BMIT Avatar: A framework for visually indexing multimedia in Personal Health Records

Michael de Ridder
School of Information Technologies
Faculty of Engineering & Information Technologies

Supervisor: Jinman Kim

MOTIVATION

- The Digital Revolution means all patient data is going digital [1]
  - Many mediums: 2D, 3D and 4D imaging, video, metadata, text
  - Patients will grow with a digital record from their first ultrasound to an autopsy
- Current initiatives to store and index this do not provide any contextual information
- PHRs aren't user friendly leading to a lack of understanding of one's own medical data [1]

AIMS

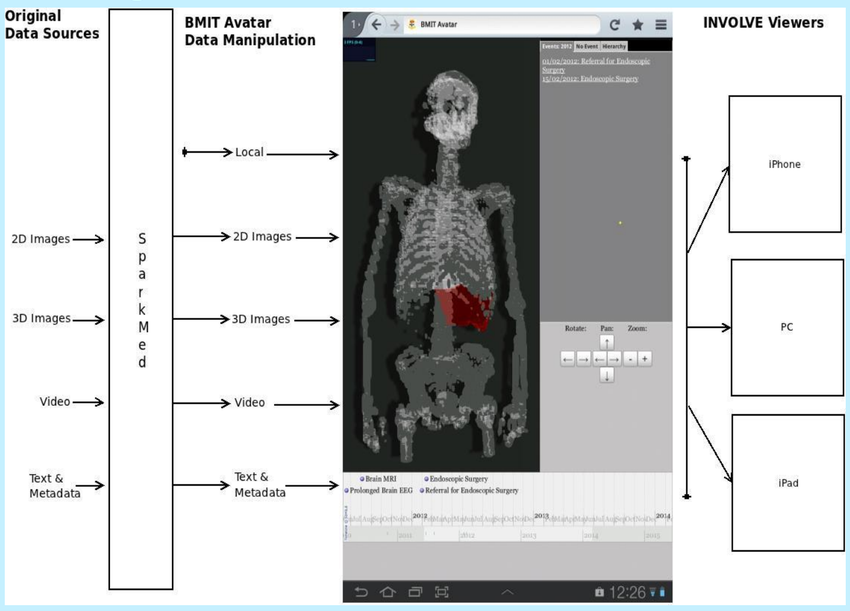
- Visual Indexing of the medical multimedia
  - Current systems can consolidate and search, but there is no way for people to garner understanding from browsing
- Use patient data to build rich, multimedia-based dictionary of their medical history
- Attain these by building a framework for an Avatar-Based PHR using the patient's own medical data

