Developing Application Based Upon An Ontology-Based Modelling of Vietnamese Traditional Dances

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Abstract—Ontology is an intelligent storage repository served for management of large-scale heterogeneous digital contents resulting, specially in dance performances. Furthermore, ontology-based applications are becoming more prevalent when semantic technologies coming of age. These applications exploit the content encoded in ontologies to represent different tasks. In this paper, we propose to develop an application based upon an ontology-based modelling of Vietnamese Traditional Dance (VTD). Accordingly, we concentrate on implementing this modelling through analyzing, classifying and determining the primary features to serve for searching VTD videos. Additionally, we present some specific cases using lightweight ontology, and implementing using description logic that underlies the web ontology language OWL2-QL for representation, reasoning and querying VTD ontology-based modelling.

Keywords: *Vietnamese Traditional Dance, Ontology, Knowledge Representation, Description Logic.*

I. INTRODUCTION

In recent years, the domain of semantic applications has grown from small-scale web applications, to large-scale enterprise systems showing real benefits in the various domains. Moreover, ontologies are formal models about how we perceive a domain of interest and provide a precise and logical account of the intended meaning of terms, data structures and other elements modelling the real world. As such, they are often viewed as the key means through which the Semantic Web vision (Berners-Lee et al. 2001) can be realized and have already found several applications in the area of Knowledge Representation (KR) and in the Semantic Web (SW). Ontologies are more important in the Semantic Web area because they provide a means to formally define the fundamental concepts and relations that comprise the vocabulary of a convinced domain of interest [12], enabling machines to process information provided by human agents.

Realizing the development of the web application based upon the basis of ontology as well as comprehending the importance of preserving and promoting of intangible culture heritages (ICHs) in Southeast Asia regions is necessary and urgent. Specially, the cultural foundation in Vietnamese community regarding dance domain plays an significant role, it brings the historical and cultural knowledge in order to retransmit to the adjacent generation [1][17]. Therefore, we proposed to develop an application for Vietnamese traditional dances.

In general, the significance of VTDs in the life activities of Vietnamese community is especially interested. It impacts straightforwardly to many aspects of their life, specially being the spiritual culture. VTDs are primarily existing with four fundamental attributes [6][2]: Firstly, utilizing flexibly characteristic props combine with traditional gentle music. The selected props for performing depend on the contents of the music lyrics in order to express character's feelings; Secondly, describing the scenes of the animated daily activities as well as reconstructing a dynamic picture w.r.t traditional careers, particular symbols or even remarkable plots in history; Thirdly, the great messages from dance performances are one of the most important features representing for VTDs. Most of the VTDs are not only creating the aestheticism on the stage as well as serving the entertainment but also transshipping many meaningful messages and the ethnicity to spectator; The final aspect is "the true, the good and the beautiful" in each performance. When the choreographers built a dance performance, the three elements in this last viewpoint must be attended.

In this paper, we start from a VTD ontology-based model that recently introduced in [20] and we develop this ontology based upon the significant overview schema of VTD for building an application. Correspondingly, we need an OWL file to be the foundation of building the VTD application. We are going to use Description Logics (DLs) to represent implementing the code in this paper because DLs family provides the certain foundations of the Web Ontology Language (OWL). According to W3C [1], three profiles of OWL2 are proposed as sub-languages of the full OWL2 language. One of these profiles is OWL2-QL dedicated to applications that used huge volumes of data where query-answering is the most important reasoning task. Additionally, our application basically focuses on querying the dance videos and several the relevant information *(such as ethnicity, props, dance orientation, postures and*

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[1]http://www.w3.org/TR/owl2-overview/

so on). Especially, most of the VTDs is recorded in raw videos which are complicated for searching, storing, classification and reasoning. From the above reasons, developing an application from ontology as well as utilizing DL-Lite as the foundation to implement is a completely appropriate selection and definitely expected.

In research process, we decomposed our approach into three main aspects: the first aspect is to develop an application from reconstructing a significant schema for panorama overview of VTDs; the second angle is about region-zone of VTDs, considering this aspect as a large branch because most of the VTDs originates from distinguishable ethnic groups living distinct region-zone; the last approach is the fundamental dance movements in each VTD. In this paper, we develop in the first aspect, we recall a brief description of the significant schema of VTDs. After that, we concentrate primarily on presenting how to implement VTD ontology using DL-Lite for reasoning and query-answering. Our challenge is to determine primary concepts combined with essential properties based on expert knowledge and to develop applications.

