Medical Imaging
Advanced Imaging Solutions for Diagnosis, Localization, Treatment Planning and Monitoring
Over the years, medical imaging has become vital in the early detection, diagnosis and treatment of various critical diseases. Today several imaging modalities exist from the well-known x-ray, ultrasound, computed tomography (CT) and magnetic resonance (MRI) to more recent nuclear imaging techniques such as position emission tomography (PET) and single-photon emission computed tomography (SPECT) that target ‘structural’ and ‘functional’ body imaging. With the advent of hybrid imaging technologies like PET/CT and SPECT/CT, and continued innovations in image processing and image analysis, the diagnostic imaging field is certainly slated for revolutionary applications. In fact, advances in medical imaging technology are said to be the catalyst for the remarkable progress in cancer care and research over the last two decades. A key development in this regard has been the creation of high speed networks that enable the transfer, sharing and archiving of images and related data.

An imaging device in a radiology center or a hospital is connected with other systems in the hospital enterprise through a well-established, automated workflow that typically includes the ordering of radiology exams, image acquisition, archiving, and data access by clinician applications. The challenge and complexity of automated workflow lies in the processing and interpretation of the images. Software plays a vital role in this regard. Applications such as image processing that register pre-operative and post-operative image data, can be used to guide radiation therapy or surgical procedures, or for providing effective localization and treatment of neurological disorders such as epilepsy and Parkinson’s. Hybrid systems that leverage fusion of ‘structural’ and ‘functional’ data into single image (fusion modalities) reduce inaccuracies caused by variations in patient positions and possible internal changes over time, however it remains to be seen if it is physically possible to build additional hybrids other than PET-CT, SPECT-CT and MR-PET. Software based solutions have fewer constraints and have the potential to combine data from different desired modalities whenever a suitable clinical application requires it. Software image registration systems have been extremely useful in the fusion of data to plan therapy or to assess responses to therapy such as MRI/CT registration for guiding deep brain stimulation therapy for Parkinson’s disease. Similar solutions are also under investigation. Thus, as hybrid modalities become more popular, image processing software solutions continue to provide new advances and clinical benefits that are useful in many scenarios yet addressed by hybrid modalities.
Infosys PoV

Infosys believes that medical imaging software solutions are going to be increasingly used for diagnosis of diseases and guiding patient treatment and surgery as well as monitoring the response to the treatment. In recent years, imaging solutions have gone beyond ‘better diagnosis’ to provide treatment planning, response evaluation and guiding intervention in areas such as pre-operative planning for neurosurgeries. Hybrid modalities such as PET/CT and SPECT/CT and software based fusion imaging solutions that merge structural and functional images are becoming more common, providing benefits in ‘localization’ of tumors/cancer and neurological disorders. Infosys’ position is that there is a growing need of focused software based image processing solutions and clinical applications for:

- Pre-surgical evaluation and planning
- Surgical/treatment guidance
- Quantitative assessment of treatment response
- Research and development of custom image registration and fusion technologies for more accurate ‘localization’ of problem areas
- Efficient and faster ways to search clinical archives as ‘evidence based medicine’ gains more popularity
- Effective communication of information to referring physicians, other clinicians/researchers
- Evaluation of needs in emerging markets and create solutions locally
Challenges / Trends in Medical Imaging

Fusion modalities

Success of PET/CT has created a strong case for fusion modalities as they provide high sensitivity towards cancer detection and more accurate localization.

Image guided treatment

The use of image guided procedures provide a dependable reference and show a great potential in the treatment of cancer, cardiac and neurological disorders.

Content Based Image retrieval

Radiologist and researchers need frequent access to past radiological archives. Content based image retrieval (CBIR) techniques such as ‘query by image’ are being developed as a useful tool.

Image processing R&D

There is a greater interest in software based image registration and fusion solutions since they combine the benefits of dual modalities while helping to visualize and localize post-operative implants. New solutions will continue to be R&D based as research for new algorithms continue to be vital to finding solutions for certain clinical problems.

