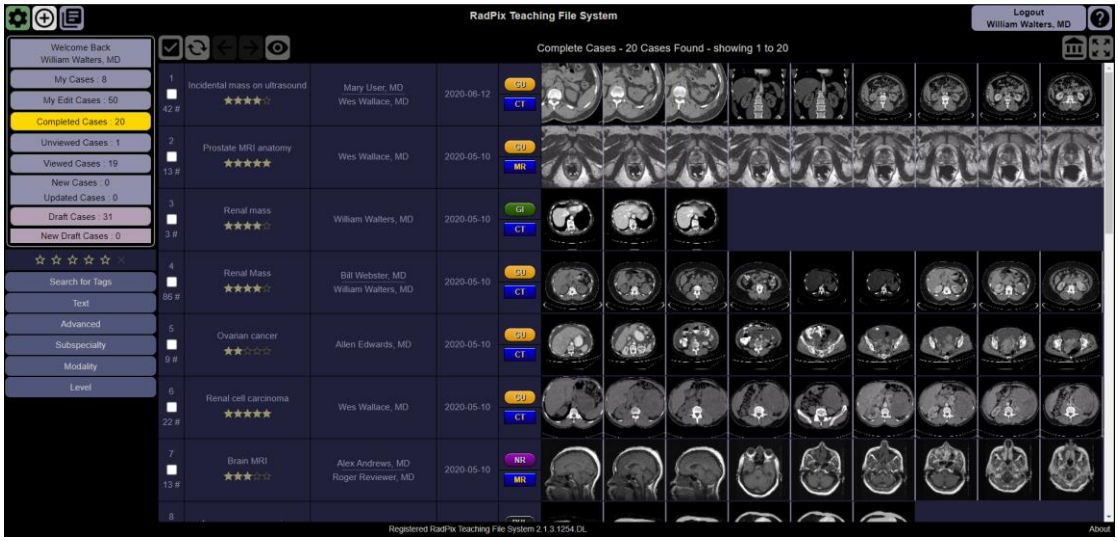
RadPix Teaching File Software



www.radpix.com

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INTRODUCTION

A radiology teaching file can be much more than just bookmarking a case in the PACS. It can have annotated images, fully searchable text describing the findings and diagnoses, and also include questions for self-testing. It can include multiple examples of the same disease process over time and allow trainees to gain better appreciation of the process. It can include the ability to tag, filter and search for cases throughout the system. It can save time and money. RadPix has been designed with these features and more.

A teaching file on a typical PACS is concentrated on the creation of teaching files, not their use by trainees. The user interface of RadPix is directed at the trainees, with options to easily search and filter on keywords, and create PowerPoint files and videos. One of the real benefits of an online teaching file is the ability to include many images for the trainee to review and test themselves. By simply clicking a button, the annotated and highlighted images show the important findings of a case. This is similar to looking at a textbook with no annotations, then clicking a button to see all of them!

There is educational value in having trainees create teaching file cases, by collecting the images and textually documenting the case as they learn about the disease process as they create a new teaching file. Mastery of a topic is shown when the individual can teach the topic to others. Creating a teaching file accessible across your entire system will consolidate educational resources on a platform which provides easy to use features and provides benefits to teacher and student alike.

OVERVIEW

RadPix is a web browser-based client / server radiological education tool that has been designed with several goals in mind:

1. Simplify the creation of professional quality educational content.
2. Create an easy-to-use application for quickly viewing radiology cases on a variety of devices.
3. Provide an interactive platform for live, individual, or group self-paced learning.
4. Eliminate the need to purchase other software products.

RadPix uses industry standard Open-Source components including Apache webserver, Apache Tomcat webserver, Apache Solr search engine, and Postgres database in a Grails/Groovy/Java-based application.

