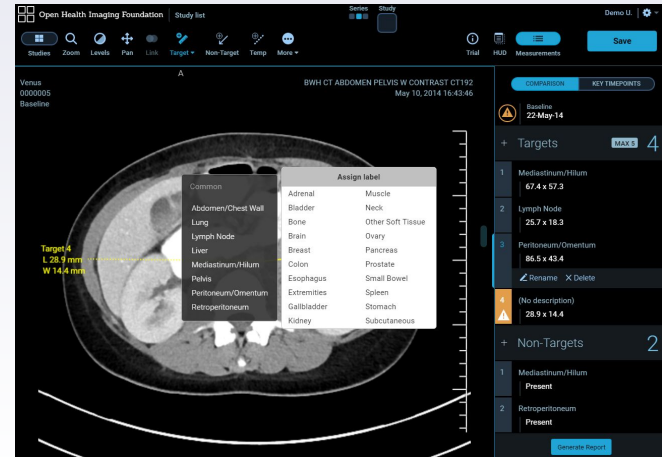


# MI4WEB

## Transition phase

Projeto em Informática - Group 7  
LEI / Universidade de Aveiro  
2021/2022



# Context and Problem

- ▶ Zero-footprint, DICOM compliant, fully web-based visualization is making its way and gaining wider acceptance within the medical imaging community.
- ▶ Since the level of acceptance is growing up, the necessity of upgrading and building new functionalities and features is mandatory, so that it can continue to gain recognition and grow.



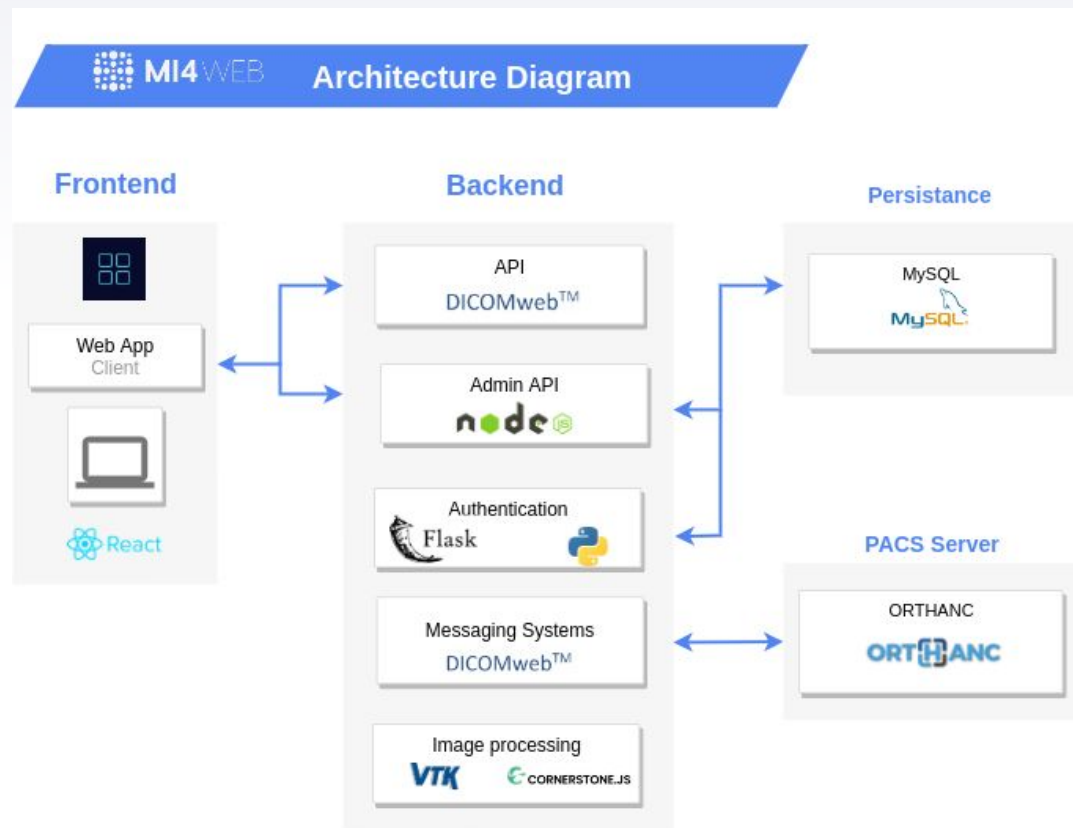
# Context

- ▶ One of these applications is OHIF, a zero-footprint, open source and web-based medical imaging viewer, that gives us the ability to add and configure extensions, which makes it very expandable. Therefore, this platform was the starting point of our project.

☐ ☐ Open Health  
☐ ☐ Imaging Foundation



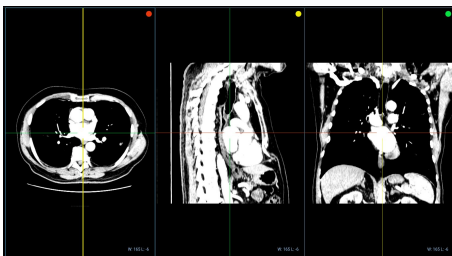
# System Architecture



# ▶ OHIF Extension

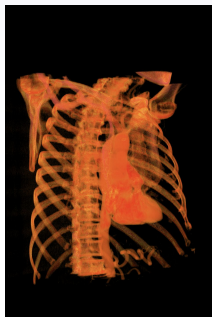
- ▶ An extension is a group of resources that provides functionalities, interface of components, and new features.
- ▶ Advantages:
  - ▶ Isolate distinct resources
  - ▶ Allows to extend entirely different implementations
  - ▶ Flexible
- ▶ To add an extension to the viewer there is a specific structure that must be followed, in this structure, there are modules like the *Toolbar* and the *DataSource*. To activate an extension it must be registered in a specific file.