Improved User Experience and optimized workflow

Medical device manufacturers want to develop optimized workflows and intuitive GUIs for next generation software applications in close collaboration with users. Next generation tablet devices such as IPads with retina displays are being considered for use in imaging workflows.
Infosys Value Proposition

Infosys has affiliations with research institutes and hospitals in the areas of neurology, cardiology and radiology, in-house subject matter experts and a research lab involved in creating medical imaging solutions.

These resources define the ecosystem used to create a broad range of services including:

- 2D/3D application development,
- image processing algorithm research and development including image registration and fusion solutions,
- DICOM-based image data interoperability management.

Infosys is also focused on building specific custom neuro-imaging solutions for registration of pre-and post-operative images such as MRIs and CT scans for treatment guidance of neurological disorders. Our in-house research lab has created a solution for clinical data mining featuring a ‘query by image’ search. This solution incorporates a novel process and framework for quick navigation and search of archived medical images, providing radiologists with the additional background information needed for delivering efficient diagnosis and treatment. Infosys also offers digital watermarking and fingerprinting solutions for the security of images and videos. Clients can leverage our ecosystem to access local hospitals and research institutions which can help enhance their solutions as well as tap emerging markets like India.
# Infosys Medical Imaging Service Offerings

## Product development/Re-engineering
- Applications for diverse modalities such as CT, SPECT, MRI and ultrasound imaging
- New GUI development and web based radiology workflow for improved user experience
- 2D, 3D imaging and visualization
- Imaging applications for mobile devices

## Image Processing
- Image processing algorithm development
  - Pre-processing filters and noise reduction
  - Post-processing algorithms image registration etc.
- Custom image processing and image analysis solutions and diagnostic measurements for clinical purposes
- Content based Image retrieval (CBIR)
- Algorithms for patient data security and privacy
  - Digital watermarking and fingerprinting

## DICOM Standard based interoperability
- DICOM format (Part 10 file) implementation for various IODs
- DICOM communication services - Service Class Users (SCUs) and Service Class Providers (SCPs)
- Image Management - archive/retrieve, distribution to media (CD/DVD) and image compression etc.
- DICOM standard reports
- Interfacing with other systems (PACS/RIS)

## Verification and Validation
- Services across the complete V&V lifecycle including:
  - Functional testing, User acceptance testing, performance testing etc.
  - Interoperability testing – DICOM/IHE compliance
- Test automation services
  - Test requirements development - alliance with users/medical domain experts in the relevant area
  - Test scripts and test automation framework development
  - Integration of 3rd party test automation tools e.g. Ranorex

## Technology Adoption Services
- Assessment of existing technology solutions in the area of medical imaging (candidate technologies)
- Analysis and proof of concept (POC) development for candidate technology solutions for a product application
- Impact analysis and product migration to the new technology or product enhancement using the new technology
Radiologists and researchers need frequent access to past clinical data. Existing medical imaging solutions deployed in hospitals lack the capability of “query by image” search. Infosys has created a solution to retrieve visually similar images using CBIR techniques by organizing and classifying images based on user preferences using metadata. It also supports region of interest ROI (ROI) and segmenting images, extracting image features for enabling ROI-based CBIR.

For a leader in radiology products, infosys worked on the development and verification of a web based radiology workflow system. This system helped automate the overall workflow with significant reduction in per case time for radiologists.
About Infosys

Infosys partners with global enterprises to drive their innovation-led growth. That’s why Forbes ranked Infosys 19 among the top 100 most innovative companies. As a leading provider of next-generation consulting, technology and outsourcing solutions, Infosys helps clients in more than 30 countries realize their goals. Visit www.infosys.com and see how Infosys (NYSE: INFY), with its 150,000+ people, is Building Tomorrow’s Enterprise® today.

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