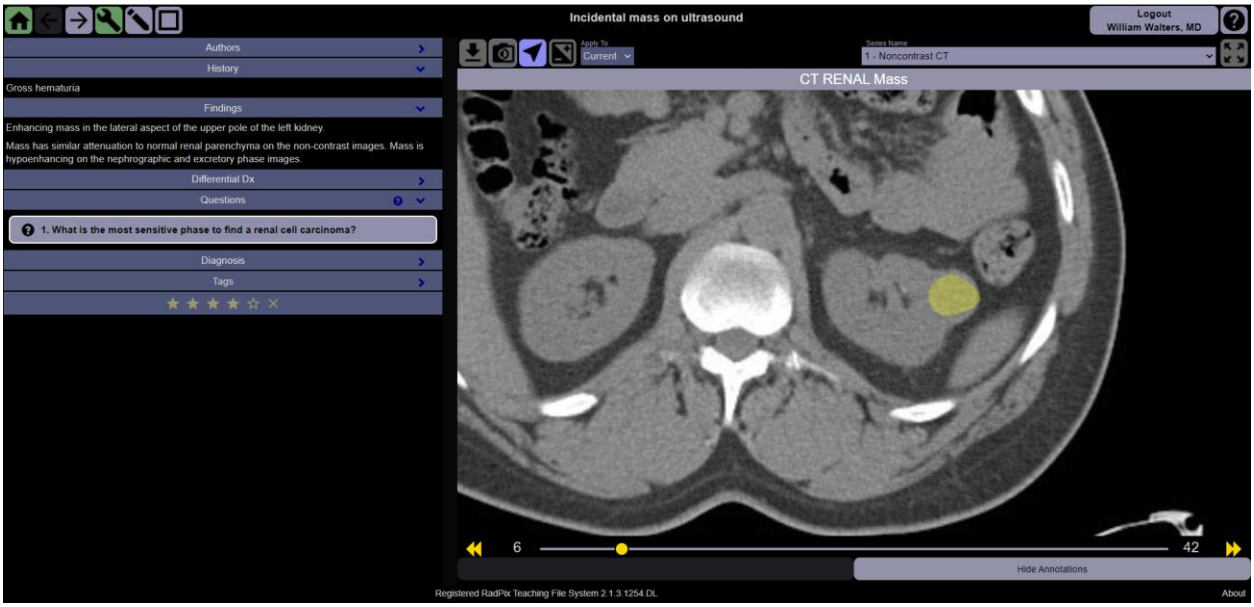
EXPERIENCE

Dr. William Weadock, owner of Weadock Software, LLC, has been a practicing academic radiologist for more than 20 years. He has been working with electronic teaching files since the beginning of the internet. A member of the RSNA Medical Image Resource Center (MIRC) teaching file committee for nearly 10 years, he was instrumental in its development of the RSNA MIRC software. After a decade of work, RSNA decided to stop development of MIRC and release the MIRC software into Open Source. Working with a software developer, Dr. Weadock then directed the development of a new teaching file system from scratch using modern HTML5 technology and industry standard components. RadPix was created without using any of the Open-Source code from RSNA. Through experience using the program and suggestions from other users, the workflow has been streamlined and additional features have been added.

RADPIX TEACHING FILE CASES

Complete radiology teaching files can be created easily with RadPix.

- DICOM images can be sent from a PACS or workstation to the RadPix server using DICOM SCP technology
- Multiframe DICOM video files are converted by RadPix to MP4 video files when uploaded.
- Other files such as JPG, PNG, TIFF, PNG can be uploaded to cases via web browser.
- PDF and PowerPoint files can be added to cases, with each slide or page made into a separate image if required. The PDF or PowerPoint file can also be viewed in the native application directly from RadPix.
- Separate text data fields for History, Findings, Differential Diagnosis, Discussion, etc. can be filled in with text. Some DICOM image information can be incorporated automatically as the cases are created.
- Images in the case can be annotated with arrows, transparent “paint”, circles, text, lines, etc.
- Multiple choice questions are easily added.
- All entered text is searchable.



Sample case showing annotated images, findings, question, etc.

RADPIX BENEFITS

While the main features of RadPix are to create radiological teaching files, several other functions are available to help the users. Extensive help information and videos are available at https://www.radpix.com.

- **Create PowerPoint files**. When a series of images is sent to RadPix from a DICOM sender device, often by the time the user logs into RadPix, the images are arranged into a case and are available from the RadPix search grid. All of the images can be exported into a provided PowerPoint presentation, either one image per slide, or as a stack of images in a PowerPoint macro. Alternatively, the images can be exported as an MP4, and the MP4 can then be inserted into a PowerPoint file.
- **Create video files.** Many users may be unable to create high quality compressed MP4 videos from DICOM files as it is often confusing and may require multiple software programs. RadPix converts multiframe DICOM files to MP4 videos using industry standard FFmpeg software, and also can create an MP4 from a stack of images, such as CTs. The MP4 video can then be inserted into a PowerPoint presentation or into a case in RadPix. In RadPix or in PowerPoint presentation

mode, the scroller bar that displays below the video can also be used to advance forward and backward through the image stack.

