SOP Discussion with Domain Expert

State of the Practice for Medical Imaging Software

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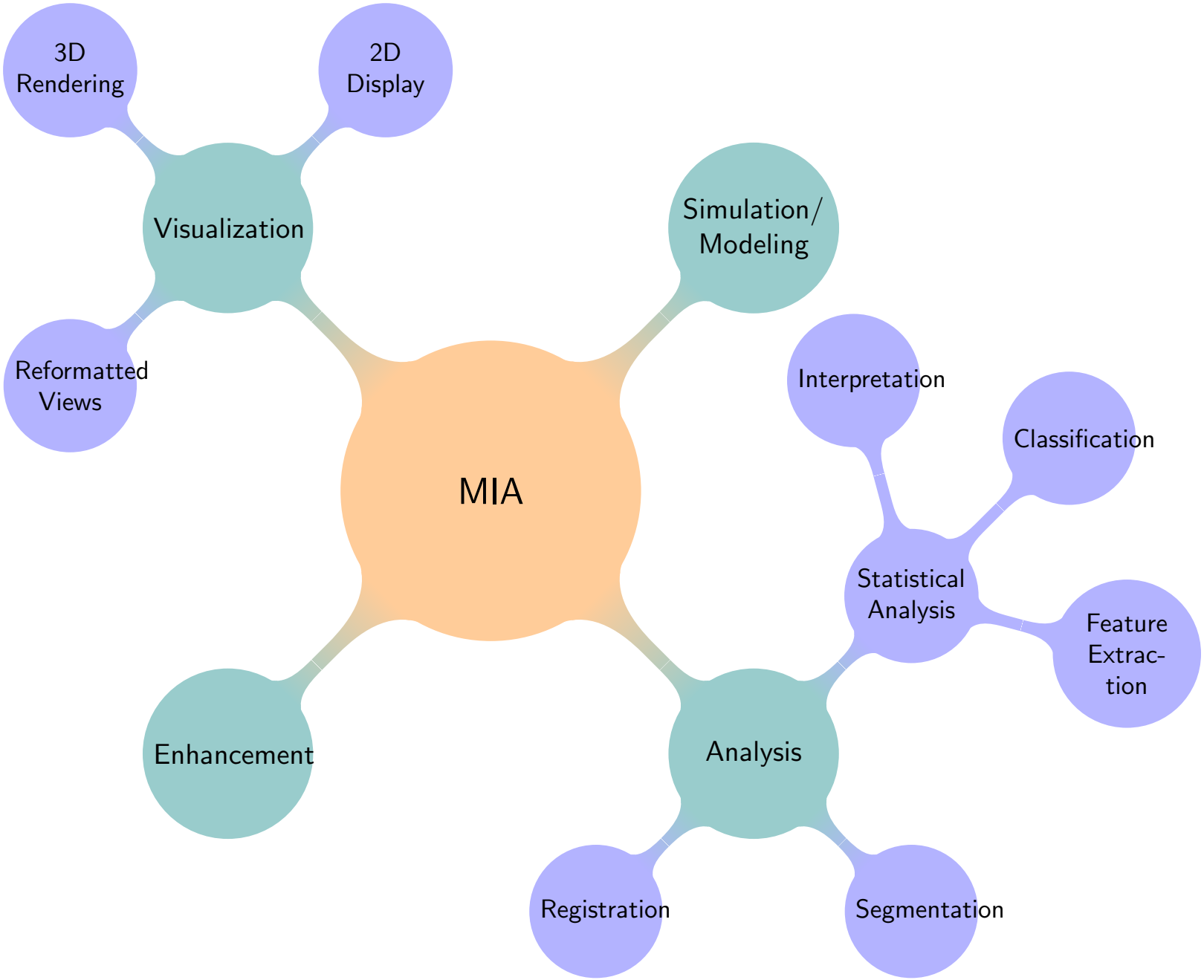
Overview

- Goals
  - Understand state of software development practice
  - Make recommendations for improvements
  - A publication that is useful to the community
- We have developed a standard methdology
- The methodology requires a **domain expert** to:
  - Vet the preliminary results
  - Assess the feasibility of the recommendations
  - Navigate the publication process
  - Answer **developer** interview questions on pain points
- Today's meeting
  - Informal
  - Questions do not have to be answered in real time

Scope


3D Rendering
2D Display
Visualization
Reformatted Views
Simulation/ Modeling
MIA
Interpretation
Classification
Statistical Analysis
Feature Extrac- tion
Enhancement
Analysis
Registration
Segmentation

Overall Process

1. *Domain Expert*: Create a top ten list
2. Initial list of candidate software packages
3. *Domain Expert*: Vet domain software list
4. Domain Analysis, Software Features
5. *Domain Expert*: Vet domain analysis / features
6. Collect empirical measures (stars, forks, lines of code, etc.)
7. Measure using measurement template
8. Interview developers (pain points)
9. Use AHP process to rank the software packages
10. *Domain Expert*: Vet AHP ranking
11. *Domain Expert*: Review recommendations

Vet Software List

- How does our list compare to the domain expert's list?
- Is any software missing?
- Is there software that should be included?
- Any other questions/comments or concerns?

- 3D Slicer
- Ginkgo CADx
- XMedCon
- Weasis
- MRIcroGL
- SMILI
- ImageJ
- Fiji
- DicomBrowser
- 3DimViewer
- Horos
- OsiriX Lite
- dwv
- Drishti
- BioImage Suite Web
- OHIF Viewer
- Slice:Drop
- GATE
- ITK-SNAP
- ParaView
- MatrixUser
- DICOM Viewer
- INVESALIUS 3
- medInria
- dicompyler
- MicroView
- Papaya
- AMIDE
- Gwyddion

Common With Domain Expert List

- 3DSlicer
- Horos
- ImageJ
- Fiji (a "batteries-included" distribution of ImageJ)
- Mango (on the initial list, but not the final list)
- Papaya (the web version of Mango)
- MRIcroGL (MRIcron development has moved to MRIcroGL)

Only on Domain Expert List

- AFNI https://afni.nimh.nih.gov
- FSL https://fsl.fmrib.ox.ac.uk/fsl/fslwiki
- Freesurfer https://surfer.nmr.mgh.harvard.edu
- Tarquin http://tarquin.sourceforge.net (for MRSpectroscopy data)
- Diffusion Toolkit http://trackvis.org/dtk/ (diffusion toolkit and trakVis)
- MRItrix https://www.mrtrix.org

Only on SOP List

- Ginkgo CADx
- XMedCon
- Weasis
- SMILI
- DicomBrowser
- 3DimViewer
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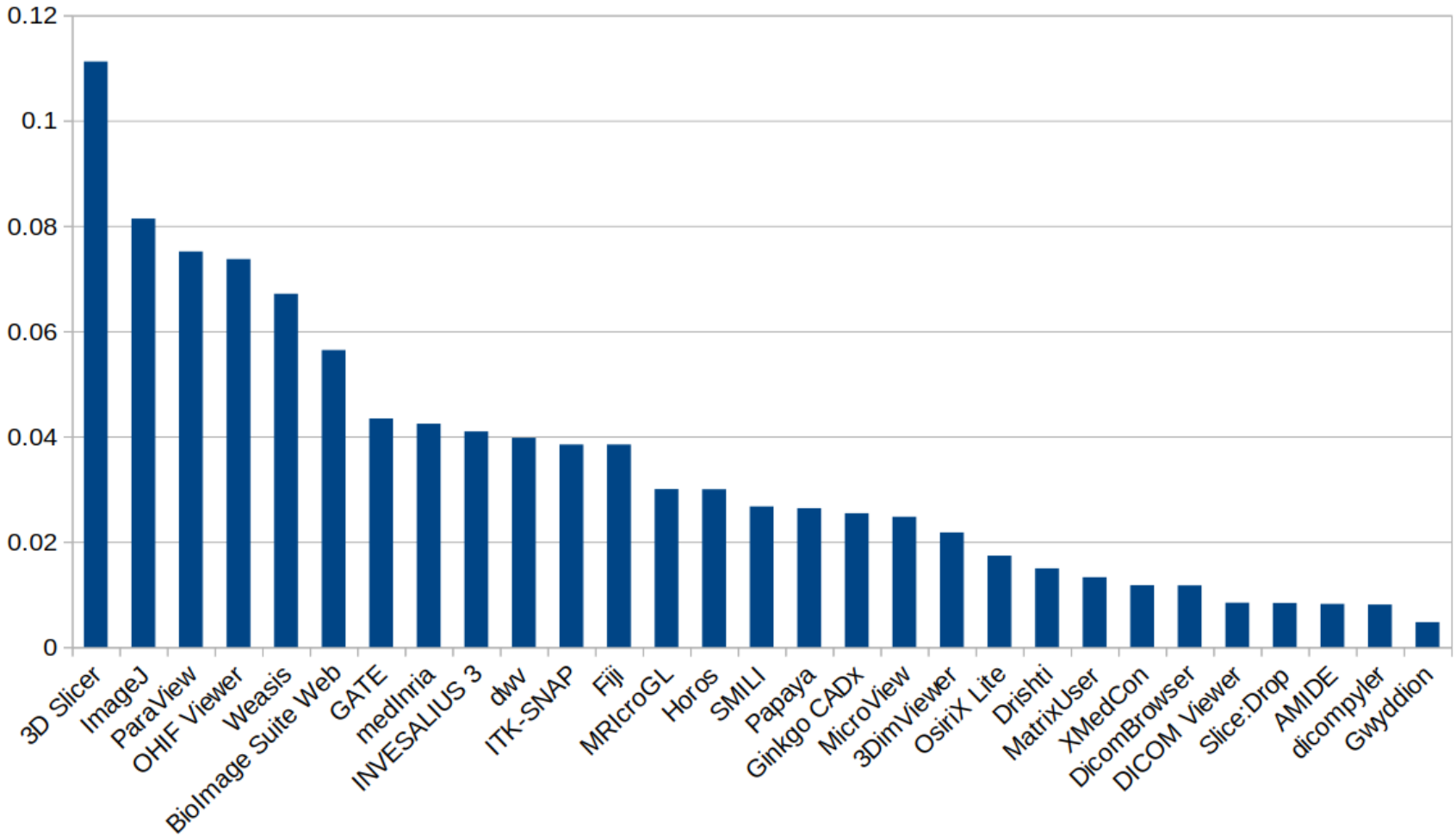
Domain Analysis and Features

