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Modeling in biomedical informatics—An exploratory analysis Part 2

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ABSTRACT

Objective: Modeling is a significant part of research, education and practice in biomedical and health informatics. Our objective was to explore which types of models of processes are used in current biomedical/health informatics research, as reflected in publications of scientific journals in this field. Also, the implications for medical informatics curricula were investigated.

Methods: Retrospective, prolective observational study on recent publications of the two official journals of the International Medical Informatics Association (IMIA), the International Journal of Medical Informatics (IJMI) and Methods of Information in Medicine (MIM). All publications of the years 2004 and 2005 from these journals were indexed according to a given list of model types. Random samples out of these publications were analysed in more depth.

Results: Three hundred and eighty-four publications have been analysed, 190 of IJMI and 194 of MIM. For publications in special issues (121 in IJMI) and special topics (132 in MIM) we found differences between theme-centered and conference-centered special issues/special topics (SIT) publications. In particular, we could observe a high variation between modeling in publications of theme-centered SITs. It became obvious that often sound formal knowledge as well as a strong engineering background is needed for carrying out this type of research. Usually, this knowledge and the related skills can be best provided in consecutive B.Sc. and M.Sc. programs in medical informatics (respectively, health informatics, biomedical informatics). If the focus should be primarily on health information systems and evaluation this can be offered in a M.Sc. program in medical informatics.

Conclusions: In analysing the 384 publications it became obvious that modeling continues to be a major task in research, education and practice in biomedical and health informatics. Knowledge and skills on a broad range of model types are needed in biomedical/health informatics.

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1. Introduction

Modeling is a significant part of research, education and practice not only in biomedical informatics and health informatics, but also for medicine and health care in general.

Ten years after their paper on modeling of processes in medical informatics [1] the authors were interested in the frequency of the introduced model types in current biomedical/health informatics research as reflected in publications in scientific journals and whether these types appropriately reflect our field's research or whether other types are more adequate. In a retrospective, but prolective observational study on recent publications we intensively looked at publications of the two official journals of the International Medical Informatics Association (IMIA [2]), the International Journal of Medical Informatics (IJMI [3]) and Methods of Information in Medicine (MIM [4]). All publications of the years 2004 and 2005 from these journals were indexed according to a given list of model types. Random samples out of these publications were analysed in more depth.

As described in detail in part 1, *regular publications* are defined as journal publications, not being part of a special issue/special topic (SIT). According to [1] we distinguished (non-disjoint) types of 'core' models for

- modeling biological processes (B),
- modeling communication processes (CM),
- modeling decision processes (D),
- modeling engineering processes (EN),
- modeling educational processes (ED),
- modeling organizational processes (O), and
- modeling computational processes (CP).

In part 2 of our paper we will report on our results for publications in special issues (as denoted in IJMI) and special topics (as denoted in MIM). The introductory sections and results for our investigations on regular publications of these journals can be found in part 1 of this paper [5].

2. Material and methods

In this section, we add those parts of the study design relevant for SITs. The first part of the study design was presented in part 1 of our paper [5]. Here also the research questions Q1–Q4 are presented. Questions Q2–Q4 will be repeated here.

For question Q2 "What are the current types of models of processes, investigated in special issue/special topic publications in biomedical/health informatics?" we were looking into publications of special issues/special topics. In the regarded time period, IJMI published:

I1 'Medical Informatics Europe 2003' (MIE03, volume 74, 2005, issues 2–4) and
I2 'MedInfo 2004' (MI04, volume 74, 2005, issues 7–8)

as conference-centered SITs, as well as:

I3 'IMIA Working Group on Education' (Edu, volume 73, 2004, issue 2),
I4 'Realizing Security into the Electronic Health Record' (Sec, volume 73, 2004, Issue 3),
I5 'Improving Patient Safety with Technology' (PSave, volume 73, 2004, issues 7–8) [10],
I6 'Supporting Communication in Health Care' (ComHC, volume 74, 2005, issue 10) [11], and
I7 'Nursing Informatics' (NI, volume 74, 2005, issues 11–12)

as theme-centered SITs. MIM published:

M1 'Selected Papers from the 50th Colloquium of the German Region of the Int. Biometric Society' (BC04, volume 43, 2004, parts of issue 5) and
M2 'Selected Papers from gmds2004' (gmds04, volume 44, 2005, issue 4, gmds2004 comprised the 2004 joint annual national medical informatics conferences of Austria, Germany, and Switzerland)

as conference-centered SITs, as well as:

M3 '4th BioSignal Interpretation Workshop' (BSI, volume 43, 2004, issue 1),
M4 'Advances in Biomedical Image Analysis' (BMI, volume 43, 2004, parts of issue 4),
M5 'Electronic Patient Information—Pioneers and MuchMore' (EPInf, volume 43, 2004, parts of issue 5) [17],
M6 'The Future of HealthGrids' (HGrid, volume 44, 2005, parts of issue 2),
M7 'Methods of Information in the Age of Prospective Medicine' (PMed, volume 44, 2005, parts of issue 2) [19], and
M8 'Microarray Gene Expression Experiments' (MArray, volume 44, 2005, parts of issue 3) [20]

as theme-centered SITs.

As for regular publications (see Q1.1 in part 1 of our paper) we were looking into *all* publications of these SITs in order to give an answer to question.

Q2.1 How are the types of models of processes distributed in SIT publications?

Both authors independently indexed the publications with respect to the types of models used, i.e. B, CM, D, EN, ED, O, and CP. If an abstract was regarded as sufficiently informative, indexing was based on a publication's abstract. For providing answers to the questions:

Q2.2 Are there specific models in theme-centered special issues/special topics?
Q2.3 Are there specific models in special issues/special topics of (inter)national medical informatics conferences?
Q2.4 Are there special observations in the context of modeling, we want to report about?
Q2.5 What are the current research aims, intended to be achieved, compared to the aims of medical informatics, as defined 10 years ago?

A sample of 20 SIT publications of IJMI as well as of MIM were obtained in the following way: