



EFMI
European Federation for Medical Informatics

Working Group on Medical Image Processing

Workshop: Reference Image Datasets for Medical Image Processing Research and Development

August 27, 2002, 16:10-17:30

Alexander Horsch
Chair of WG MIP



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Topic summary

- MIP is of increasing importance for modern medicine (CAD, CAS, etc)
- However: Results of R&D work are usually not or hardly comparable due to the fact that each R&D group uses its own datasets for to develop and evaluate their methods
- Furthermore: datasets themselves are often insufficient or too small for clinically sound evaluation studies
- There is an urgent need to establish, step by step, a reference image database providing numerous high-quality datasets for medical image processing R&D groups from different domains.
- In September 2001, with the EFMI WG an initiative has been started to begin this work.



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Goal of the workshop

- During the workshop, the existing concept and roadmap for to create such a database, as well as first available datasets shall be presented and discussed.
- In the end of the workshop, a list of recommendations for a revision of both concept and roadmap shall be agreed on.
- Furthermore, interested colleagues can join the efforts of EFMI WG MIP.



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Professional interests of audience

- intended audience are colleagues working in the field of medical image processing, either on methodological research or on development of clinical applications like CAD or CAS. Possible motivations for to join the workshop can be:
 - to get information about existing material and how to get it for the own work
 - identification of possible own contributions to the database
 - for to get up-to-date information about the subject
 - for to meet experts in this field



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Expected outcome

- A list of recommendations on further development of reference database
- New contacts between the WG and potential participants in the development



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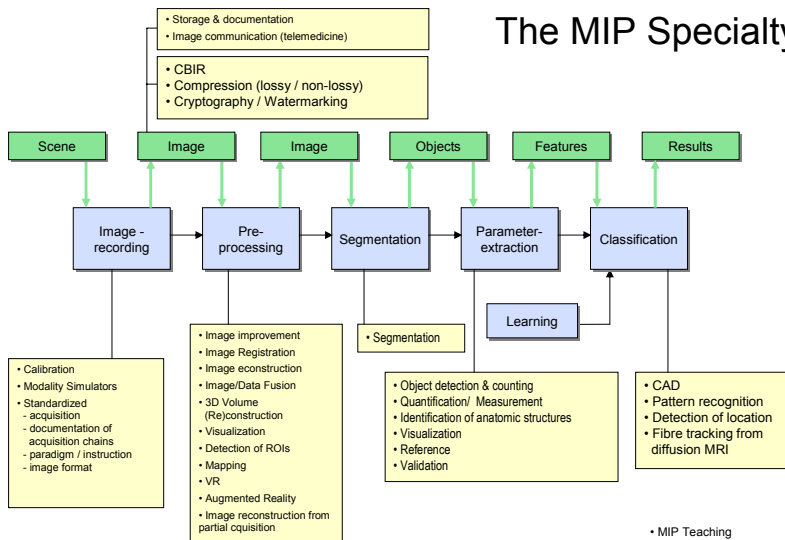
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Agenda

- Presentation of
 - **Background**
 - Concept
 - Roadmap
 - First Datasets
- Presentation of Casim@ge (Christian Lovis, Geneva)
- Discussion of the presented material
- Collection (brainstorming) and sorting of ideas for improvement
- Selection and final agreement on a list of recommendations



The MIP Specialty



Background

- MIP is growing interdisciplinary field
- Basic research, clinical evaluation, algorithm design, clinical studies
- Own image datasets by almost each R&D group
- Algorithms tend to be optimized to the one or few acquisition units available
- Comparison of research results from different R&D groups rarely possible
- Datasets usually do not represent the medical variety needed for large clinical studies
- Solution multi-center studies usually suffers from unbalanced usage of different imaging units



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EFMI WG MIP

- Initiated 09/2001 London (Medinfo)
- Mission:
 - Foster discussion and activities on theory and practice of MIP
 - comprising: integration of decision support by MIP into clinical practice (including clinical evaluation, standardization, technology transfer)
- Work products:
 - RID-MIP
 - MIP R&D Groups IS
 - WG Website



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WG Members

- Austria: Prinz, Vogl
- Finland: Sipilä
- Germany: Horsch, Wittenberg, Schneider, Zahlmann
- Switzerland: Vallée
- The Netherlands: Verdonck

Interested colleagues from further EFMI countries:

- Spain: Gomez Vilda

...coming from universities, Siemens, hospitals.



