

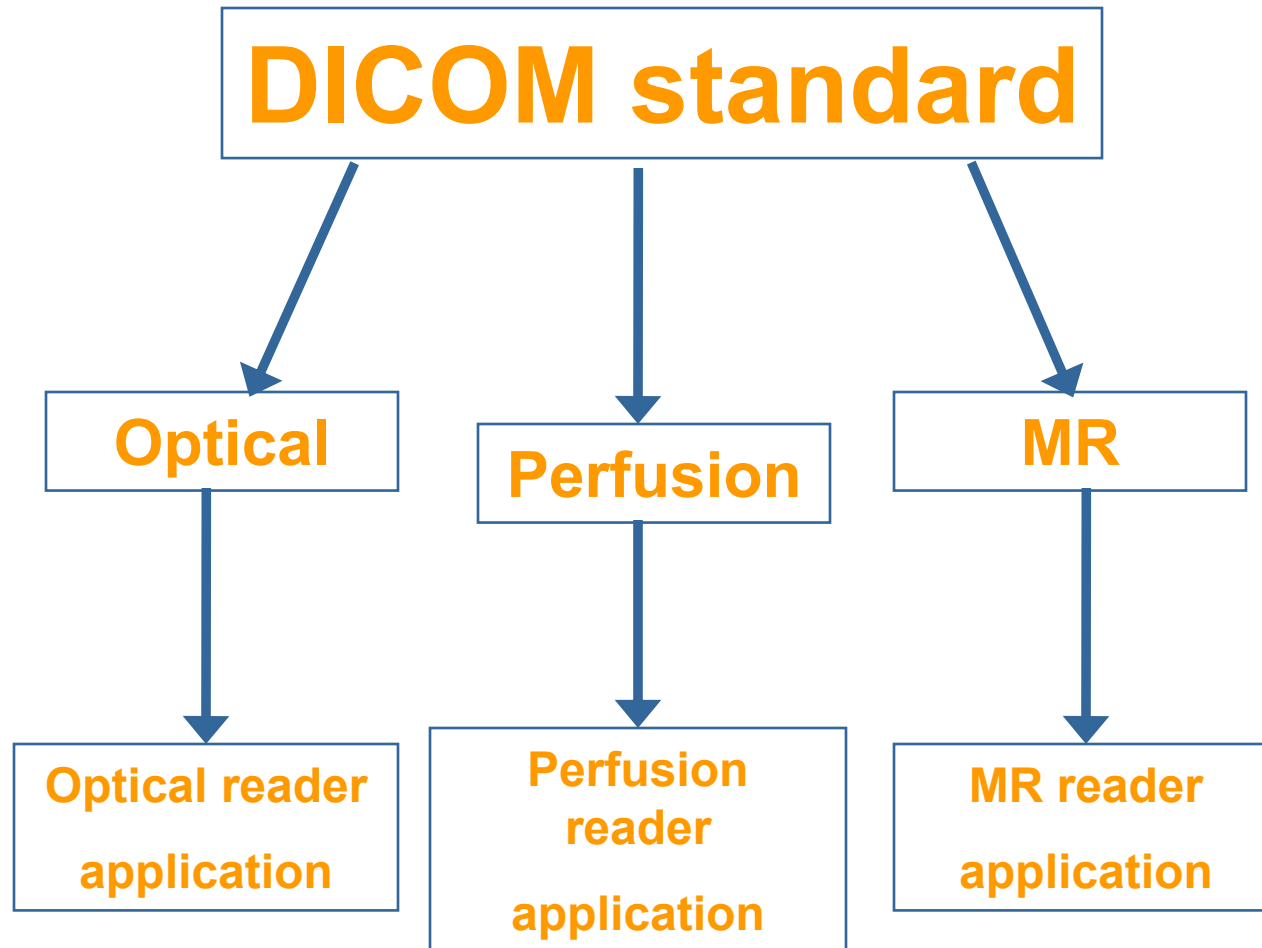
A new method for increasing the flexibility of DICOM tags management in application-specific integration

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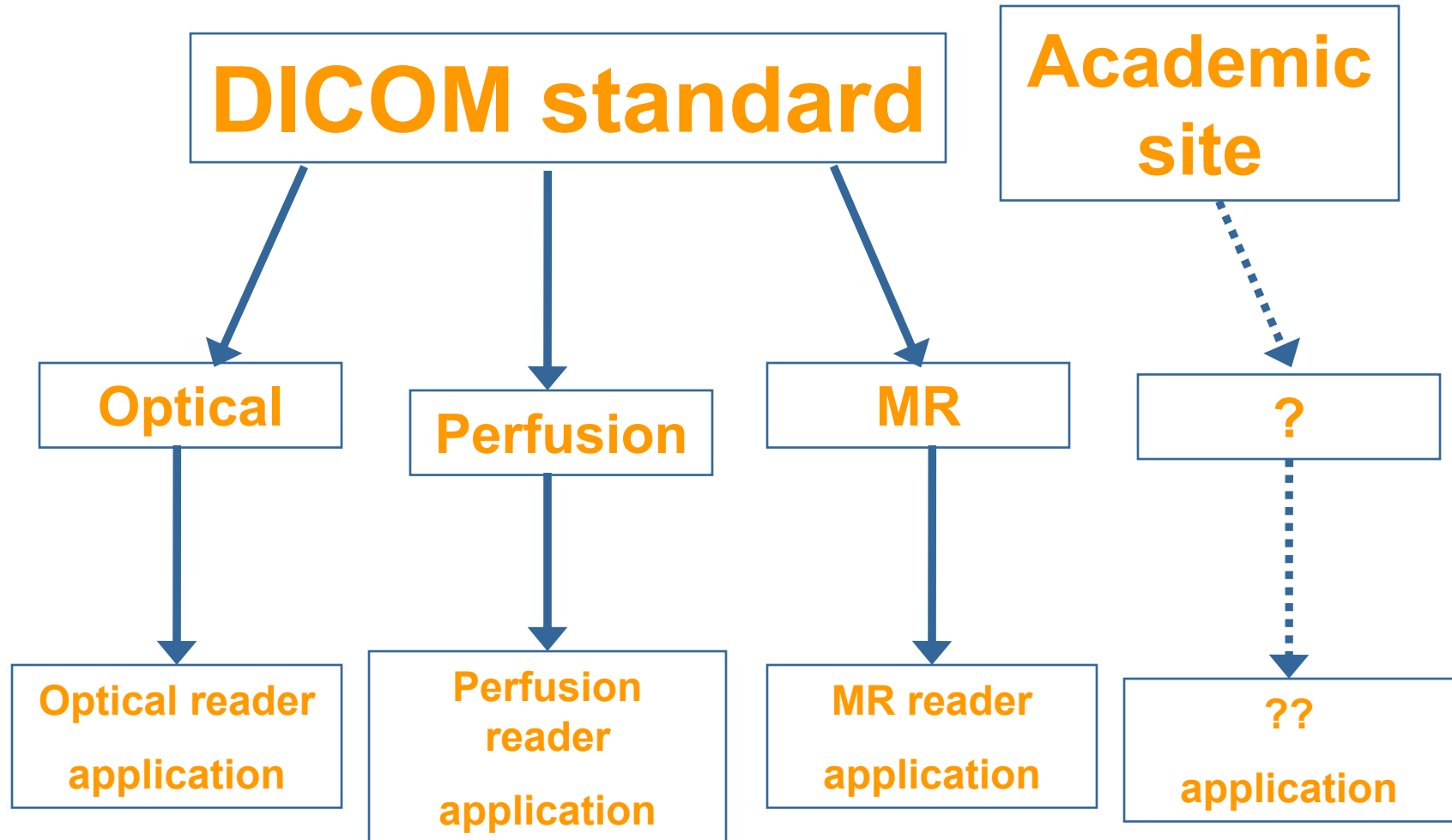
Motivation

- Researchers use DICOM objects of various origins, functionalities, ...
- Current solution: application specific DICOM reader/writer → time lost
- Need for a standard tool to read/write DICOM object for all configurations

Motivation



Motivation



New Method

- Standard tool → configuration file to describe reading/writing procedure
- User editable
- Simpler than re-write a DICOM reader/writer software
- User-friendly