# Main features



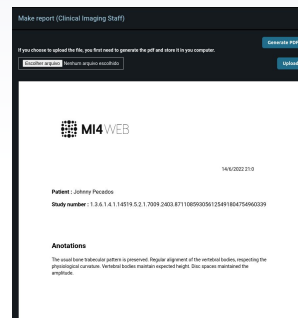
## Image Reformatting

Multiplanar image display functionalities



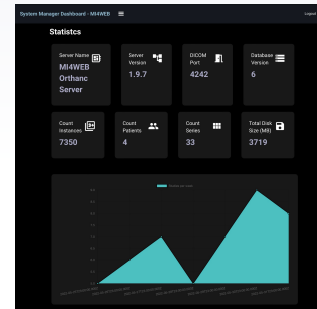
## 3D Views

3D Display tools as VTK



## Reports

Creation of Medical Reports



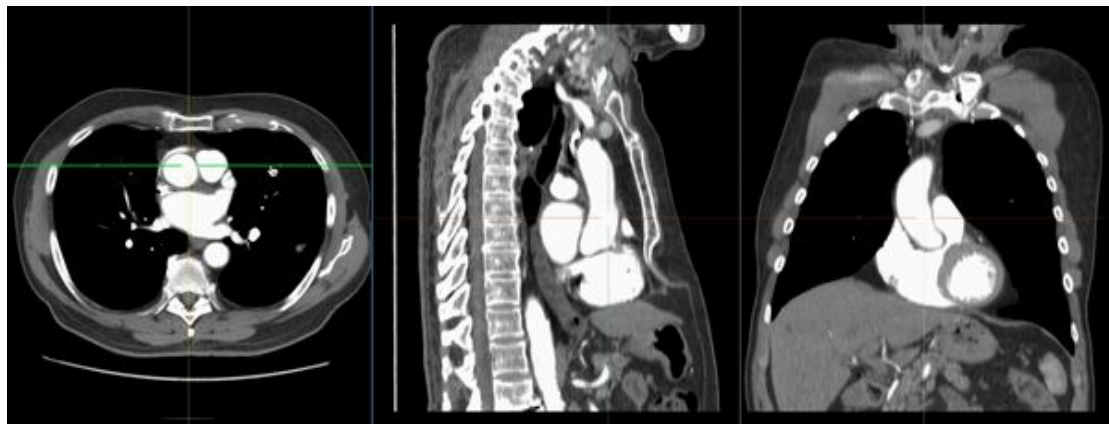
## Admin dashboard

Admin Interface to manage the application software and the user permissions.

# Image Reformating

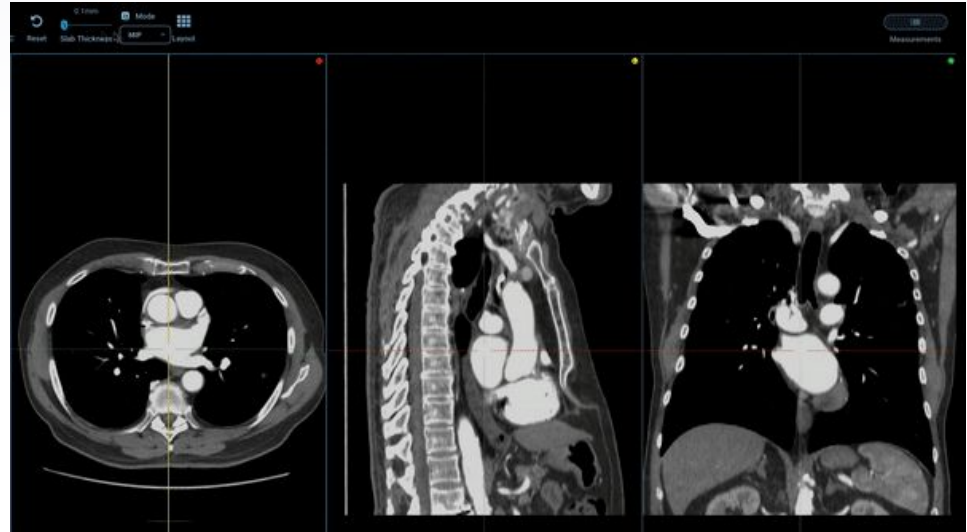
## Implementation

- ▶ Made using the VTK extension
- ▶ Load Data from PACS server
- ▶ Create different views
  - ▶ Axial
  - ▶ Sagittal
  - ▶ Coronal



# Image Reformattimg Implementation

- ▶ MIP - (Maximum Intensity Projection)
- ▶ MinIP - (Minimum Intensity Projection)
- ▶ This features were made by rendering each pixel with the maximum value in the line of sight.





# 3D Views Implementation

- ▶ 3D views performed on the client side using the vtk.js library



We used vtk.js library, that is a standard visualization library

- ▶ Data received from an Orthanc server, by a DICOMWeb API.