- Can we work together on doing the following for the paper?
  - Domain analysis
  - List of features
  - Matrix of software related to features

Measurements Made

1. Installability
2. Correctness and verifiability
3. Surface reliability
4. Surface robustness
5. Surface usability
6. Maintainability
7. Reusability
8. Surface understandability
9. Visibility and transparency

Maintainability Measurement



Does anything stand out?

Domain Expert: Ranking Follow-Up

- Can you review the full ranking measurements?
  - There are 9 measurements
  - The write up is about 10 pages long
  - Our goal is to find anything that seems out of place

Developer Interviews: Pain Points

1. Lack of time to 1) implement all requested new features 2) write and maintain good documents 3) review all contributions from the community
2. It is difficult to find or keep the members with experience in both software development and medical imaging
3. Lack of funding for software development (especially for maintenance)
4. No organizations to help with developing high quality software
5. Difficulty to get test data
6. Difficulty to achieve cross-platform compatibility: 1) native app - more time and work 2) web app w/o server - worse performance 3) web app w/ servers - more cost

Recommendations

Do these seem feasible? What other ideas do we have?

- Consult with software development organization (P4)
  - Better Scientific Software (BSSw)
  - Software Sustainability Institute
  - Software Carpentry
- Citations for software (Katz project)
- Redefine productivity to include time working on tasks like testing, continuous integration and documentation

Publication

- Who do you see as the targeted readers?
- Where should we publish this paper?

Developer Questions

- What experience do you, or your students, have with developing software?
- How big would the development group be?
- What is the typical background of a developer?
- How many users would you software typically have?
- What is the typical background of a user?
- Currently, what are the most significant obstacles in your development process?
- How might you change your development process to remove or reduce these obstacles?
- How does documentation fit into your development process? Would improved documentation help with the obstacles you typically face?

Developer Questions Continued

- In the past, is there any major obstacle to your development process that has been solved? How did you solve it?
- What is your software development model? For example, waterfall, agile, etc.
- What is your project management process? Do you think improving this process can tackle the current problem? Were any project management tools used?
- Was it hard to ensure the correctness of the software? If there were any obstacles, what methods have been considered or practiced to improve the situation? If practiced, did it work?

Developer Questions Continued

- When designing the software, did you consider the ease of future changes? For example, will it be hard to change the structure of the system, modules or code blocks? What measures have been taken to ensure the ease of future changes and maintainance?
- Provide instances where users have misunderstood the software. What, if any, actions were taken to address understandability issues?
- What, if any, actions were taken to address usability issues?
- Do you think the current documentation can clearly convey all necessary knowledge to the users? If yes, how did you successfully achieve it? If no, what improvements are needed?

Developer Questions Continued

- Do you have any concern that your computational results won't be reproducible in the future? Have you taken any steps to ensure reproducibility?