The remainder of this paper is structured as follows. In the next section (section 2) we give an overview and related works, after that we condense a brief description of published modelling to develop ontology for VTD in section 3. In section 4, we discuss and illustrate how to implement an ontology through logical description as well as recall DL-Lite for representation. Finally, section 5 concludes the paper.

II. OVERVIEW AND RELATED WORKS

A. Vietnamese Traditional Dance Overview

Vietnam is a multi-ethnic country existing many different cultures[17] with fifty-four-ethnic groups living in a territory. The dances had became the spiritual foods of each Vietnamese person, it influences explicitly to the regular life from urban to rural. Most of the VTDs is taught by previous generations through "word-of-mouth", the present generation would instruct fundamental movements to adjacent generations. Additionally, the VTDs is also a steady bridge in educating about human dignity, morality and even historical knowledge. Instead of learning the historical lesson in regular classes as well as participating in the training course for life skills, the dances has became the digital channel for efficiently educating personality, knowledge and even ethnicity to the generations.

Generally, the VTDs concentrate on ethnicity and bringing many significations in each performance. Most of the Vietnamese people attaches strong importance to worship the god as well as their ancestor, therefore, several dances are performed in festival and celebrations with desiring to be blessed for harvesting rice and having good health. Furthermore, the VTDs is not only attaching exaggerated importance to artistic value, but also focusing on the aestheticism. Combining between particular props and traditional costumes would be the remarkable characteristic in VTDs.

B. Related Works

Researchers are developing their ontologies with intention to share and allow reusing concept. This idea has lead to the formation of ontology libraries. D'Aquin, Natalya F.Noy [19] lists 11 new generation ontology libraries. They are BioPortal, CupBoard, The OBO Foundry, oeGov, OLS, Ontology Design Patterns, OntoSelect, OntoSearch, The ONKI ontology server, The TONES repository and Schema-Cache. In [14], the author group proposed a framework of automatic movement phrase annotation, in which the motion vectors are used as movement phrase features, they used KNN to classify movement phrases for Vietnamese folk dance videos.

The existing approaches to ontology induction those that start from structured data, merging ontologies or database schemas (Doan, et al. 2002). In [18], Dekang Lin and Patrick Pantel proposed a method for domain concepts discovery based on a clustering algorithm called CBC (Clustering by Committee). They generally regard a concept as a cluster of terms. It just deals with only one aspect of the whole progress of ontology induction. Another approach for automatic annotation and retrieval of video content, which is based on ontologies, has been presented by Ballan et al [13]. They build an ontology schema based on abstract concepts and relations, after that they described a web video search engine that based on ontologies. In [7], dances were described and stored taking advantage of expressivity of description logics. Dance choreographies was built in OWL to represent and archive. Besides using SPARQL queries for searching within the ontology based on steps and movements of dances.

III. DEVELOPING ONTOLOGY-BASED MODEL OF VTDs

A. Expert Knowledge Congregation

Most of the VTDs is originated from the rural, it illustrates distinctly and replicates the daily life through its formal art form. Each ethnic group community existing the different dances with the gestures and movements intimately related to processing manual labor as well as the life activities in each distinguishable topography. Each dance performance session lasts from 4 minutes to 10 minutes, including average about 5-10 dancers (normally) [17]. In this section, we concentrate predominantly on condensing the primary knowledge of an ontology-based modelling of VTDs. Five primary categories on VTDs are split as follows:

- Non-story dances (dư-hứng)
- Bare-handed traditional dances of Vietnam
- Historical dances
- Dances about traditional manual labor of ethnic groups
- Dances in festival and daily life

The following depicts a condensed description of the VTDs on two main groups: (1) non-story dances and (2) existing the plot in each dance performance. Firstly, we condense briefly regarding non-story dances. There are a large number of the bare-handed dances belonged to this classification, it originates from the community activities of the minority ethnic groups

Figure 1. Vietnamese Traditional Dances with props and bare-hand

including festival dances, dances for praying and so on. In contract, considering the dances utilizing props is intimately related to the familiar tools of the daily life as well as the traditional symbols of those ethnic community. Several peaces of these evidences for the VTDs with props are flower dances, labor tool dances and instrument dances. In general, the dances in this group is always performed practically in the formal art forms in festival. Secondly, regarding the dances bringing plot in each session is preserved the high artistry. In the VTDs, the dances concentrate primarily on transhipping the message to audiences. It could be the knowledge with respect to historical domain as well as depicting great virtues in traditional manual labor of ethnic groups through characteristic dance movements. Specially, the traditional culture and religious belief of each ethnic community impact and influence directly to VTDs, the most of the ethnic festivals plays an importance role in their life. Therefore, the traditional dances had established and became the spirit foods in their community.