DICOMweb™



# 3D Views Implementation

Data Processing



3dSource

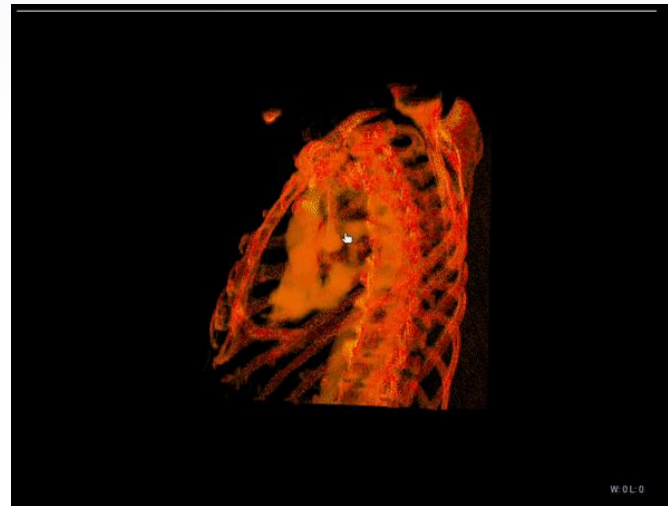
vtkMapper

Data Rendering

vtkRenderWindow

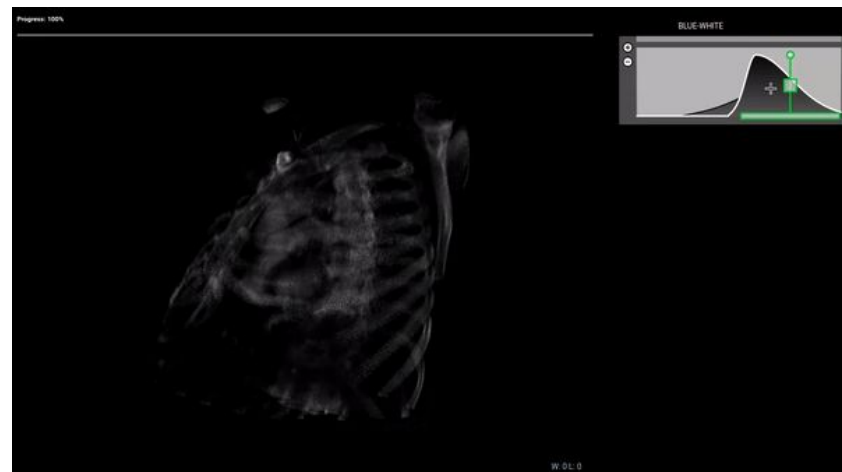
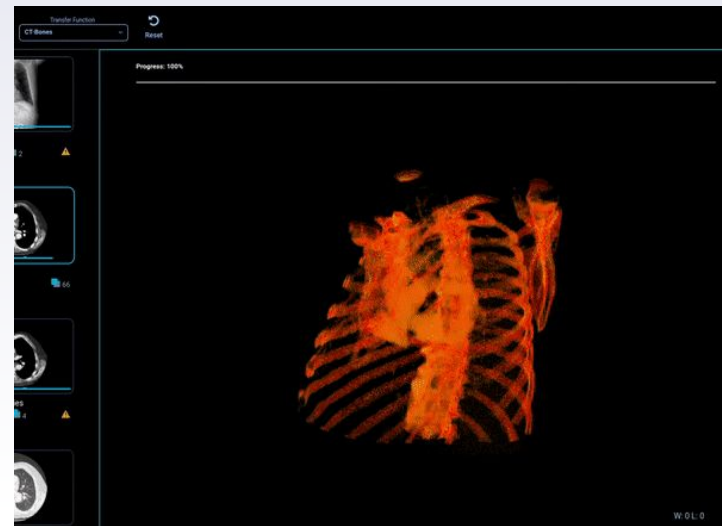
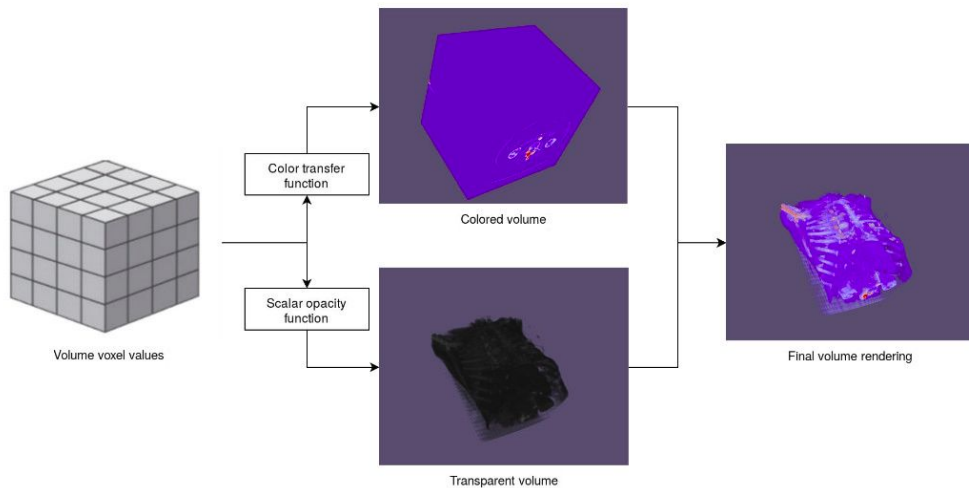
vtkRenderer

