

Initial Observation Research Report

Initial research findings

Place: IU health & Riley hospital radiology study room

Date: December 20, 2019; Time: 10:00 to 12:00

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- Radiologist work in high contrast environment
- Resolution specifications
- Have certain DICOM monitoring standard
- Radiologists work mostly in collaboration but seek solitude while performing certain tasks like 'dictation'
- Use of 3D, CAD in advanced viewers
- Signals T1, T2 to detect protein and water: this part does bit of problem solving for radiologists
- Physicians have concerns regarding biasing the radiologist, so they don't share the EHR data.
- Frustrations are ED (Emergency), time-sensitive workflow
- They like to use standing workstation after lunch
- They follow a template while dictating
- Phone call in the middle-too much of multitasking
- Likes to work in noise proof cubes
- Want to see recent list-a recent study to appear on top (Sorting)
- Radiologists prefer to see studies based on priority
- They call the encounter observation as study list
- Modality is a device form factor through which a study is scanned (E.g. CT, MRI)
- Needs more intuitive interface
- Dictating quickly does not capture all the words to the template
- Many studies, difficult to remember ideal cases

- Good templates are defined something that just needs to short cut of data bindings to the existing template to make sense.
- Uses Radiopedia, DORIS to look up for terminologies
- Relative value unit, high level procedure

Research Summary

A study states, one billion annual radiologic studies equates to about 40 million **radiologist errors** per annum [1]. Radiologists do a lot of multi-tasking and helping them in any means could potentially result in reduced cognitive load on the user. In order to help them, we can leverage the power of AI and machine learning constantly learning patterns to aid them in decision making or diagnosis. As it is the DICOM viewer radiologists predominantly use to study images, it would be highly beneficial if we could have an intuitive interface. As part of this I have been exploring user interfaces that could potentially help them in automatically segmenting and annotating the images and later enabling them to edit the region of interest to customize for special studies that need human input to refine (Augmented approach to diagnose)

Initial Prototype to understand the expected interaction screen

Image1: AI showing the segmentation on the DICOM image with the interaction option to edit on the right side of the screen

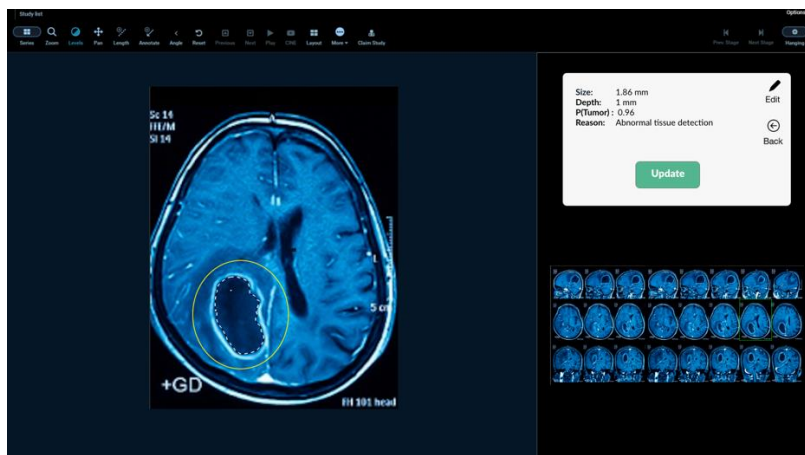


Image 2: AI predicted image and details on the right side of the DICOM Viewport.

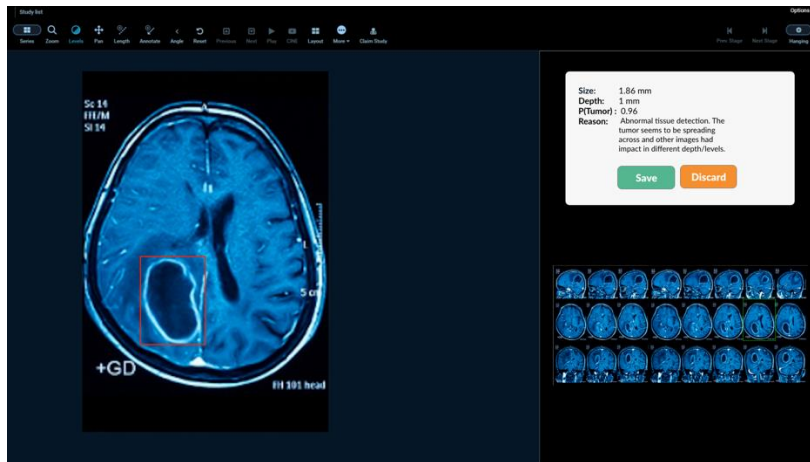
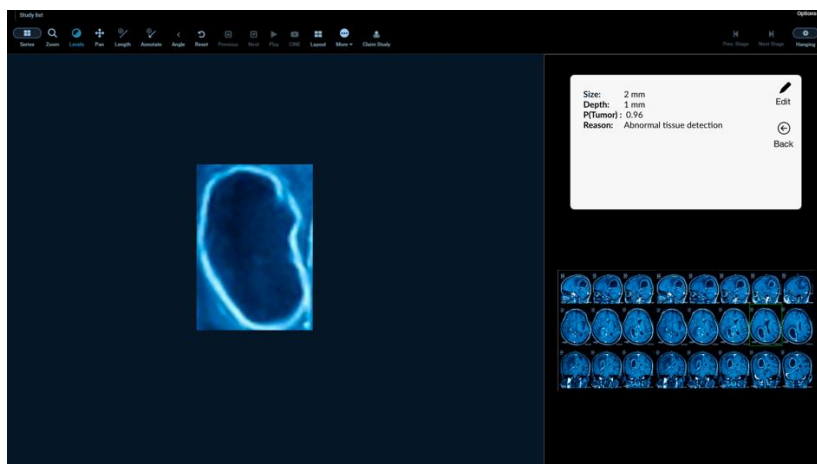


Image 3: Segmented view of the bounding prediction made by AI on the DICOM study



Libre Health DICOM Viewer currently supported features

I have been exploring Libre Health DICOM viewer to understand the features and functionality provided to view a study and perform interactions on it. The task windows shown below provides

1. Viewing series on the left side of the screen.
2. Basic zoom functionality to zoom through the series.
3. Annotation and measurement of anomalies.
4. Options to lock the study.

5. Configuring layouts of the viewport using hanging protocol.
6. JSON export and import feature of the DICOM image.



Image 4: The control or task options for the radiologist to interact with DICOM study.

DICOM Viewers Comparison

I went ahead and explored other open source DICOM viewers, below is the comparison by feature

DICOM Viewer	Libre Health	Weasis	OSIRIX Lite
Annotation on viewport	Yes	Yes	Yes
Key object selection	No	Yes	Yes
Export and Import	Yes	Yes	Yes
Importing study from other DICOM Viewers	No	No	Yes

References

[1]. Error and discrepancy in radiology: inevitable or avoidable?

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5265198/pdf/13244_2016_Article_534.pdf