Framework for Resource management based on evidence-based Careflow systems using Granular Partitions

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Workflow Process Definition

A variety of different tools may be used to analyse, model, describe and document a business process. The workflow process definition interface defines a common interchange format, which supports the transfer of workflow process definitions between separate products.

A process definition is defined as "The representation of a business process in a form that supports automated manipulation, such as modeling, or enactment by a workflow management system. The process definition consists of a network of activities and their relationships, criteria to indicate the start and termination of the process, and information about the individual activities, such as participants, associated IT applications and data, etc. (WfMC Glossary - WfMCTC-1011)". This needs a minimum set of objects and attributes necessary to initiate and support process execution.

The process definition leads to a process model. However, the process model can contain entitites whose scope can be wider than a single process defintion, for example the definition of participants, applications and workflow relevant data maybe referenced from a number of process definitions. In order to addess this issue, Wfmc created the meta-Model. The meta-model assumes the use of a common process definition repository, associated with the workflow management system, to hold the various entity types comprising the process definition.

Issue of knowledge management

The current initiatives of knowledge management are directed towards promoting certain modifications in the individuals, in order to enable them contribute and apply the collective knowledge in real time for decision-making process. The collective knowledge is derived from

the clinical practice guidelines and the medical textbooks. The application of this collective knowledge is done by the health care orrganizations(HCOs).

Implementation Formalism

The creation and implementation of computer interpreable guideline models has been a very widely researched topic. This not only requires the understanding and interpretation of the guideline text and models based on that, but also on the workflow of the health-care organization.

We have applied the concepts of Basic Formal Ontology and the Theory of Granular Partitions to create a framework, which formally describes a layered approach, starting from the interpretation of the guideline free-text to the implementation of the guideline model in a health-care setup.

The concept of vagueness and the approximations of the vague objects play a key role in this model. When we speak of vagueness here, we are talking about the projected objects of the functions in reality. Thus the objects are the instances of every function present. Thus, the objects which are based on the functions are vague objects. There can be no, partial or complete overlaps between the object of functions, as elaborated below. In order to approximate the vague objects, one needs a more precise partition. In this context, we have different partitions available – partition related to the functions in medicine in general, partition related to pathology-management functions mentioned in the clinical guidelines, partition related to the composition of health-care organizations, partiton related to the functions of different agents in the health-care organization, etc. None of these partitions are very precise and they can change with time. However, objects in the last two partitions are more precise than the first two; and the third is the most precise relatively. That is, objects associated with the composition of the human agents in the health-care organization is usually precise and fixed for certain periods of time. A less precise, but closer partition is regarding the functions of the different human agents, for example, physicians, nurses etc. The functions related to pathology or in medicine in general

are more vague. Putting it all together, the guideline text provides some precision as regards the pathology-related functions; however, objects related to these functions are still quite vague, when it comes to their implementation. We approximate vague objects by using it together with the more precise objects in the partition of health-care organization.

We claim that this approach provides a new insight into this area of research and would prove complimentary to the already existing tools and specifications.

We introduce the following definitions, before elaborating on the layered approach.

1. Partitions before applying the concept of Vagueness(V_{pre}):

   1.1 Pathology-related functions (f,P)

      1.1.1 Collective functions (f_C,P,V_{pre}): The collective functions related to a pathology are mentioned in the clinical practice guideline. It is merely a collection of all the functions which are recommended and does not contain any information regarding the sequence in which the tasks need to be carried out, nor the relation of the functions to each other in form of parent-child or part-subpart relationships.

      1.1.2 Situated functions (f_S,P,V_{pre}): The situated functions encorporates more knowledge than present in the collective functions. It provides the parenthood and parthood relations between the functions, as mentioned in the clinical practice guideline. This helps to determine the context within which a particular function is recommended.

   1.2 Health-care organization-related fucntions (f,H)

      1.2.1 Collective functions (f_C,H,V_{pre}): The collective function of a health-care organization is the set of all the functions which can be carried out within the organization, irrespective of the agent who carries the function.

      1.2.2 Situated functions (f_S,H,V_{pre}): The functions mentioned in (f_C,H,V_{pre}) are assigned to the different agents in the health-care organization. Different agents

can perform the same function or part of function and different functions can be performed by the same agent.

2. Partitions after applying the concept of Vagueness (V_{post}):

2.1 Pathology-related functions (f,P)

2.1.1 Collective functions (f_C,P,V_{post}): The boundaries of the collective functions related to a pathology do not change after applying the concept of vagueness. This is in lines with the assumption that the knowledge mentioned within the guideline text is considered to be the standard for further steps.

$B((f_C,P,V_{pre})) = B((f_C,P,V_{post}))$ (where B represents the Boundary)

However, the functions present within the boundary can have a complete, partial or no overlap. If there is no overlap within the functions, they are not modified. The functions with complete overlap are considered as the same function. The function with partial overlap are depicted with a connection.

2.1.2 Situated functions (f_S,P,V_{post}): The connections present in the (f_C,P,V_{post}) is also be present in the (f_S,P,V_{post}). The connection is strengthened if the connected functions are present within the same context.

2.2 Health-care organization-related fucntions (f,H)

2.2.1 Collective functions (f_C,H,V_{post}): Similar to (f_C,P,V_{post}), the boundary of (f_C,H,V_{post}) will remain the same as (f_C,H,V_{pre}), as overall the collective functions will not change. If there is no overlap within the functions, they are not modified. The functions with complete overlap are considered as the same function. The function with partial overlap are depicted with a connection.

2.2.2 Situated functions (f_S,H,V_{post}): Similar to (f_S,P,V_{post}), the connections present in the (f_C,H,V_{post}) is also be present in the (f_S,H,V_{post}). This means that the functions carried out by the health-care organization can overlap with each other. However,

an added overlap exists. It is between the functions carried out by the agents. Thus, two agents could perform overlapping functions, depending on the context.

Thus the layered approach consists of the first following steps.

S1. Guideline text has been used to manually extract the pathology-specific functions as a distinct partition, in two steps – (f_C,P,V_{pre}) and (f_S,P,V_{pre}).

S2. The functions carried out in a health-care organization are modelled as a distinct partition, in two steps – (f_C,H,V_{pre}) and (f_S,H,V_{pre}).

S3. The concept of vagueness is applied in order to create (f_C,P,V_{post}), (f_S,P,V_{post}), (f_C,H,V_{post}) and (f_S,H,V_{post}).

S4. (f_C,P,V_{post}) is compared to (f_C,H,V_{post}). In order that all the guideline-recommended functions are possible within the health-care organizational setup, all the functions in (f_C,P,V_{post}) should be a part of (f_C,H,V_{post}).

$$\forall x\{(x \subseteq (f_C,P,V_{post}) \rightarrow x \subseteq (f_C,H,V_{post})\}$$

In terms of mereology, the boundary of (f_C,P,V_{post}) must be situated within or overlapping with the boundary of (f_C,H,V_{post}).

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1. A distinct temporal context for the execution of the Situated functions are provided based on the guideline text, giving a framework of pathology-related processes or tasks.
2. A distinct temporal context for the execution of the Situated functions are provided based on the organizational workflow, giving a framework of organization-related processes or tasks.
3. The task-network model based on the two contexts in 4 and 5 are compared.
4. The implementation of the recommendations in the clinical guideline is carried out based on the comparison in 6.