vtkActor



W.D.L.O

# 3D Views Implementation



# Report Clinical Imaging Staff

Make report (Clinical Imaging Staff)

Make a full report filled with annotations

Patient Name

Johnny Sins

Process Number

376251432

Medical Annotations

The usual bone trabecular pattern is preserved. Regular alignment of the vertebral bodies, respecting the physiological curvature. Vertebral bodies maintain expected height. Disc spaces maintained the amplitude.

Cancel

Preview of the PDF

Make report (Clinical Imaging Staff)

Generate PDF

If you choose to upload the file, you first need to generate the pdf and store it in you computer.

Escolher arquivo

Nenhum arquivo escolhido

Upload

MI4WEB

14/6/2022 21:0

Patient : Johnny Pecados

Study number : 1.3.6.1.4.1.14519.5.2.1.7009.2403.871108593056125491804754960339

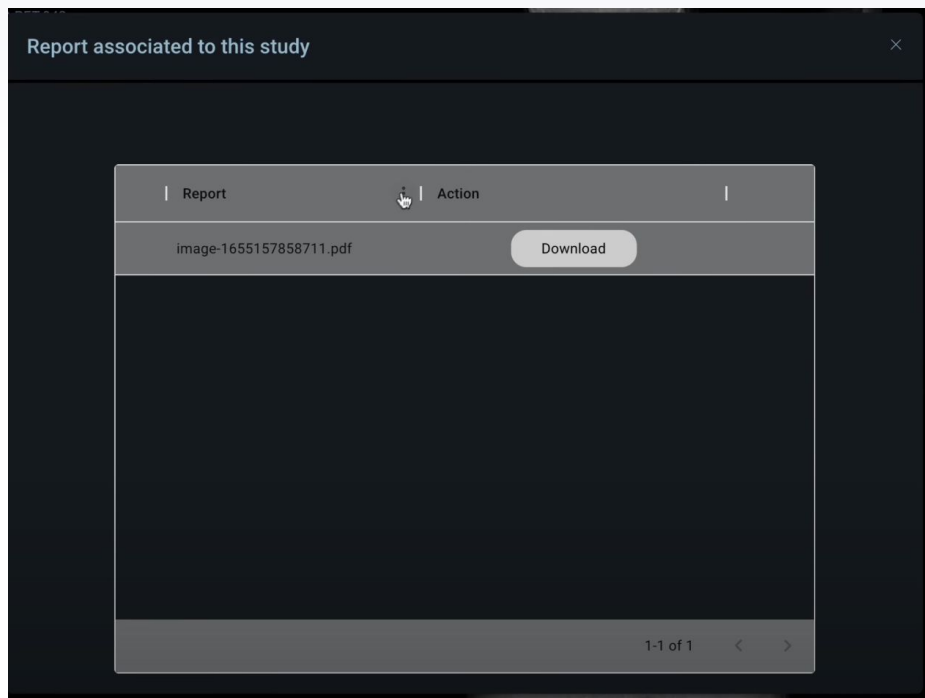
Anotations

The usual bone trabecular pattern is preserved. Regular alignment of the vertebral bodies, respecting the physiological curvature. Vertebral bodies maintain expected height. Disc spaces maintained the amplitude.