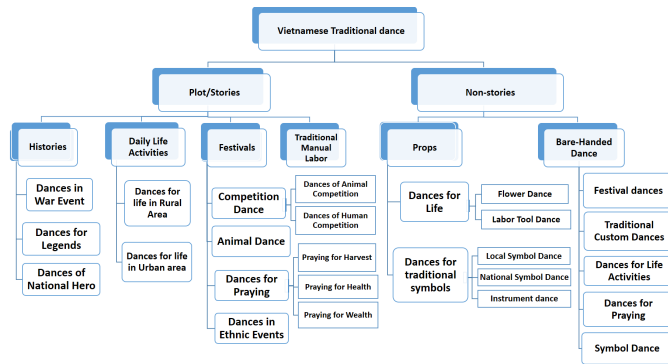### B. Structure of Vietnamese Traditional Dances

Figure 2. The overview schema for VTD

This subsection re-presented an overview on a preliminary schema for VTD recently proposed in [20]. We recall that this noteworthy schema is based on [1][2][6][15][17] but also profit gained from the dance experts *(consist of dance choreographers, dancers and their teacher)* at art school in Vietnam. Through collecting the primary characteristics, we reconstructed the schema of VTD as in Figure 2.

Additionally, existing three sufficiently great features that the dance experts suggested to be interested essentially in our research process: (1) ethnicity, (2) message in dance performance, (3) festival and events. It would be to explain as follows: firstly, the ethnicity in VTD in order to answer the questions related to "community and ethnic groups" because most of the traditional dances departs from the customs of ethnic groups, interested in two elements: props and costumes. Secondly, transhipping the meaningful messages to the audience, interested in plots (stories). Thirdly, the VTDs in the festivals and events play an essential role in the ethnic community because it brings the ethnicity and the cultural features to representative for their community.

C. Developing Vietnamese Traditional Dances

Based upon Figure 2 and the significant features discussed with the experts in the dance domain, we developed the ontology-based modelling of VTD within Protégé as in Figure 3 and using DL-Lite to represent implementing the code served for reasoning and searching [2]. In this sub-section, we present particularly on three main parts: Non-story and story concept *(top level concepts of VTDs)*, dance sub-concepts *(bottom level concepts of VTDs)*, general concepts.
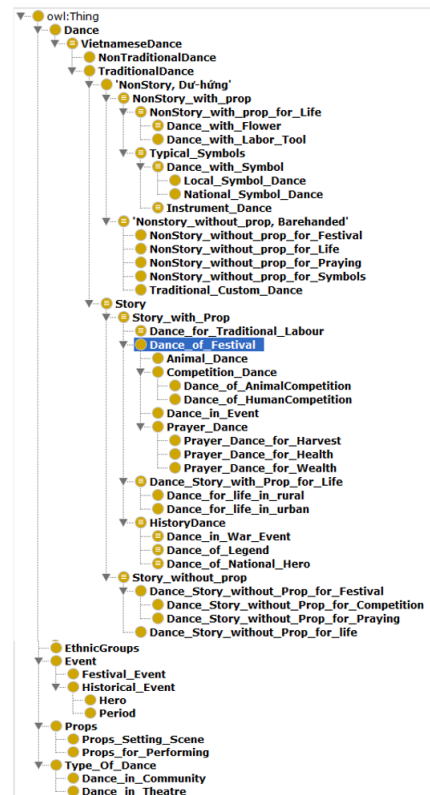

Figure 3. Class Hierarchy of Vietnamese Traditional Dance

The following details and explains explicitly how to implement and advance VTD's schema into lightweight ontology-based in order to store dance videos served for searching, reasoning and querying:

[2]We will soon make the ontology availability on github.