New Method

DICOM standard



Modality X + init file



Reader / Writer application

New Method

[Essential_TAGS]		
[SLICE_RELATED_TAGS]		
	IMAGE_NUMBER	x00200013
	IMAGE_POSITION_PATIENT	x00200032
	IMAGE_ORIENTATION_PATIENT	x00200037
[PATIENT_RELATED_TAGS]		
	PATIENTS_NAME	x00100010
[DICOM_OBJECT_RELATED_TAGS]		
	HIGH_BIT	x00280102
	PIXEL_SPACING	x00280030
	ROWS	x00280010
	COLUMNS	x00280011
	BITS_ALLOCATED	x00280100
	BITS_STORED	x00280101
[Essential_TAGS]		
[Optional_TAGS]		
[SLICE_RELATED_TAGS]		
	ACQUISITION_TIME	x00080032
[PATIENT_RELATED_TAGS]		
	BODY_PART_EXAMINED	x00180015
	PATIENTS_SEX	x00100040
	PATIENT_ID	x00100020
	PATIENTS_BIRTH_DATE	x00100030
[DICOM_OBJECT_RELATED_TAGS]		
	SERIES_NUMBER	x00200011
	MODALITY	x00080060
	MANUFACTURER	x00080070
	INSTITUTION_ADDRESS	x00080081
	STUDY_DESCRIPTION	x00081030
	SERIES_DESCRIPTION	x0008103E
	PHOTOMETRIC_INTERPRETATION	x00280004
	STUDY_DATE	x00080020
	SERIES_DATE	x00080021
	STUDY_TIME	x00080030
	CUSTOM_TAG	x00080031
[Optional_TAGS]		



**Differentiate
objects**



Optional tags

New Method

[Essential_TAGS]		
[SLICE_RELATED_TAGS]		
	IMAGE_NUMBER	x00200013
	IMAGE_POSITION_PATIENT	x00200032
	IMAGE_ORIENTATION_PATIENT	x00200037
[PATIENT_RELATED_TAGS]		
	PATIENTS_NAME	x00100010
[DICOM_OBJECT_RELATED_TAGS]		
	HIGH_BIT	x00280102
	PIXEL_SPACING	x00280030
	ROWS	x00280010
	COLUMNS	x00280011
	BITS_ALLOCATED	x00280100
	BITS_STORED	x00280101
[Essential_TAGS]		
[Optional_TAGS]		
[SLICE_RELATED_TAGS]		
	ACQUISITION_TIME	x00080032
[PATIENT_RELATED_TAGS]		
	BODY_PART_EXAMINED	x00180015
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	STUDY_DATE	x00080020
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	STUDY_TIME	x00080030
	CUSTOM_TAG	x00080031
[Optional_TAGS]		

Custom tags

A Flexible Method

This method is flexible enough for use in various contexts, such as:

- Imaging modalities: perfusion or angiography,
- Application-specific data: contour sequences for image segmentation,
- Novel imaging modalities: molecular or optical imaging.

Relevant Example

Network for Translational Research in Optical Imaging: A Software Platform for Multi-Modal Information Integration & Visualization



Project Background

- Program Funded:

 - Breast Cancer Multi-Dimensional Diffuse Optical Imaging
(MD-DOI)**

- Program duration: 5 years

- Vision & Goals:

 - Develop a **standardized Multidimensional Diffuse Optical Imaging technology platform** for use in breast imaging as a stand-alone device or in conjunction with MRI and X-ray mammography,
 - Dramatically improve breast cancer detection, clinical management and quality of life for breast cancer patients.

Siemens Corporate Research (SCR) : Role & Approach

- **Integrate (register/fuse/combine) MD-DOI with MR & X-ray mammography**
- **Assist “Projects” with common software/algorithms issues**
 - Develop software platform for common functions,
 - **Help establish common data formats and processes for sharing data and software,**
 - Integrate into the hardware platforms.

OMIRAD Platform - Capabilities

Optical & Multimodal Imaging Platform for Research, Assessment & Diagnosis (OMIRAD)

- Multimodality 3D Visualization, Segmentation, Registration, Measurements:

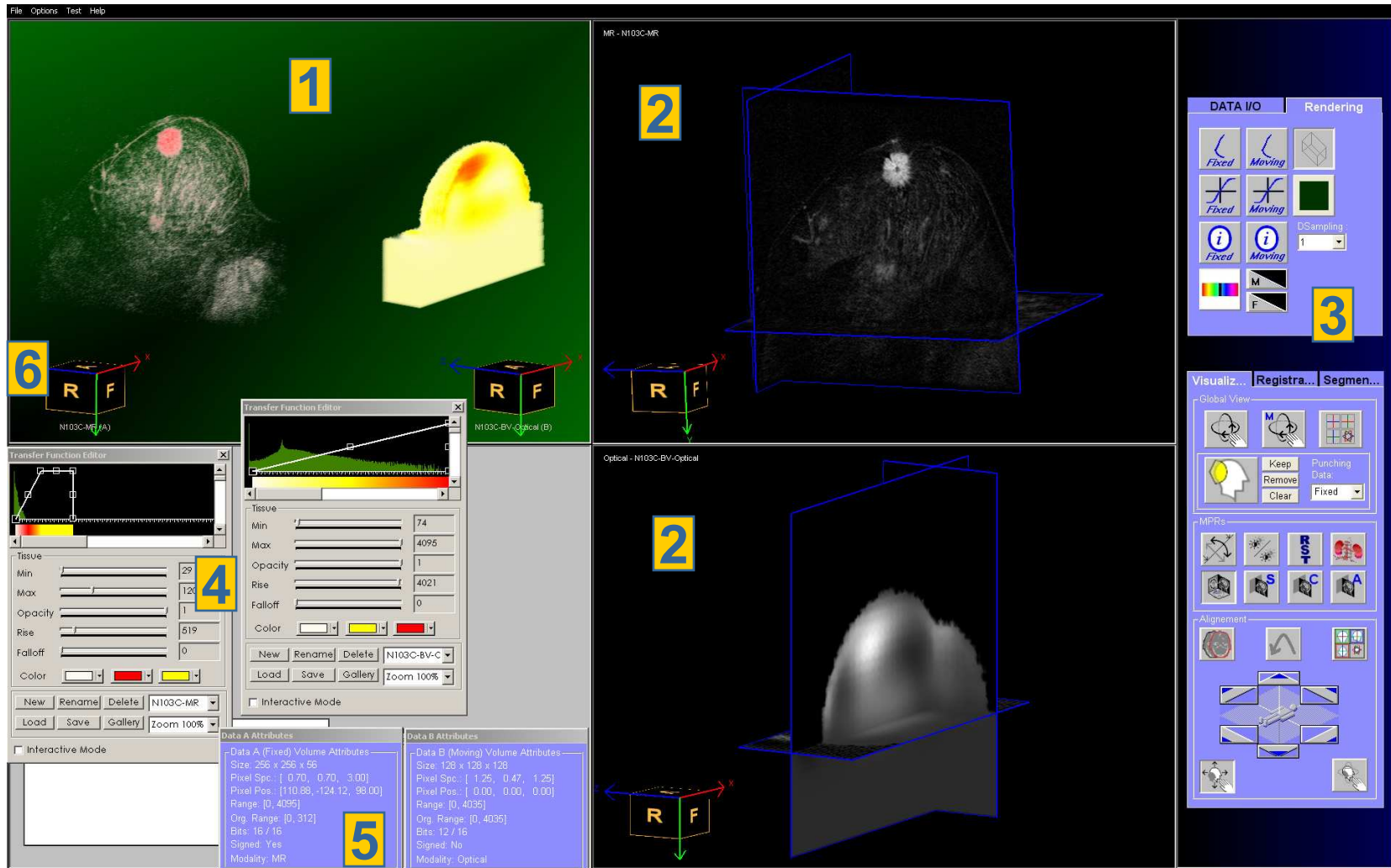
- Diffuse optical tomography (DOT),
- Diffuse optical spectroscopy (DOS),
- Magnetic resonance imaging (MRI),
- X-ray Tomosynthesis of breast cancer,

- **Import/Export:**

Arbitrary optical imaging format → DICOM Format.

- Prototype Platform released to all Academic Sites in the Network, for testing & standardization of methods

OMIRAD Platform - Snapshot



1 3D Volume rendering window: Cancer appears in MR and DOT data

2 2D visualization windows

3 Command tabs: Data I/O, Visualization, Registration, Segmentation

4 Transfer function editors

5 Data attributes windows

6 Orientation cube

OMIRAD Platform – I/O Challenges

- With respect to Optical Imaging data:
 - Each Academic Site has its own custom hardware imaging device,
 - Each Academic Site has its own proprietary image format,
 - Each Academic Site stores different sets of parameters,
 - Many different parameters to keep track of:
 - Optical image acquisition (wavelengths used, position of light emitters, light receptors, etc...),
 - Optical image reconstruction (reconstruction parameters),
 - Physiologic parameters (oxy-, deoxy- hemoglobin concentration, oxygen, water concentration),
 - Need for a flexible method to store, organize & share data across Academic Sites.

Example

Academic Site 1:
Format 1 ≠ DICOM

2005

DICOM
Initialization File

Academic Site 2:
Format 2 ≠ DICOM

Conclusion

- New method for increasing the flexibility of DICOM tags management,
- Standard tool → configuration file to describe reading/writing procedure,
- User editable & user friendly,
- Simpler than re-write a DICOM reader/writer software,
- This method is flexible enough for use in various contexts:
 - Imaging modalities: perfusion or angiography,
 - Application-specific data: contour sequences for image segmentation,
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