Designing and Using an Audio-Visual Description Core Ontology

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Outline

• Motivations
• Methodology and content
  – Focusing on domain needs
  – Focusing on upper-level considerations
  – Reconciliation
• Use
• Conclusion
Uses of AV Document Descriptions

- Archival and description of documents from a cultural heritage point of view: INA
- Exchanging program identification and characterization for interactive TV: TV-Anytime
- Diffusion of program information (news agencies): ProgramGuideML
- Storing and sharing AV content descriptions (automatic extraction results): MPEG7 standard

⇒ Development of standard vocabularies, syntactic specifications
Meaning problem

- Description deep meaning cannot be accessed and processed by systems
  - Knowledge is often implicit (labels and comments in natural language)
  - Formal specifications are mostly syntactic

- Formal semantics should be interesting
  - Reasoning with AV document descriptions
  - Interoperability with formal domain-specific ontologies, allowing to mix AV and domain-related reasoning

⇒ Need for a formal ontology to better manipulate AV content
Can we find an AV core ontology?

• There are many common needs amongst observed applications
  – Characterization of programs and sequences
  – Decomposition of programs and sequences
  – Ability to introduce description of the activities that constitute the context of AV documents (roles of people involved, way production and broadcast are achieved)

• These concepts are close to a "neutral" archival viewpoint
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Methodology

• Grounding conceptualization by observed purposes and domain initiatives
  ⇒ justification of the C.O. by making it compliant with shared views on the domain

• Articulation with an upper-level ontology
  ⇒ justification of the C.O. by making it compliant with shared views on high-level categories and axiomatizations

⇒ Get a fully shareable and interoperable C.O.
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MPEG 7 and AV C.O.

• Large effort
• Existing formal ontologies adaptations
  – [Hunter, SWWS'2001] (RDFS)
  – [Tsinaraki, CAISE'2004] (OWL)

• MPEG7 main features
  – Descriptors focused on the physical features of the AV signal
  – Higher-level description schemes rather centred on grammatical specifications

⇒ More "conceptual" DSs need some development to catch core domain needs
C.O. content

- Concerning AV objects:
  - distinction sequence/program
  - decomposition and qualification of those objects
  - link to external world themes and entities (content description)
- Underlying use patterns for elicited categories
Example:

Upper-level categorization of sequences
Towards Formal Semantics

• Formal definitions of concepts (NC, SC)
• Relational axioms (composition)
• An OWL example:

```xml
<owl:Class rdf:ID="DialogSequence">
  <rdfs:subClassOf rdf:resource="#SpokenSequence"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:about="#hasParticipant"/>
      </owl:onProperty>
      <owl:minCardinality rdf:datatype="&xsd;int">2</owl:minCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```
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Upper-level foundations

• Chosen framework:
  – DOLCE [Gangemi, EKAW 2002]
  – Description & Situation extension [Gangemi, ODBASE 2003]

• Provides:
  – Upper-level concepts and relations
  – Ontological design pattern

⇒ Both of them can be specialized to match domain needs
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Articulation with domain needs

- Do foundationally motivated choices really fit domain needs?
  - Some notions are too abstract
  - Some relational paths are too long

\[ \Rightarrow \textit{descriptions may be far from domain concerns} \]

- To be usable in the domain, core notions have to be adapted to domain uses
  - Goal:
    - Articulation between upper-level AV pattern and use patterns
  - How?
    - With formal rules allowing KBS to deal simultaneously with both forms of knowledge
Relational shortcut example (1)

- BroadcastTime
  - valuedBy:
    - Date
- BroadcastCourseOfEvents
  - has for requisite:
    - BroadcastedProgram
  - modality for:
    - Program
- BroadcastedProgram
  - plays:
    - Program

Existing relation: `-X-
Inferred relation: `--X--"
Relational shortcut example (2)
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How to use a core AV ontology?

• Domain extension (and restriction)
  – Complementary vocabulary: roles, kinds of AV creation processes and effects, etc.
  – Focusing choices: for some sub-domains, no need for complex description of specific AV actions (broadcast)

• Application extension
  – Fine-grained vocabulary and reasoning knowledge customization
  – Articulation with ontologies describing "world" domains (with formal knowledge involving concepts and relations from both ontologies)
Applications

• TV-Anytime
  – We can now create formal descriptions referring to TV-Anytime vocabulary

• [Troncy, ISWC 2003]
  – AV ontology has been used in conjunction with a domain ontology (cycling) to formally describe structure and content of sports-related AV documents

• OPALES project
  – Similar experiment, characterization of sequences and their AV features from a pedagogical viewpoint
Conclusion

• Dual legitimacy for a core ontology
  – Domain relevance (user needs)
  – Upper-level compliance (Dolce)

⇒ Reasoning knowledge as reconciliation

• Limitations and problems
  – Time-consuming effort (adaptation, rules, etc.)
  – Is full-scale reasoning feasible?
  – Limits between core and domain conceptualizations
  – TV bias (*publication* instead of *broadcast*?)