1) Non-story and story concept in VTDs: In the brief description regarding the overview schema mentioned two main groups of VTD, including non-story and existing plot. Additionally, it has also split explicitly on two clusters: using props or without props for performing as in Figure 4. Most of the dances in the minority ethnic community as well as the particular activities of the village is without props to perform, it could narrate the legend stories and also could be the dances to connect the communities together. Following the experts from dance schools in Vietnam, although some dance performances have overlapped between using props and without props, but it is quite necessary and authentic to cluster obviously in four main groups *(story with props, story without props, nonstory with props and nonstory without props)* to support for the next researches relevant to VTD.
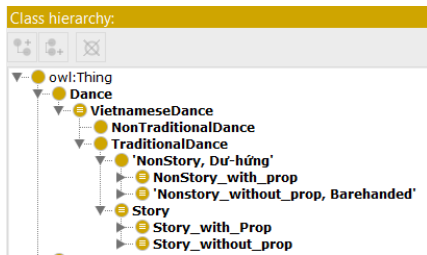

Figure 4. Class Hierarchy of Non-story and story concept in VTD

2) Dance sub-concepts in VTDs: We are going to archive and store all of the videos of VTDs into the sub-concepts of Non-story and story concept, such as the videos of Lotus Dance, Sunflower Dance and Grain Dance are stored in Dance-with-Flower concept. Based upon the schema of Figure 2, we implemented respectively the sub-concepts as in Figure 3. In this sub-section, we would present some specific cases regarding story-without-prop concept. Because there are the little number of the VTD having story without prop in Vietnamese community, hence it is really not popular in VTD. It could be performed in the festival as well as in the daily life. Regarding these concepts require the choreographer using the large number of the performers to establish the character images. Most of the plots in this art form is performed primarily in theatre. Based on the fundamental movements combine with the visual arts and incoherent peaces of story to build the dance performances. We interested in these conceptual clusters because existing the overlap between the names of the dances regarding using props and without props in each performance.

3) General concepts in VTDs: In this sub-section, we present the general concepts which would be contained the large number of the significant information to serve for reasoning and query-answering. It includes four classification as in Figure 5: (1) ethnic groups, (2) events, (3) props, (4) type of dance. The explicit explanation as follows: firstly, regarding ethnic groups concept, due to the dances originate from the different ethnic community and it brings the private cultures of each ethnic group, this concept plays an important role in each dance. Based upon the information of ethnic

groups would be one of the efficient features to classification. Secondly, most of the VTDs would be creative to perform in the events, it could be the festival events as well as the historical events. This concepts would contains the information with respect to the remarkable events of ethnic community and the significant national events. Most of the dances in this assertion is almost the existence of story. Thirdly, considering the props, it includes the props for performing and the props to settle on the stage. Most of the props to set the scene is the habitual tools in the life activities. We could determines the ethnic community through the particular props. Many props in the dance performance are symbol of the ethnic community. Remarkably, the large number of the names of VTD assigned by the name of props, such as "Tính dance" *("Tính" is a kind of instrument of Thai ethnic group)*. Therefore, the name of the props is also the outstanding features for the classification. Finally, we concerned in type of dance, it consists of dances for community and dances in theatre. The place to perform is one of the primary features to determine VTD, because many dances are performed in local community with informal art forms while many dances in theatre is created by the professional choreographer. These information are absolutely importance and completely expected to support for reasoning and query-answering.
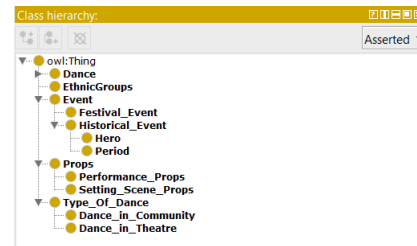

Figure 5. Class Hierarchy of General concepts in VTDs

IV. IMPLEMENTING ONTOLOGY-BASED MODELLING OF VTDS USING DL-LITE

This section proposes implementing a modelling of VTD using lightweight ontology by DL-Lite. As we had known that the upcoming version 2 of Web Ontology Language (OWL2) had defined in three profiles [21], correspondingly the DL-Lite family is at the foundation of one of these OWL2 profiles *(we interested specially in OWL2-QL)*. Additionally, OWL2-QL is aimed at applications that used very large volumes of instance data, and where query-answering is the most significant reasoning assignment. Let us now provides a refresher of DL-Lite. One of the main advantage of DL-Lite is that query-answering is down in an efficient way. In fact query-answering since down to answer a set of queries over a so-called assertion boxes (Abox). Realizing the significance of DL-Lite in representing ontology-based model as well as perceiving further what is the motivation behind using DL-Lite in order to build an application *(semantic Web)* for VTDs through OWL2-QL language, therefore we proposed to select

DL-Lite to represent implementing ontology-based modelling of VTDs in this paper.