- **Create publication quality TIFF files with vector quality annotations.** Often Adobe Photoshop is used to create such images, and it can take a long time for the novice user to become proficient with Photoshop. With RadPix, simply use the arrow or other tool to create annotations, and export the file as a TIFF.
- **Create interactive question and answer sessions.** As used at the annual RSNA meeting for the past 3 years, a stack of images from a study can be easily loaded into RadPix, and a few questions added to each case. The presenter shows the stack of images and can scroll through them. The audience can also scroll through the same set of images on their own phone or tablet device and answer questions for the case. The presenter screen on the overhead projector shows the number of responses and can then reveal the distribution of the answers. There are other generic tools in the marketplace, but there is nothing like RadPix for presenting cases in this manner.
- **Replace other software applications.** RadPix can take the place over several software programs, including Photoshop.

EDUCATIONAL TOOLS

- RadPix displays images and allows the participant to find the abnormality (without an arrow on it as seen in printed documents), with the option of clicking a button to see the annotated image(s). This allows one to self-test and then verify understanding.
- Create collections of cases which can then be assigned to students or residents for review.
- The interactive question and answer sessions can also be configured for a live quiz session or even distance learning. After each question is answered, the correct answer is displayed to the participant along with any text explaining the right answer. The user responses are all tracked and summary reports can be reviewed by the presenter. This data could be used for American Board of Radiology (or other) SAM sessions.

CONVERSION OF OTHER TEACHING FILE CASES TO RADPIX

- The structure of RadPix teaching files is based on the RSNA MIRC XML data structure, although RadPix uses an expanded data structure to support many additional features. Other data files such as those from Horizon Study Share, etc. could be migrated to RadPix.

HARDWARE/SOFTWARE CONFIGURATION

- The RadPix server application can run on Windows or Linux (Debian 9/10 preferred) on modern hardware. Customer is responsible for operating system costs (if any). A backup system is highly recommended and is the responsibility of the customer. The entire application and all supporting applications (except Chrome) are installed in one directory, making backup easy. In addition, the data folder can be moved to a different drive if desired.
- The RadPix server can be accessed with any of several web browsers, including Chrome, Internet Explorer (greater than version 9), Firefox, Edge, Safari, and Android and iPad browsers. Windows and MacOS PCs and tablets are supported. Although iPhones and Android phones are also supported, their small screen size makes them suboptimal, but many people successfully used their phones to view the cases at recent RSNA annual meetings.

INDUSTRY STANDARD SECURITY

- Apache webserver uses Modsecurity and OWASP rules to examine each incoming request and log and/or block any suspicious activity.
- Apache webserver hands-off web requests to the RadPix application which is a Java servlet that runs in the Apache Tomcat server.
- SSL is recommended for the server.
- Institutional LDAP is recommended for user authentication. If you are using any other software for user authentication on your network, we can integrate with it.
- All ports on RadPix server can be closed except: 443 (https), 80 (http), 1090 (DICOM SCP).
- Every case and 'storage' has permissions associated with them that can be set when the case is edited. Users can have no access, read access or update access and every access of any media of the case will require user credentials.
- RadPix uses JavaScript web tokens (JWT) for user credentials and every server request contains the credentials. RadPix does not use cookies or store other personal information on the client so it does not have to deal with the European Union privacy restrictions, etc. on cookie use.

INSTALLATION

RadPix is delivered for Windows as a single executable installer, which installs and configures everything needed. The Linux distribution is delivered as a bash file, which downloads files from www.radpix.com and elsewhere as needed.

