

2. Use Cases

Overview

The SNOMED CT Concept Model is a set of rules that govern the ways in which SNOMED CT concepts are permitted to be modelled. The Machine Readable Concept Model (MRCM) represents these concept model rules in a machine readable form. The SNOMED CT MRCM may be useful in a number of use cases, including:

- Development of precoordinated terminology content;
- Authoring and validation of SNOMED CT expressions, constraints and queries;
- Natural Language Processing;
- Terminology binding to information models, for purposes such as data capture and semantic interoperability.

In the following subsections, we describe each of these key use cases.

Precoordinated Terminology Development

Overview

One of the key uses of the SNOMED CT MRCM is to assist in the consistent development of precoordinated terminology content. This includes terminology content authoring, validation and testing. The authoring and validation of SNOMED CT content may be performed in the SNOMED CT International Edition or in a SNOMED CT Edition that incorporates one or more National or Local extensions. In the case of the International Edition, the SNOMED CT International concept model will be used. Other SNOMED CT Editions may be authored and validated using either the international concept model or an alternative concept model that has been customized to meet specific national or local requirements, while ensuring consistency and data integrity between editions is maintained.

Authoring

When precoordinated SNOMED CT concepts are authored, the MRCM can be used to suggest the possible attributes that may be used to define a concept, based on the hierarchy or subhierarchy it belongs to. The MRCM can also assist in limiting the number of times each attribute can be used in a concept definition, and restricting the possible value of these attributes to the valid range.

An example scenario, in which the MRCM is being used during concept authoring, is:

1. Author creates a concept, with fully specified name and synonyms;
2. Author assigns one or more supertypes for the concept;
3. The MRCM is used to determine the domains to which a concept belongs, based on its supertypes;
4. The MRCM is used to determine the appropriate attributes, ranges and cardinality for the given domain;
5. The author is allowed to assign an appropriate number of values to each of the attributes, from the relevant range, subject to the associated cardinality constraints.

Validation and Testing

In addition to its use during concept authoring, the MRCM can also assist in the validation of concept definitions, by enabling the testing of defining relationships against the rules in the concept model. The MRCM can also enable significant optimizations for batch terminology content validation, by minimizing the repetition of processing through the appropriate selection of relationships to be tested.

In a similar way, the MRCM can be used to enable effective testing of proposed changes to the Concept Model.

Expressions, Constraints and Queries

In a similar way, the SNOMED CT MRCM can be used to assist the authoring and validation of SNOMED CT postcoordinated expressions, SNOMED CT expression constraints, or SNOMED CT queries.

When authoring expressions, constraints or queries, the MRCM can be used to suggest possible attributes that may be applied to the selected focus concepts. Similarly to the authoring of precoordinated content, the MRCM can also restrict the possible value of each attribute refinement to the valid range.

The use of MRCM cardinality constraints differs between expressions, expression constraints and queries. When authoring postcoordinated expressions, an attribute cardinality constraint may be used to limit the number of times each attribute can be used in each concept definition. When authoring expression constraints and queries, however, the MRCM cardinality constraints serves to influence the cardinality constraints that are appropriate to apply to specific attribute refinements.

The SNOMED CT MRCM can also be used to validate expressions, expression constraints and queries to confirm that they conform to the expected concept model rules. In the case of close-to-user expressions, these rules may be less strict to support additional flexibility of expression (including allowing 'laterality' to be applied to a clinical finding that is defined using a lateralizable finding site).

As with precoordinated content, the authoring and validation of SNOMED CT expressions, expression constraints and queries can be performed using the international MRCM rules, or using the rules from a localized MRCM.

Natural Language Processing

Natural Language Processing (NLP) enables a computer program to analyze and extract meaning from human language. When processing clinical free text using a NLP tool, SNOMED CT's concepts, relationships and descriptions can be used to extract the clinical meaning that has been captured.

The SNOMED CT concept model can also be used to identify potential connections between words and possible postcoordination opportunities. For example, if a term such as 'open fracture' (which is found to be a [404684003 | Clinical finding|](#)) occurs in close proximity to the term 'femur' (which is found to be an [91723000 | Anatomical structure|](#)), then this may indicate that there is a 'finding site' relationship between the concepts. By capturing the concept model rules in a machine-processable way, the SNOMED CT MRCM can be used to assist a range of NLP-supported tasks, including:

- Encoding clinical free text using SNOMED CT expressions;
- Indexing and retrieving large repositories of clinical healthcare information and knowledge;
- Searching;
- Analyzing clinical phrases entered into a health record to suggest potential postcoordinated expressions that may match the intended clinical meaning;
- Analyzing search terms to determine the strength of the semantic relationship to matching records or documents.

For more information on using SNOMED CT in Natural Language Processing, please refer to [Data Analytics with SNOMED CT](#).

Terminology Binding to Information Models

When binding SNOMED CT to information models, it is important to ensure that the bindings are consistent (at least at a high level) with the SNOMED CT concept model. Terminology binding using the MRCM may be used to support a range of purposes, from data capture on the user interface through to data integration and semantic interoperability.

There are two main types of terminology binding:

- Value set bindings, which record the set of possible values that can be used to populate a coded data element or attribute;
- Model meaning bindings, which define the meaning of an information model artifact using terminology.

Value set bindings that correspond to a particular concept model attribute (e.g. [272741003 | Laterality|](#)) can be designed to be consistent with the appropriate attribute range (e.g. [182353008 | Side|](#)) defined in the MRCM. Similarly, the MRCM can be used to suggest possible model meaning bindings for an information model, to suggest new data elements that could be added (at either design time or runtime) to represent relevant attribute refinements, and to test existing model meaning bindings for consistency with the concept model.

Expression templates (designed with the support of the MRCM) can also be used to define a canonical representation of meaning for an information model, where this meaning may be recorded either using a single precoordinated concept, or using multiple data elements. This can provide a useful mechanism to support consistent querying of data that has been integrated from multiple sources, and to support semantic interoperability in general.