In this section, we present explicitly how to develop ontology-based model using DL-Lite through representation of TBox, ABox and query-answering. Furthermore, we indicate some inconsistencies and/or incoherences *(see for instance [5] for case of DL-Lite)* regarding some specific cases of VTDs.

A. Presentation of DL/DL-Lite

Description Logics (DLs) provide the formal foundation for ontologies, and the tasks related to the use of ontologies in various application domains are posing new and challenging requirements with respect to the trade-off between the expressive pover of a DL and the efficiency of reasoning over knowledge bases (KBs) expressed in the DL. Description Logics [21] are also the logical frameworks underlying the ontology language. A description logic knowledge base is formed by a terminological base, called TBox, and an assertional base, called ABox. The TBox contains inclusion axiom concepts and rules regarding knowledge of the application domain whereas the ABox stores data (individuals and constants) DL-Lite is a family of tractable DLs specifically altered for applications that utilize the huge number of data, for which query answering is the significant reason assignment.

1) DL-Lite syntax: Let [21] N_C, N_R and N_I be three pairwise disjoint sets of atomic concepts, atomic roles and individuals respectively. Let $A \in N_C, P \in N_R$, three connectors $'\neg', '\exists', '-'$ are used to define complex concepts and roles. We only present $DL-Lite_{core}$ the core fragment of all the $DL-Lite$ family and we would utilize $DL-Lite_R$ instead of $DL-Lite_{core}$. Nevertheless, we concentrate on two important members of the $DL-Lite$ family in this paper, including $DL-Lite_R$. Considering basic concepts (*resp.* roles) B (*resp.* R), complex concepts (*resp.* roles) C (*resp.* E) are defined in DL-Lite as follows:

$$B \rightarrow A \mid \exists R \qquad C \rightarrow B \mid \neg B$$
$$B \rightarrow A \mid P^- \qquad E \rightarrow R \mid \neg R$$

where P^- represents the inverse of P and A is an atomic concept, P is an atomic role.

A DL-Lite knowledge base (KB) is a pair $\mathcal{K} = \langle \mathcal{T}, \mathcal{A} \rangle$ where $\mathcal{T}$ is the TBox and $\mathcal{A}$ is the ABox. The TBox $\mathcal{T}$ includes a finite set of inclusion axioms on concepts and on roles respectively of the form: $B \sqsubseteq C$ and $R \sqsubseteq E$. The ABox contains a finite set of assertions (facts) of the form A(a) and P(a,b) where $A \in N_C, P \in N_R$ and $a, b \in N_I$.

2) Semantics: The semantics is given in term of interpretations. An interpretation $\mathcal{I} = (\Delta^{\mathcal{I}}, \cdot^{\mathcal{I}})$ where $\Delta^{\mathcal{I}}$ is called domain, and $\cdot^{\mathcal{I}}$ an interpretation function that assigns to each $a \in N_I$ an element $a^{\mathcal{I}} \in \Delta^{\mathcal{I}}$, to each $A \in N_C$ a subset $A^{\mathcal{I}} \subseteq \Delta^{\mathcal{I}}$ and to each $P \in N_R$ an $P^{\mathcal{I}} \subseteq \Delta^{\mathcal{I}} \times \Delta^{\mathcal{I}}$. The function $\cdot I^{\mathcal{I}}$ is extended in a straightforward way for complex concepts and roles, e.g $(\neg B)^{\mathcal{I}} = \Delta^{\mathcal{I}} \setminus B^{\mathcal{I}}, (P^-)^{\mathcal{I}} = \{(y,x) \in \Delta^{\mathcal{I}} \times \Delta^{\mathcal{I}} \mid (x,y) \in P^{\mathcal{I}}\}$ and $(\exists R)^{\mathcal{I}} = \{x \in \Delta^{\mathcal{I}} \mid \exists Y \in \Delta^{\mathcal{I}} \mid (x,y) \in R^{\mathcal{I}}\}$.