METHODS

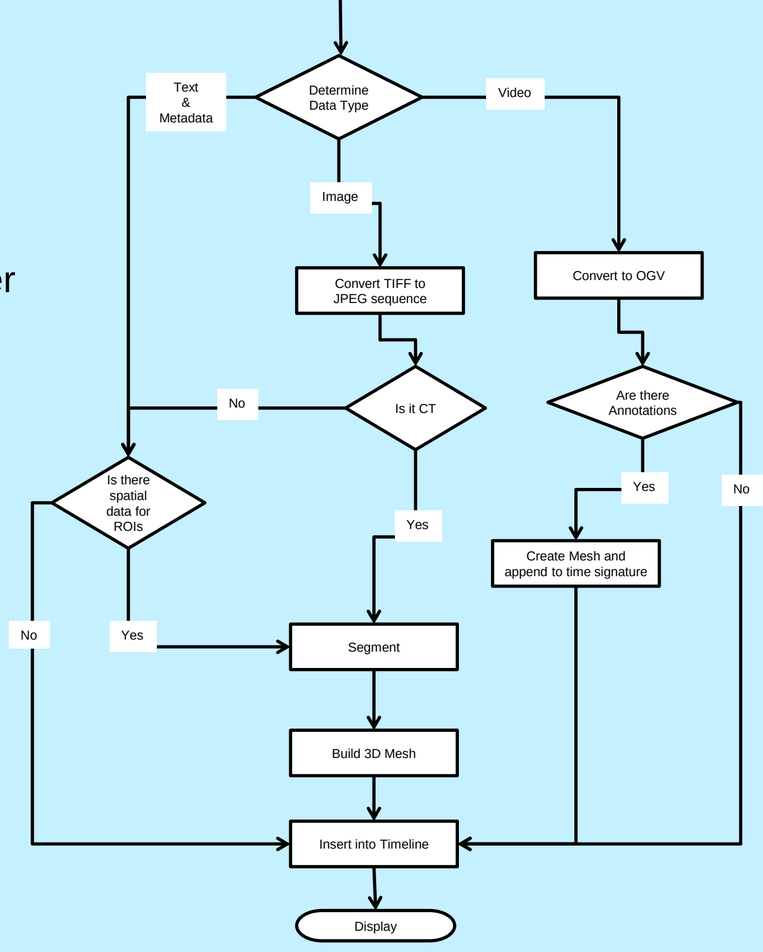
Data Input & Tools Used

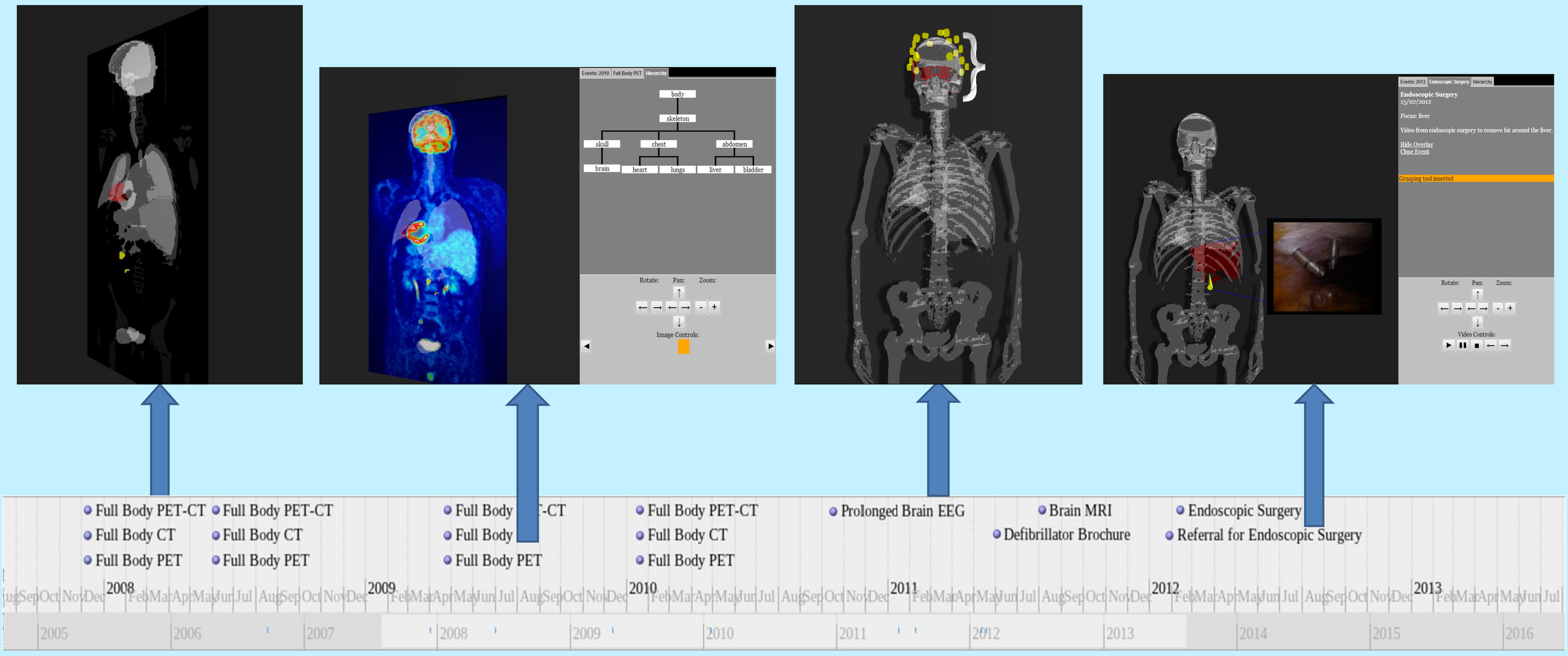
- Medical Images (CT, PET, MR, PET-CT)
  - Semi-automatically annotated using segmentation algorithms [2-4]
- Textual notes and metadata
- Spatial coordinates
  - Tumours, EEG electrodes, Endoscopic Apparatus
- Manually Annotated Endoscopic Video
- WebGL, ImageJ, MeVisLab, FFMpeg and Blender

The Big Picture



Data Flow





RESULTS

- Visually indexes clinical data in the form of:
  - Text, CT, PET, MRI, PET-CT & Video
- Indexes auxiliary metadata in the form of:
  - Spatial coordinates, 3D meshes & online brochures
- Able to index these data types with time-based updates of the Avatar mesh
- Handles addition of 2D & 3D images, video, text and meshes

Performance

Frame Rate (FPS)	Avatar Only	Avatar + Image	Avatar + Video
Dell Optiplex	12.6	12.1	10.2
Macbook Air	56.9	54.0	50.6
Samsung Galaxy Tab 7.7	3.8	2.9	<1

CONCLUSIONS

- A robust framework for visually indexing using an avatar-based PHR was developed
- Results demonstrate good performance on desktop computers with promising results for mobile devices as they become more powerful

FUTURE WORK

- Can be extended to include more data types
  - Natively support EEG
  - Better integration with Augmented Reality
  - Cloud-based PHRs
- Automation
  - Fitting into the Big Picture '3 Pillar' model
  - Segmentation, OBJ creation and import of CT
  - Video annotation
- Use of MRI as well as CT data to build the avatar
- Connection to ontologies and better formed hierarchies
- Optimisations for mobile devices

REFERENCES

[1] Archer, N., et al., "Personal health records: a scoping review." *JAMIA.*, vol. 18, pp. 515-522, 2011
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[3] E. Rikxoort et al., "Automatic segmentation of the liver in computed tomography scans with voxel classification and atlas matching." *Proc. MICCAI Workshop 3-D Segmentat. Clinic: A Grand Challenge*. 2007.
[4] I. Isgum et al., "Multi-Atlas-Based Segmentation With Local Decision Fusion–Application to Cardiac and Aortic Segmentation CT Scans." ." *IEEE T. Med. Imag.*, vol. *28*, no. 7, pp. 1000-1010, 2009.

We would like to acknowledge & thank our collaborative partners at the Royal Prince Alfred (RPA) Hospital .