Model Guided Medicine (MGM)
Patient Specific Modelling and Management for Medical Diagnosis and Therapy

FET “Understanding Life through future ICT”

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Idea

From data- and information-centric to model-centric medicine for intelligent decision making in medical diagnosis and therapy

Examples of models:
- Probabilistic Relational Models (PRMs)
- Multi-Entity Bayesian Networks (MEBN)
Modelling Medical Information and Model Management System (MIMMS)
ICT infrastructure for data, image, model and tool communication for patient model-guided medicine

Simulation
Kernel for WF and K+D Management

Visualisation
Rep. Manager

Diagnosis
Intervention

Validation
Tools

Imaging and Biosensors
Modelling
Simulation
KF and K+D tools
Rep. tools
Devices/ Mechatr. tools
Validation

Medical Information and Model Management System (MIMMS)
ICT infrastructure for data, image, model and tool communication for patient model-guided medicine

Data and information
Patient specific Models
Process models
Models and medical records

Ambition
ICT architecture and functionalities for Model Guided Medicine (MGM)
(to be realized by 2020)
Impact

• **Model Guided Medicine (MGM)**
  – Patient-specific modelling (PSM), Process modelling (PM) and Medical Information and Model Management Systems (MIMMS) will enable a Model Based Medical Evidence (MBME).
  – If designed and employed successfully, this MBME will help to establish scientifically valid standards for medical activities of physicians, patients and the healthcare community at large.
  – MGM requires the challenging task of developing appropriate diagnostic and therapeutic ICT-based tools such as a MIMMS and other computing and communication intensive systems.

• **Advantages for Physician and Patient:**
  – **PSM**: Descriptive, interactive, updatable, probabilistic representation of the patient.
  – **PM**: Capable of medical procedure analysis, understanding, learning, prediction and decision-making.
  – **MIMMS**: Medical ICT-based system which integrates the PSM with the PMs and a spectrum of computer assisted medical functionalities to provide a model based patient care.

\[ \text{MGM = PSM, PM and MIMMS} \]
Integration
ICT platform/infrastructure for MGM services and management

MGM network of research centres

- MGM Grid Server
- De-identified Data
- Anonymized Data
- Data with PHI
- Research Centres
- Grid data services
- Medical Information and Model Management System
- CRMS functionalities
- Grid project/study invocation, workflow and security services (clinically driven)
- Clinical EMR Repository
- Firewall
- Intervention devices

MGM network of clinical centres

- Clinical Imaging and biosensor systems
- QARC and collaborators
- Intervention devices
- Research imaging and biosensor systems
- MIMMS functions
- Application services (research driven)
- Research MIMMS Information Repository
- Medical Information and Model Management System
- CRMS functionalities
- Application services (research driven)

- Intervention devices
- Medical Information and Model Management System

Research centres

- Research MIMMS Information Repository
- Clinical EMR Repository
- Medical Information and Model Management System
- CRMS functionalities

Clinical imaging and biosensor systems

- Intervention devices
- Medical Information and Model Management System
- CRMS functionalities
- Application services (research driven)
Plausibility


6. Realization of repositories with PSMs and processes for different medical disciplines including protocols for cross health care enterprise sharing of models and definition of appropriate standards (2015-2020).

Support

• The International Foundation for Computer Assisted Radiology and Surgery (IFCARS) is built on a more than 25 years of experience in assessing and coordinating R&D activities in computer assisted medicine on a world wide basis. IFCARS is active in the promotion of R&D results in congresses and peer reviewed publications as well as in the realisation of new medical projects. The combined achievements of IFCARS/CARS and its partners have had a major impact on how health care is carried out today.

• MGM network of research centres
  IFCARS research partners for a FET: Final selection TBD

• MGM network of clinical centres
  IFCARS clinical partners for a FET: Final selection TBD