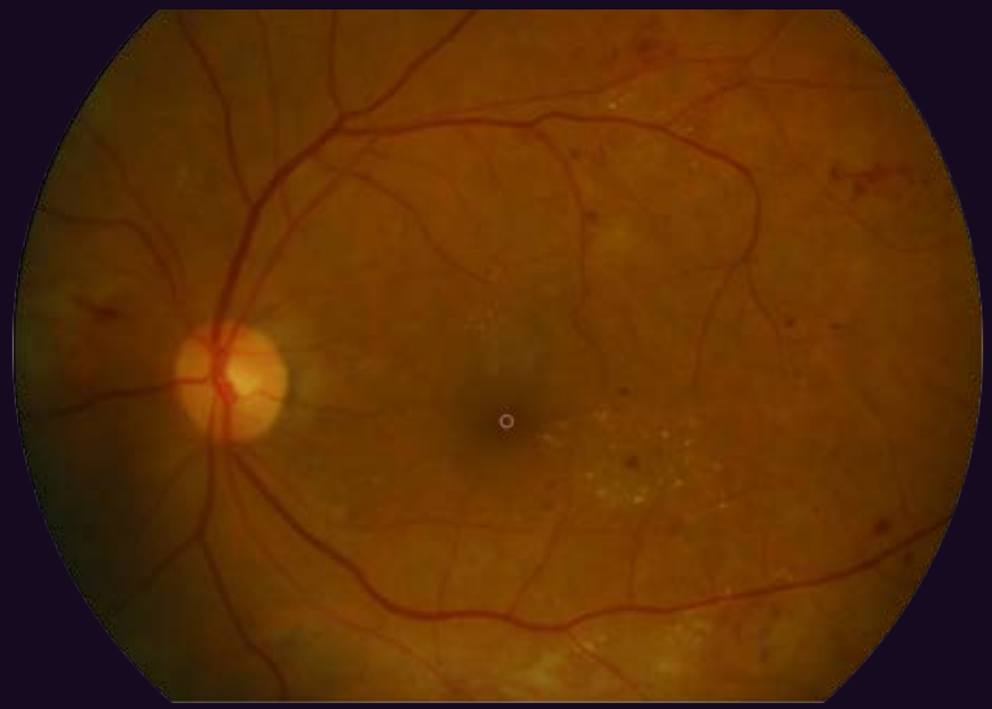
### Interrupted and ineffective workflow in telemedicine service
Telemedicine or teleophthalmology service needs to send fundus image for interpretation by trained grader before they can present it to patients

View More with

# VUNO Med®

# Fundus AI™





What abnormalities do you see?

VUNO | VUNO Med®-Fundus AI™

Abnormal


- [x] Hemorrhage
- [x] Hard Exudate
- [x] Cotton Wool Patch
- [x] **Drusen & Drusenoid Deposits**
- [x] Vascular Abnormality
- [x] Glaucomatous Disc Change
- [x] Non-glaucomatous Disc Change
- [x] RNFL Defect
- [x] **Membrane**
- [x] Chorioretinal Atrophy / Scar
- [x] **Macular Hole**
- [x] Myelinated Nerve Fiber



# What does VUNO Med®-Fundus AI™ do?

VUNO Med®-Fundus AI™is an AI-based screening solution
that provides diagnostic support for common ocular diseases based on the detection of 12 retinal findings in the fundus of the eye.

## 12

Detection of 12 retinal findings associated with diagnosis of eye diseases

## 95%

High sensitivity and specificity with AUROC 96.2 – 99.9%

## 2s

Immediate fundus interpretation in only 2 seconds

## 100,000+

Developed and validated with 100,000+ images graded by 57 ophthalmologists of different subspecialties

## Vision-Threatening Eye Diseases

Diabetic Retinopathy

Age-related Macular Degeneration

Retinal Vein Occlusion

Glaucoma Suspect

Epiretinal Membrane

Macular Hole



# How can I use VUNO Med®-Fundus AI™ to optimize and improve my clinical workflow?

## Diagnostic Accuracy

· Accurately detects and locates (AUROC = 95% and above) 12 fundus abnormalities trained on 103,262 fundus images with 57 Ophthalmologists
· Provides as a cross check reference and increase confidence in interpretation among untrained graders
· Improves sensitivity – ensure no findings are missed out

## Effective Screening

· Provides interpretation results within 2 seconds
· Provides more effective and necessary referrals to high volume ophthalmology clinics, so patient consultation and treatment can be prioritized
· Provides tangible evidence to patients for referral

## Consistency

· Provides consistent diagnosis results without depending on interpreter's knowledge and experience



# VUNO Med®-Fundus AI™ is Intuitive & User-friendly

1 Step

### Take and Upload Fundus Image

A high-quality fundus image taken with mydriatic, or non-mydriatic fundus camera is uploaded in **JPG, DCM or PNG format**