- SSL installation instructions will be provided for the Apache webserver.
- DNS entry is directed to RadPix server, i.e., www.radpix.generalhospital.edu.
- LDAP configuration requires specific configuration settings. We will assist with configuration as needed. LDAP groups can be mapped to RadPix groups, which can then be used for specific functions in RadPix, such as the ability to edit cases. For instance, faculty, fellows, and residents can be given edit privileges, but medical students can be given only read privileges.
- RadPix DICOM destinations are added to your PACS. We recommend a different destination for each of the radiology subspecialties, for a total of 10-12. When users send images to one of the subspecialty destinations, i.e., “Neuroradiology”, the case will be tagged with the Neuroradiology subspecialty label, which will make the case easier to find.
- RadPix can be run on a bare server or on a virtual machine.

JAVA

RadPix uses an Open-Source version of Java distributed by Amazon, which can be used for free in production environments. RadPix will be shipped with the 64-bit version of Amazon Corretto Java 8.

LOGGING

Extensive system logging is available, including user activity including case access, case creation, etc. Other built in logging options include DICOM SCP activity, security events, patient information access, etc.

MAIN SOFTWARE COMPONENTS

Apache webserver 2.4.x
Apache Tomcat webserver 9.x

Postgres database server 12.x
Apache Solr 8.x
Amazon Corretto Java 8
FFmpeg
Grails
AngularJS

RadPix Use Cases

WORKFLOW

The RadPix system has been designed to integrate seamlessly into the daily workflow of a radiologist. While the radiologist is reading a study, key images are selected on the PACS. A button on the PACS allows the user to send DICOM images directly to RadPix via DICOM SCP. The received images are assembled by RadPix into cases based the hashed value of the patient ID and the cases are placed in Draft status. The radiologist or trainee can then view the case of selected images in RadPix and edit the draft file that RadPix created to complete a teaching file. Annotating images, adding text to the Findings, Diagnosis, Discussion and other sections, adding questions can all be done easily. If the radiologist only wants to get PowerPoint slides from the case, that can be done with a single button click, and the case can be immediately deleted. Each case has read and update permissions that can be set as the case is edited. RadPix checks the user credentials for access to every piece of the case.

SEARCH

The ability to search the system can be done by free text search of all entered text in cases, or by filters including subspecialty, modality, level of difficulty. System-wide or personal tags can be applied to cases for additional custom filtering.

PRESENTATIONS

Cases can be grouped into “Presentations” which can then be used in a live, interactive teaching session, or for self-paced learning. Presentations allow for optimum use of the built-in question and answer features and can also be used for testing. Recently, RadPix was also used as the platform for a national hands-on course by a radiology institution.

KEYS TO SUCCESS

One of the keys to having a successful teaching file system is to have a “Superuser” that can champion the cause for a teaching file system. If RadPix is deployed across multiple sites, a Superuser at each site that could show others how the system can help them. Simply showing the steps to use RadPix to get images into a PowerPoint quickly can often be enough to increase interest and usage.

Two ways to build a successful teaching file system are to require cases be created each month by residents or to have residents create cases out of their own good will. The culture of the group will best define which would be the most successful.

It can also be very useful to start a daily or weekly “Case of the Day”, in which the URL to a case is emailed to the entire user group. When viewing cases in this fashion, RadPix becomes part of the everyday education and can prompt additional case creation. Having a resident in charge of selecting the cases and then sending the email, invests people in the process. Such a task might rotate every year and include one or more trainees.

RadPix does not have the functionality to email cases by itself as this would require the RadPix server to have its own email address and email server, but it can create emails using in the user's email application. In the event that direct email sending ability is desired, this feature could be added.

Positive feedback to case creators can also have a positive effect on participation. This can include prizes for creating the most cases, answering the most questions correctly, etc. If a “Case of the Day” program is instituted, the person in charge could get recognition at the end of the year.

RadPix can also be used for daily resident conferences, either with or without added questions. The Presentation feature can be used to collect cases into a group which can be easily shown at conferences. By including a few images of each case, the residents can scroll through the images on their own devices during the conference.

A medical student case curriculum can also be set up, in which a series of cases from each of the radiology subspecialties can be assigned for review. The medical students can also be creators of cases, with review of the cases by faculty members.

A product demonstration can be set up for customers as desired. Also, a demo website on the internet can also be set up. More information and help pages are available at www.radpix.com.

RadPix is a modern radiology teaching file system that can be integrated into the daily routine of a radiology department. RadPix can provide a professional framework for radiology education that can save time, and money for its users.

Please let me know if you have any questions.

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