An interpretation $\mathcal{I}$ is said to be a model a concept (*resp.* role) inclusion axiom, denoted by $\mathcal{I} \models B \sqsubseteq C$ (*resp.* $\mathcal{I} \models R \sqsubseteq E$), if $B^{\mathcal{I}} \subseteq C^{\mathcal{I}}$(*resp.* $R^{\mathcal{I}} \subseteq E^{\mathcal{I}}$). Similarly, we say that $\mathcal{I}$ satisfies a concept (*resp.* role) assertion, denoted by $\mathcal{I} \models A(a)$ (*resp.* $\mathcal{I} \models P(a,b)$), if $a^{\mathcal{I}} \in A^{\mathcal{I}}$ (*resp.* $(a^{\mathcal{I}}, b^{\mathcal{I}}) \in P^{\mathcal{I}}$). An interpretation $\mathcal{I}$ is said to satisfy a knowledge base $\mathcal{K} = \langle \mathcal{T}, \mathcal{A} \rangle$ where $\mathcal{T}$, denoted $\mathcal{I} \models \mathcal{K}$, if $\mathcal{I} \models \mathcal{T}$ and $\mathcal{I} \models \mathcal{A}$. Such interpretation is said to be a model of $\mathcal{K}$. Lastly, a Tbox $\mathcal{T}$ is said to be incoherent if there exist a concept C s.t $\forall \mathcal{I}: \mathcal{I} \models \mathcal{T}$, we have $C^{\mathcal{I}} = \emptyset$. A DL-Lite knowledge base $\mathcal{K}$ is said to be inconsistent if it does not admit any model. Note that within a DL-Lite setting, the inconsistency problem is always defined with respect to some ABox since a TBox may be incoherent by never inconsistent.

3) Query-Answering: Normally, A query is a first-order logic formula, denoted $q = \{\vec{x} \mid \phi(\vec{x})\}$, where $\vec{x} = (x_1, ..., x_n)$ are free variables, n is the arity of q and atoms of $\phi(\vec{x})$ are of the form $A(t_i)$ or $P(t_i, t_j)$ with $A \in N_C$ and $P \in N_R$ and t_i, t_j are terms, i.e, constants of N_I or variables. When $\phi(\vec{x})$ is of the form $\exists \vec{y}.conj(\vec{x}, \vec{y})$ where $\vec{y}$ are bound variables called existentially quantified variables, and $conj(\vec{x}, \vec{y})$ is a conjunction of atoms of the form $A(t_i)$ or $P(t_i, t_j)$ with $A \in N_C$ and $P \in N_R$ and t_i, t_j are terms, then q is said to be a conjunctive query (CQ). When $n=0$, then q is called a boolean query (BQ). A BQ with no bound variables is called a ground query (GQ). Lastly, when q only contains one atom with no free variables, then it is called an instance query (IQ). For a BQ q, we have $\mathcal{I} \models q$ iff $(\phi)^{\mathcal{I}} = true$ and $\mathcal{K} \models q$ iff $\forall \mathcal{I} : \mathcal{I} \models \mathcal{K} \Rightarrow \mathcal{I} \models q$. For a CQ q with free variables $\vec{x} = (x_1, ..., x_n)$, a tuple of constants $\vec{a} = (a_1, ..., a_n)$ is said to be the certain answer for q over $\mathcal{K}$ if the BQ $q(\vec{a})$ obtained by replacing each variable x_i by a_i in $q(\vec{x})$, evaluates to true for every model of $\mathcal{K}$. Hence CQ answering can be reduced to BQ answering. For more details, see [21].

B. Implementing VTDs using DL-Lite

In this section, we present predominantly to implement ontology-base modelling VTDs through using [3] DL-Lite language. The representation to answer for the common questions: "what are these dances?, where are these dances from? and which videos do these dances include?. From discussing deeply the expert knowledge and overview for VTD as in Figure 1, we have built and implemented an ontology for VTD as in Figure 5. Following representation is some fragments of VTD ontology in DL-Lite:

TBox: T_{VTD}

$VietnameseDance \sqsubseteq Dance$
$NonTraditionalDance \sqsubseteq VietnameseDance$
$TraditionalDance \sqsubseteq VietnameseDance$
$TraditionalDance \sqsubseteq \neg NonTraditionalDance$
$PropsSettingScene \sqsubseteq Props$
$PropsForPerforming \sqsubseteq Props$
$DanceInCommunity \sqsubseteq TypeOfDance$
$DanceInTheatre \sqsubseteq TypeOfDance$
$DanceInCommunity \sqsubseteq \neg DanceInTheatre$
$NonStory \sqsubseteq TraditionalDance$
$Story \sqsubseteq TraditionalDance$
$Story \sqsubseteq \neg NonStory$
$FestivalEvent \sqsubseteq Event$