12

# Report

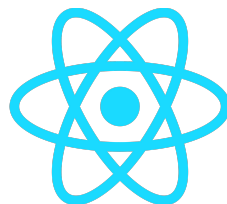
## Referring Imaging Staff



# Report

## Implementation and Decisions

- ▶ Implementation:
  - ▶ Reacts JS.
  - ▶ Database and a server to make the storage of the report.
  - ▶ API calls.
- ▶ Decisions:
  - ▶ Use DB to store the reports instead of DICOM image.



# Admin Implementation

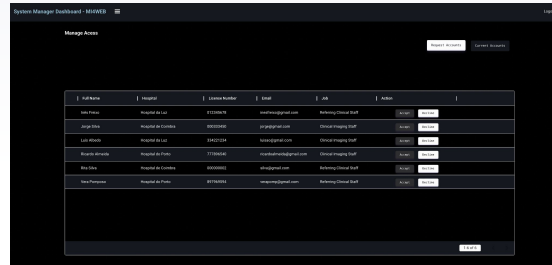
- ▶ Admin pages to manage access and collect informations about the application performance and structure using react.js.



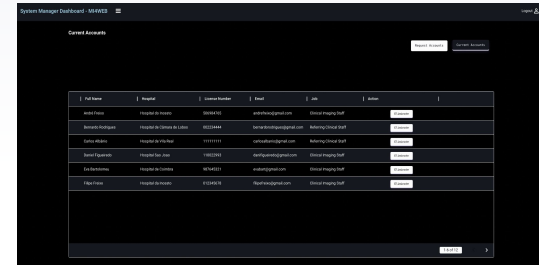
We used react.js a de facto standard

# Admin Implementation

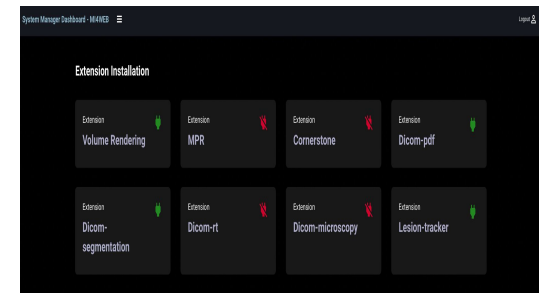
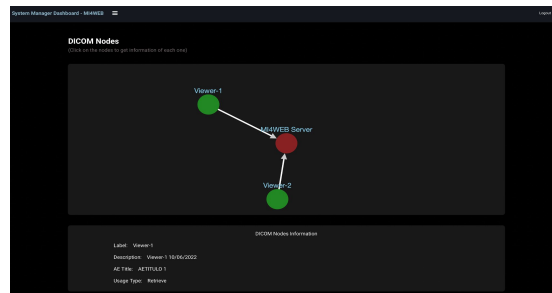
- ▶ Dashboard
- ▶ Manage Access
- ▶ Dicom Nodes
- ▶ Extensions Installation



ID	Name	Username	Email	Job	Action
1	User 1	user1@company.com	user1@company.com	Admin	[Action]
2	User 2	user2@company.com	user2@company.com	Admin	[Action]
3	User 3	user3@company.com	user3@company.com	Admin	[Action]
4	User 4	user4@company.com	user4@company.com	Admin	[Action]
5	User 5	user5@company.com	user5@company.com	Admin	[Action]
6	User 6	user6@company.com	user6@company.com	Admin	[Action]



ID	Name	Username	Email	Job	Action
1	Account 1	account1@company.com	account1@company.com	Admin	[Action]
2	Account 2	account2@company.com	account2@company.com	Admin	[Action]
3	Account 3	account3@company.com	account3@company.com	Admin	[Action]
4	Account 4	account4@company.com	account4@company.com	Admin	[Action]
5	Account 5	account5@company.com	account5@company.com	Admin	[Action]
6	Account 6	account6@company.com	account6@company.com	Admin	[Action]