2 Step

### Perform Analysis with VUNO Med®-Fundus AI™

**In only 2 seconds,** VUNO Med®-Fundus AI™ algorithm provides **automatic detection** of abnormal findings

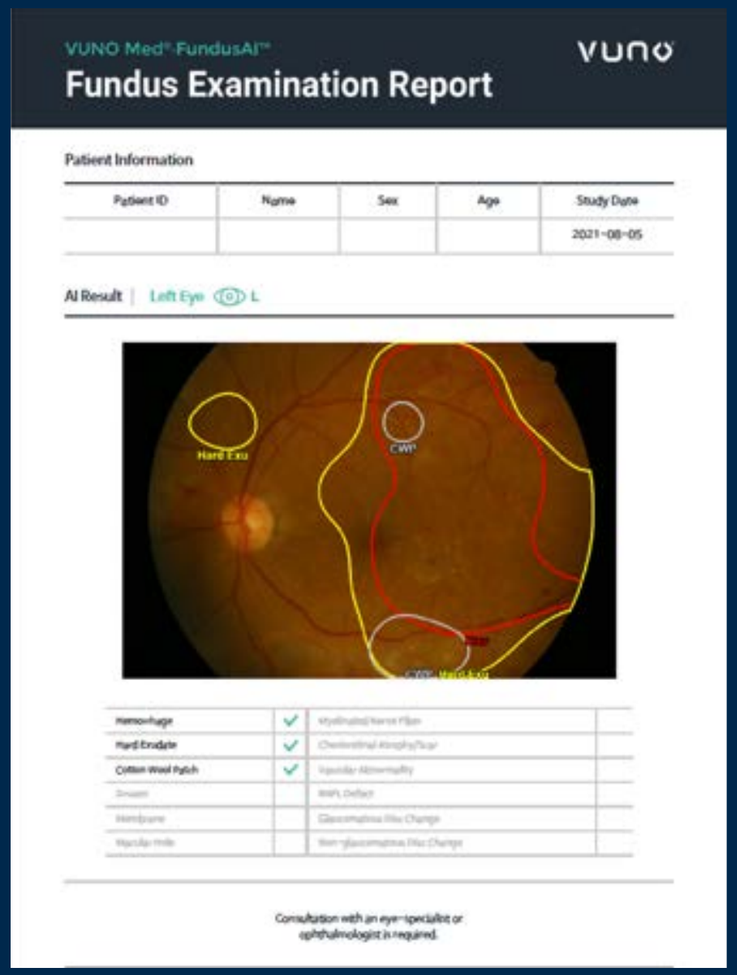
3 Step

### Receive Examination Report

**Report** is generated with labeled abnormal findings for the examiner and/or patients for further consultation

# VUNO Med®-Fundus AI™ Report

Patient report containing visualized abnormality findings
that facilitate doctor-patient communication and enhance patient satisfaction.




# VUNO Med®-Fundus AI™ is
# Versatile & Easy-to-Implement

## Cloud-Based

· A virtual server where **VUNO Med®-Fundus AI™** is installed and customers can access the solution by logging on to the server (URL) to use our products
· **VUNO Med®-Fundus AI™** can be used on a license / subscription basis or pay-per-scan basis

## On-Premise

· A virtual server where **VUNO Med®-Fundus AI™** is installed and run within a client's in-house infrastructure
· **VUNO Med®-Fundus AI™** can be used on a license / subscription basis or pay-per-scan basis

## On-Device

· A virtual server where **VUNO Med®-Fundus AI™** is installed and embedded in diagnostic modalities through the SDK integration
· **VUNO Med®-Fundus AI™** can be used as a bundled product in diagnostic modality

# How and where can VUNO Med®-Fundus AI™ be used?

## Ophthalmology
· Diagnostic support tool for eye hospitals and clinics' eye screening campaigns or programs

## Primary Care Settings & Screening Centers
· Diagnostic support tool for common eye diseases for effective patient referral to ophthalmology
· Offer as additional ophthalmology screening service for patients

## Tele-Ophthalmology, Tele-Medicine and Medical Imaging Centers
· Time and cost saving diagnostic support tool
· Offer as additional ophthalmology screening service

## NGOs & IGOs
· Effective screening tool and partnerships for eye screening campaigns or care programs

## Camera Suppliers & Manufacturers
· Offer as competitive advantage over competitors
· New market penetration into non-ophthalmology settings