$HistoricalEvent \sqsubseteq Event$
$Hero \sqsubseteq HistoricalEvent$
$Period \sqsubseteq HistoricalEvent$
$HistoricalEvent \sqsubseteq \neg FestivalEvent$
...
$NonStoryWithProp \sqsubseteq NonStory$
$NonStoryWithPropLife \sqsubseteq NonStoryWithProp$
$DanceWithFlower \sqsubseteq NonStoryWithPropLife$
$DanceWithLaborTool \sqsubseteq NonStoryWithPropLife$
$TypicalSymbols \sqsubseteq NonStoryWithProp$
$InstrumentDance \sqsubseteq TypicalSymbols$
...
$Story \sqsubseteq TraditionalDance$
$StoryWithProp \sqsubseteq Story$
$StoryWithoutProp \sqsubseteq Story$
$StoryWithProp \sqsubseteq \neg StoryWithoutProp$
$DanceForTraditionalLabour \sqsubseteq StoryWithProp$
$HistoryDance \sqsubseteq StoryWithProp$
$DanceInWarEvent \sqsubseteq HistoryDance$
$DanceOfLegend \sqsubseteq HistoryDance$
$DanceOfNationalHero \sqsubseteq HistoryDance$
...
$\exists hasProp \sqsubseteq VietnameseDance$
$\exists hasProp^- \sqsubseteq Props$
$\exists hasEthnic \sqsubseteq VietnameseDance$
$\exists hasEthnic^- \sqsubseteq EthnicGroups$
$\exists hasFestival \sqsubseteq VietnameseDance$
$\exists hasFestival^- \sqsubseteq FestivalEvent$
$\exists isEthnicPropOf \sqsubseteq Props$
$\exists isEthnicPropOf^- \sqsubseteq EthnicGroups$
$\exists hasDanceType \sqsubseteq VietnameseDance$
$\exists hasDanceType^- \sqsubseteq DanceInCommunity$
$\exists isPeriodOf \sqsubseteq Period$
$\exists isPeriodOf^- \sqsubseteq HistoryDance$
$\exists hasPeriod \sqsubseteq HistoryDance$
$\exists hasPeriod^- \sqsubseteq Period$
$\exists hasHero \sqsubseteq DanceOfNationalHero$
$\exists hasHero^- \sqsubseteq Hero$
$\exists isHeroOf \sqsubseteq Hero$
$\exists isHeroOf^- \sqsubseteq DanceOfNationalHero$
...

C. Query-Answering

In this subsection, we would present two outstanding cases for query-answering to verify and evaluate the feasibility of the implementation process, including: handkerchief dance of Thái ethnic group and "Tính Tẩu" dance of Tày ethnic group. Firstly, we present a logical representation of *"knowledge of the remarkable dances in Kim-Pang-Then festival of Thái ethnic community"*. This is a significant festival that is taken place on March, 10th (lunar year) in North Southern region. In this festival, there are many ethnic activities as: "Ném còn", "farm work", tilling, "handkerchief dance", "Xòe dance" and so on. Indeed, Thái people have thirty-six "xòe dances" that origin from six traditional kinds of "Xòe dance": "khắm khăn mơi lẩu" dance(1) using handkerchief and offering wine, "phá xí" dance using "gùi(papoose)" prop(2), "nhôm khăn" dance(3) using "Phiêu handkerchief prop", "khắm then" dance(4) using handkerchief prop and holding hands, "Đổn Hôn" dance(5), "ỏm lọm tốp mư" dance (6) using bare-handed (claps) in circle formation. Secondly, considering with "đàn tính *(drum or Nekara)*" dance, "Tính Tẩu" is a famous instrument of Tày community. In each festival of the local village, the first selection of Tày's people to perform in community would be this dance. "Tính tẩu" is not only simple being a musical accessory, but also it plays role being a remarkable symbol

of Tay community. In this example, we would mention to "Lồng tồng" fesitval, one of the most outstanding festival of Tày ethnic groups which usually organizes in "lunar new year" occasion.