Extension Installation

Extension	Status	Description
Volume Rendering	Green	Extension for Volume Rendering
MPR	Red	Extension for MPR
Cornerstone	Red	Extension for Cornerstone
Dicom-pdf	Green	Extension for Dicom-pdf
Dicom-segmentation	Green	Extension for Dicom-segmentation
Dicom-rt	Red	Extension for Dicom-rt
Dicom-microscopy	Red	Extension for Dicom-microscopy
Lesion-tracker	Green	Extension for Lesion-tracker





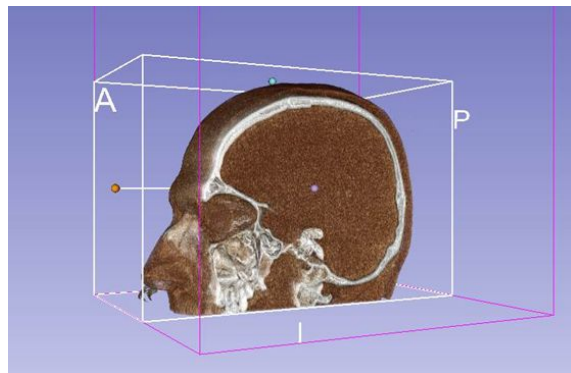
# Usability Test

## 5 participants

Task	Difficulty (1-5)
Use mpr tool to obtain canonical and oblique views.	2.8
Use mip to see hyperdense structures.	4.2
View and manipulate 3D images.	2
Upload a report.	2.8
Find information about the server analytics.	2.8

# Future Work

- ▶ Implement transfer functions on 2D views.
- ▶ Interactive 3D Clipping.
- ▶ Embed report viewing in the application.
- ▶ Increase report customization.
- ▶ Escalate the ORTHANC server.

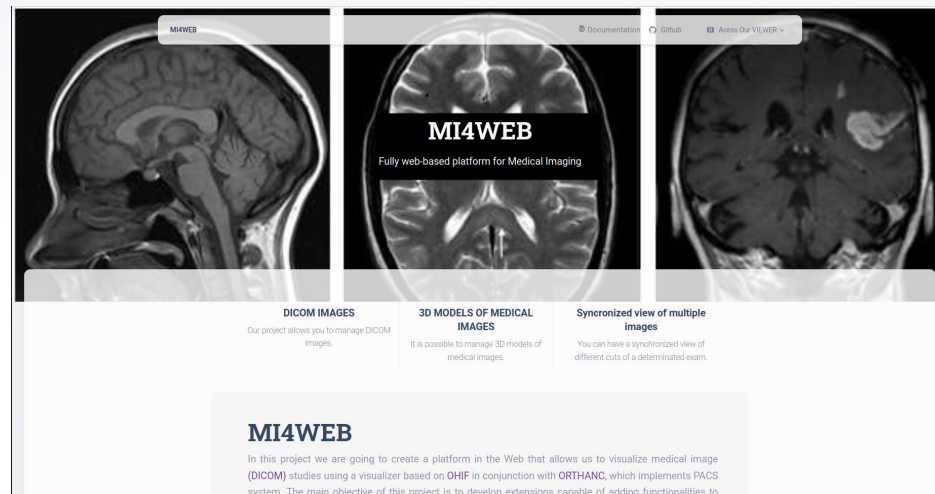


# ► Conclusion

- ▶ Main goals were achieved and all the main features are working.
- ▶ Despite all the goals were achieved, our major difficulty was to implement the 3D functionality.
- ▶ Gained a significant amount of new knowledge (reactjs, docker, Vtk, Cornerstone, DICOM, Medical Image Concepts).

# Website

<https://thescorpai.github.io/>



# THANKS!

## Any questions?