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Overall Approach

- RIDSs (well-defined, validated) from experienced providers
- RIDSs meet quality criteria defined by interdisciplinary expert groups (domain-specific)
- Bilateral agreements / contracts between provider & users of a RIDS
- EFMI WG MIP
 - proposes tasks / challenges
 - supports RIDSs specifications
 - supports RIDSs dissemination
 - organizes special sessions at conferences
 - evaluates overall impact



Criteria for Task Assessment

- Relevance of medical problem in terms of
 - Mortality & morbidity statistics
 - DRG statistics (e.g. USA, Australia, Austria)
 - What is funded by WHO, EC, ...
 - Current science activities,
 - Literature
- Role of imaging in the diagnostic / therapeutic process
 - key role, important role, marginal role
- Potential for improvement of outcome by improvement of image reading / image usage / image analysis
 - life years, cost savings
- MIP task – paths to find solutions exists
- MIP challenge – no real ideas present of how to find a solution



Leading causes of death, USA 1999

Rank ¹	Cause of death (Based on the <i>Tenth Revision, International Classification of Diseases, 1992</i>), race, sex, and age	Number ²	Percent of total deaths ²	Rate ²
	All races, both sexes, all ages ³			
...	All causes	2,391,399	100.0	877.0
1	Diseases of heart . . . (I00–I09,I11,I13,I20–I51)	725,192	30.3	265.9
2	Malignant neoplasms (C00–C97)	549,838	23.0	201.6
3	Cerebrovascular diseases (I60–I69)	167,366	7.0	61.4
4	Chronic lower respiratory diseases (J40–J47)	124,181	5.2	45.5
5	Accidents (unintentional injuries) (V01–X59,Y85–Y86)	97,860	4.1	35.9
6	Diabetes mellitus (E10–E14)	68,399	2.9	25.1
7	Influenza and pneumonia (J10–J18)	63,730	2.7	23.4
8	Alzheimer's disease (G30)	44,536	1.9	16.3
9	Nephritis, nephrotic syndrome and nephrosis . . . (N00–N07,N17–N19,N25–N27)	35,525	1.5	13.0
10	Septicemia (A40–A41)	30,680	1.3	11.3
...	All other causes (Residual)	484,092	20.2	177.5

From EFMI-WG-MIP-2310-00.10 draft 2002-07-24 Fig. 1: Part of Table 1: Deaths, percent of total deaths, and death rates for the 10 leading causes of death in selected age groups, by race and sex: United States, 1999. National Vital Statistics Reports, Vol. 49, Nr. 11, October 12, 2001, page 14



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Medline Meta-Studies

From EFMI-WG-MIP-2310-00.10 draft 2002-07-24 Table 1: Total number of meta-studies on diagnostic imaging referenced in Medline database on June 5, 2002, sorted by frequency

#	Diagnosis	Prozedure
25	Mammatumoren,Mensch	Mammographie
17	Koronarkrankheit	Koronarangiographie
16	Mammatumoren,Mensch	Reihenuntersuchung
11	Myokardinfarkt	Koronarangiographie
9	Koronarkrankheit	Echokardiographie
9	Koronarkrankheit	Belastungstest
8	Koronarkrankheit	Prognose
6	Rezidiv	Koronarangiographie
6	Koronarkrankheit	Elektrokardiographie
6	Koronarkrankheit	Einzelphotonen-Emissionscomputertomographie
6	Koronarkrankheit	Computertomographie
6	Myokardinfarkt	Behandlungsergebnis
5	Infertilität,weibliche	Hysterosalpingographie
5	Pulmonale_Embolie	Computertomographie
5	Pankreatitis	Cholangiopankreatographie,retrograde_endoskopische
5	Herzkrankheiten	Echokardiographie
4	Rezidiv	Prognose



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Task/challenge proposals

- CAD for support of breast cancer screening:
Detect micro-calcifications on all images of the mammography dataset D_1 with a 10-fold cross-validated sensitivity > 0.9 at a rate of false positive ROI detections $< 0.5!$ CHALLENGE
- CAD for esophagus tumor staging:
Make a robust and fully automatic T1 to T3 staging of esophageal tumors in the EUS still images dataset D_2 with an overall classification quality of $\kappa > 0.6!$ CHALLENGE
- ...



