Automated Notification System that Facilitates AI Triage on a Legacy PACS System

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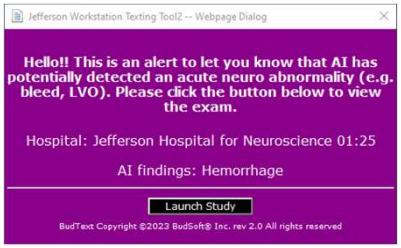
Background/Problem Being Solved

- AI triage tools typically route results to providers in one or more of the following methods: (1) secondary capture image, (2) worklist flag/prioritization in PACS/EMR/Reporting system, (3) desktop alert and (4) mobile alert.
- Many legacy PACS systems do not accept a worklist prioritization message; therefore, the radiologist may not be aware of a study with acute findings.
- Many legacy PACS and RIS systems cannot process an AI result which would prioritize specific exams with potential acute findings.
- Unless a PACS agnostic alert tool is available from the vendor, there is no simple method to alert the radiologist of an acute finding.
- We implemented a custom notification system that creates an alert on a legacy PACS to provide a means for the radiologist to address acute findings in a timely fashion.



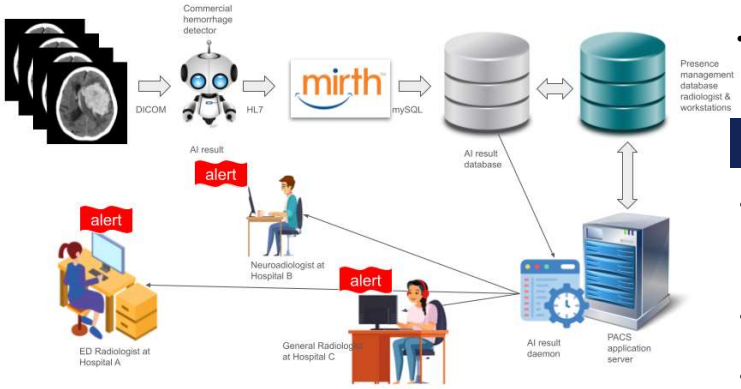
Barriers/Challenges

- Challenges were primarily developing rules that would simultaneously accommodate a large academic core and multiple community practices to minimize alert fatigue.
- The capability of sending alerts to the relevant individual(s) at the right time is inexorably tied to having an up-to-date inventory of active radiologists matched to workstation locations; this can be difficult to maintain in large, heterogeneous multi-specialty practices where there are also role-changing trainees at specific locations as well as community radiologists who are not defined by subspecialty.

Intervention

- The legacy PACS AI notification engine consists of four components: (1) AI result processing engine, (2) a results database, (3) radiologist/workstation database and (4) a notification poller (See Figure).
- Integral to the solution is a real-time database called “Presence Management” which keeps a dynamic record of all active radiologists and workstations currently logged into the Philips Intellispace PACS system (Philips Informatics, California) in our eighteen hospital, two state system stored in a mySQL dbase. All radiologists/workstations are categorized by their role (e.g. attending, trainee, neuroradiologist, general community

Workflow of the Legacy PACS Automated AI Alert System



- Contemporaneous AI results for acute intracranial hemorrhage (Viz.AI San Francisco, California) are sent by HL7 to a MIRTH receiver which parses the message and stores the accession number, the exam code, the location where the exam originated and the AI result.
- An active poller interrogates the AI results database every five minutes for new positive results and matches the exam to active radiologists/workstations in that location.
- Messages are *only sent to the relevant workstations and/or radiologists where the exam originated*. Academic and community practice roles are managed by user / workstation roles. Shift variation is accommodated.
- A custom modal window and a bell sounds on one or more specific workstation(s) to deliver the alert to the most appropriate radiologist(s) to avoid alert fatigue for others.
- The radiologist can launch the exam from the modal window or dismiss the window. The radiologist action is recorded in the database with timestamp.
- Once dismissed or viewed, the alert is deactivated in the database.
- All built using a combination of PHP, mySQL and Python.

Outcome

- Since its inception ten months ago, there have been 347 ICH alerts sent and acknowledged by specific radiologists throughout this practice covering eighteen hospitals in two states.
- There has been rapid adoption and acceptance of this relatively minimalistic alert mechanism which is tightly integrated into the core PACS viewer that delivers the alert to the most appropriate person augmenting care delivery and minimizing interruptions.
- We are currently tabulating “engagement” statistics to determine if the alert has impact on the completion to first view interval.
- Alerts extended to LVO (large vessel occlusion as well as ICH)

Conclusion/Statement of Impact/Lessons Learned

- An alert system based on roles and locations for AI triage applications on a legacy PACS can minimize delays in care by quickly notifying the most appropriate radiologist without distracting others.
- This add-on tool can be built with minimal off-the-shelf components.
- The only requirement is the capability to capture the AI results from the vendor and the login events in PACS.
- The Philips Intellispace PACS API was particularly suited for this addition.

References

- Prevedello LM, Erdal BS, Ryu JL, Little KJ, Demirer M, Qian S, White RD. Automated Critical Test Findings Identification and Online Notification System Using Artificial Intelligence in Imaging. Radiology. 2017 Dec;285(3):923-931. doi: 10.1148/radiol.2017162664. Epub 2017 Jul 3. PMID: 28678669.

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