## VUNO Med®-Fundus AI™ is
## Versatile & Easy-to-Implement

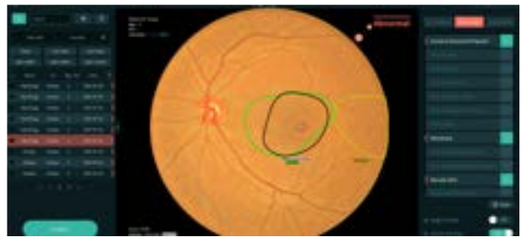
### 1 Choose type of service

Cloud vs On Premise vs Embedded

### 2 Choose payment type

Annual subscription basis vs Pay-per-use basis

### 3 Perform analysis at your fingertips





# Clinical Data of
# VUNO Med®-Fundus AI™

# VUNO Med®-Fundus AI™ is Comprehensively Trained & Validated

**Developed and validated with 100,000+ images graded by 57 ophthalmologists of different subspecialties**

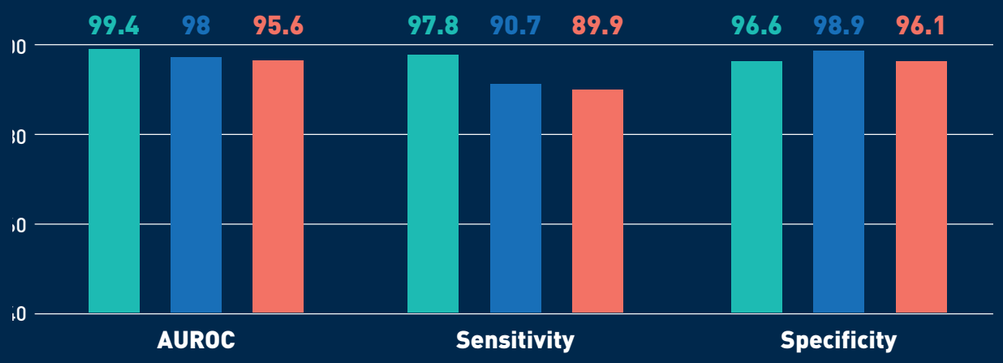
· Consistent and stable performance on internal test set (AUROC 96.2 – 99.9%)

· Consistent and stable performance on external test set (France and India) (AUROC 94.7 – 98.0%)

## Diagnostic Performance

**Hospital A** (In-House test, Korea) **Hospital B** (External test, India) **Hospital C** (External test, France)

**Performance Comparison** (Hemorrhage case)






# Publications

| No | Year | Jour/Cof | Type | Title |
|---|---|---|---|---|
| 1 | 2018 | JKMS | Journal | A Novel Fundus Image Reading Tool for Efficient Generation of a Multi-dimensional categorical Image Database for Machine Learning Algorithm Training |
| 2 | 2018 | MICCAI | Workshop | Classification of Findings with Localized Lesions in Fundoscopic Images using a Regionally Guided CNN |
| 3 | 2018 | MICCAI | Workshop | An Efficient and Comprehensive Labeling Tool for Large-Scale Annotation of Fundus Images |
| 4 | 2018 | JDI | Journal | Towards Accurate Segmentation of Retinal Vessels and the Optic Disc in Fundoscopic Images with Generative Adversarial Networks |
| 5 | 2018 | JDI | Journal | Laterality Classification of Fundus Images Using Interpretable Deep Neural Network |
| 6 | 2019 | MIA | Journal | REFUGE Challenge: A unified framework for evaluating automated methods for glaucoma assessment from fundus photographs |
| 7 | 2019 | MIA | Journal | IDRiD: Diabetic Retinopathy – Segmentation and Grading Challenge |
| 8 | 2019 | Ophthalmology | Journal | Development and Validation of Deep Learning Models for Screening Multiple Abnormal Findings in Retinal Fundus Images |

# Awards

Ministry of Food and Drug Safety

**Korea's 1st Innovative Medical Device**

**1st place in Automatic Detection Challenge on Age-related Macular Degeneration,**

**1st place in Diabetic Retinopathy Segmentation and Grading Challenge**

**1st place in Retinal Fundus Glaucoma Challenge**

**IDRiD Challenge**

All sub-challenges
1st and 2nd place

**REFUGE Challenge**

Glaucoma classification 1st place
Overall 2nd place

**ODIR Challenge**

Ocular Disease Intelligent Recognition
Top 2% (offsite)

**PALM challenge**

Pathological Myopia classification
1st place (off-site)

**AGE Challenge**

Angle closure classification
1st place (off-site)

**DeepDRiD Challenge**

DR grading (macular, disc-centered):
3rd place
DR grading (ultra-wide): 1st place

**ADAM Challenge**

Overall 1st place All sub-challenges 1st, 2nd places
except for disc segmentation (5th place)



## VUNO Med®-Fundus AI™ Demo

# Are you interested in trying out VUNO Med®-Fundus AI™?

Do you

**# Want to request a demo?**
**# Want to learn more about how this technology improves and optimizes clinical workflows?**
**# Want to discover how you can implement this technology?**

Just let us know!

# VIEW THE INVISIBLE
# KNOW THE UNKNOWN

VUNO is one of the biggest healthcare AI companies in the world with strong commercial traction of road-tested and clinically-proven solutions.

Founded back in December 2014, the company successfully obtained the 1st Korean FDA (MFDS) approval for medical AI software. Since then, VUNO has rapidly expanded its product portfolio to a diverse and comprehensive line up, that is reshaping the delivery of medical imaging diagnostics in the field of radiology, pathology, bio-signal and medical speech recognition.

A proven track record of success in winning international technical challenges coupled with a series of regulatory approval and commercial deployments to over 500 hospitals, make VUNO an undisputed leader in the global medical AI arena.

Ministry of Food and Drug Safety

CE 2195

If you are interested in distributing **VUNO Med®-Fundus AI™** contact us.

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