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Objectives of RID-MIP

- Provide a methodology for building a medical image database
- Provide information on existing datasets and who is the provider
- Provide templates for bilateral agreements / contracts between provider and users
- Provide different kinds of datasets for evaluation of MIP methods and applications
- Follow-up the usage of datasets in terms of published results
- Bring the prototypical RID-MIP into long-term operation (e.g. at a publishing company)



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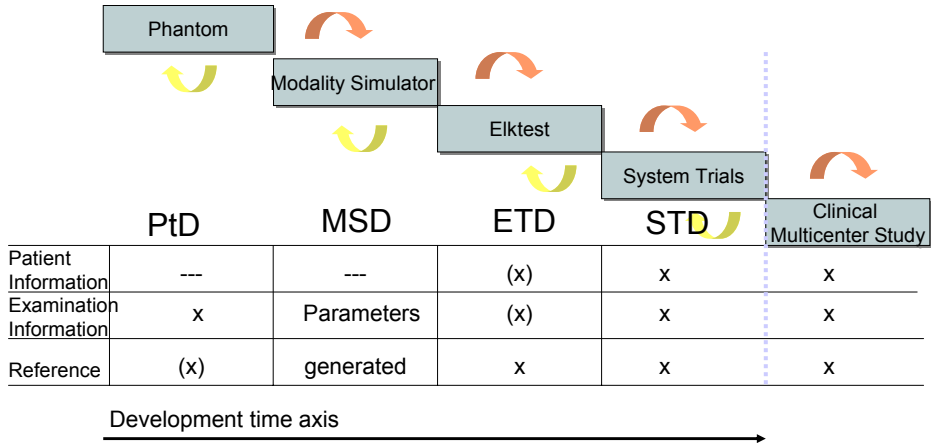
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Addressees of RID-MIP

- European MIP R&D groups
- MIP R&D groups outside Europe
- Public sector (usually free of charge)
- Private / commercial sector (usually by licensing)



MIP system development and the different kinds of datasets



Licensing Policy

- ETDs method-oriented → free (agreement)
- STDs research public sector → free, agreement
- STDs product-oriented → license fees user to provider, contract
- EFMI WG MIP will provide templates for agreements & contracts



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Provider/User Agreement

§ 1 Subject

... timely limited, non-exclusive usage license for the dataset...

§ 2 User license

... user is allowed to use the dataset in the framework of the following scientific studies: ...

§ 3 Binding to purpose

§ 4 Validity timespan

§ 5 Reference character of the dataset

§ 6 Usage by a third party



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Provider/User Agreement

§ 7 Media and copies

§ 8 Reference copy

§ 9 Fees

§ 10 Co-operation

§ 11 Publication of the results

§ 12 Runtime and irregular termination



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Organisation & Roles

- EFMI WG MIP (RID-MIP Project Group)
 - initiating, supporting, organizing, assessing
- Technical Board of Experts
 - specifying
- Medical Board of Experts
 - recommending
- Dataset Provider
 - preparing, submitting, offering
- Dataset User
 - using, reporting / publishing



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Roadmap (preliminary)

- Identification and specification of important tasks
- Selection of 3 tasks from different domains where data are probably easy to get
- Specification and preparation of related ETDs
- Publishing of task descriptions on the Web & dissemination of ETDs
- Evaluation of impact on R&D



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Time Schedule for phase 1

(preliminary, updated August 2002, not yet passed in the WG)

- 1st WG meeting June 6-7, Munich
- choice & specification of first ETDs until Aug 2002
- [early application for funding]
- preparation of ETDs Oct 2002 to Feb 2003
- 3rd WG meeting Feb/Mar 2003
- dissemination Apr to Aug 2003
- [late application for funding]
- evaluation (3 years)



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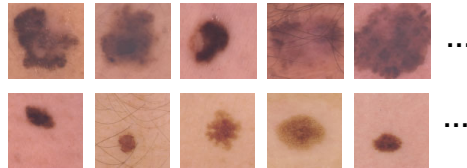
First datasets

- Munich group:
 - Skin Surface Microscopy of Melanocytic Lesions
 - EUS Gastrointestinal tumors
- Erlangen group:
 - MRI of Stroke Lesions



D-SSM-ML-300-V1.0 (Dec 2001)

- Dermatology
- Skin Surface Microscopy
- Melanocytic Lesions
- 150 melanomas
- 150 naevi
- **In total 300 images**



Standardized RIDS naming

- | | |
|---------------------------|-------------------------------|
| • medical domain | Dermatology = D |
| • modality | Skin Surface Microscopy = SSM |
| • subject of imaging | Melanocytic Lesions = ML |
| • number of images/series | 300 |
| • version number | V1.0 |
| • optional: date of issue | (Dec2001) |

Dermatology Skin Surface Microscopy Melanocytic Lesions 300
D-SSM-ML-300-V1.0



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