ABox: A_{VTD}

$EthnicGroups("ThaiPeople")$
$EthnicGroups("KinhPeople")$
$EthnicGroups("KhmerPeople")$
$EthnicGroups("TayPeople")$
$EthnicGroups("MongPeople")$
$EthnicGroups("ChamPeople")$
$NonStory("XoeDance")$
$InstrumentDance("TinhTauDance")$
$DanceWithLaborTool("NhomKhanDance")$
$DanceWithLaborTool("PhaXiDance")$
$DanceWithFlower("LotusDance")$
$NoneStoryWithoutPropForFestival("Romvong")$
$DanceInCommunity("Community")$
$PropsForPerforming("Papoose")$
$PropsForPerforming("TinhTau")$
$PropsForPerforming("PhieuHankerchief")$
$FestivalEvent("KimPangThenFestival")$
$FestivalEvent("LongTongFestival")$
$FestivalEvent("OcOmBokFestival")$
...
$hasProp("PhaXiDance","Papoose")$
$hasProp("TinhTauDance","TinhTau")$
$hasEthnic("PhaXiDance","ThaiPeople")$
$hasEthnic("TinhTauDance","TayPeople")$
$hasEthnic("RomVongDance","KhmerPeople")$
$hasFestival("PhaXiDance","KimPangThenFestival")$
$hasFestival("TinhTauDance","LongTongFestival")$
$hasFestival("RomVongDance","OcOmbokFestival")$
$isEthnicPropOf("Papoose","ThaiPeople")$
$isEthnicPropOf("Papoose","MongPeople")$
$isEthnicPropOf("TinhTau","TayPeople")$
$hasDanceType("PhaXiDance","Community")$
$hasDanceType("TinhTauDance","Community")$
$hasDanceType(RomVongDance,"Community")$
$hasFestival("NhomKhanDance","KimPangThenFestival")$
$hasProp("NhomKhanDance","PhieuHandkerchief")$
$hasEthnic("NhomKhanDance","ThaiPeople")$
$isEthnicPropOf("PhieuHandkerchief","ThaiPeople")$
$hasDanceType("NhomKhanDance","Community")$
...

In the first case, we select some dances (PhaXiDance and NhomKhanDance) in Kim-Pang-Dance festival of Thai people to illustrate. Additionally, we also use a remarkable feature to search that is "Phiêu handkerchief" props. We built VTD lightweight ontology to answer for question: "what are the name of these dances? and where are these dances from?. Based on assembling concrete information through observing consists of handkerchief on the hands, non-story, a festival and dance in community. We are able to encode with the following query to answer for those questions. Let us consider the common query:

$Q(x, m, z) \leftarrow EthnicGroups(x) \land$
$FestivalEvent(m) \land DanceWithLaborTool(z) \land$
$DanceInCommunity("Community") \land$
$hasProp(z,"PhieuHandkerchief") \land hasFestival(z,m) \land$
$hasEthnic(z,x) \land isEthnicPropOf("PhieuHandkerchief",x) \land$
$PropsForPerforming("PhieuHandkerchief") \land$
$hasDanceType(z,"Community")$

The query means: searching for ethnic groups with x, dance name with z and name of festival with m. The answer from

Vietnamese traditional dance ontology and the ABox above is $z = "NhomKhanDance"$ dances of $x = "ThaiPeople"$ in $m = "KimPangThenfestival"$ and props which they have seen it is "Phiêu Handkerchief".

In the second case, we implement "TinhTau" dance in LongTong festival of Tày ethnic community to illustrate. In addition, the primary feature that we selected to be "Phiêu handkerchief" props. The information that we utilize to search consisting of Tính tẩu on the hands, LongBong festival. We are able to encode with the following query to answer for those questions. Let us consider the common query:

$Q(x, y, z) \leftarrow FestivalEvent("LongBongFestival") \wedge EthnicGroups(x) \wedge TypeOfDance(y) \wedge hasEthnic(z, x) \wedge VietnameseDance(z) \wedge isEthnicPropOf("TinhTau", x \wedge hasProp(z, "TinhTau") \wedge hasFestival(z, "LongBongFestival") \wedge hasDanceType(z, y)) \wedge PropsForPerforming("TinhTau")$

The above query explanation as follows: variable x is ethnic groups, type of dance with variable y and variable z is dance name . The answer from VTD ontology and the ABox above is $z = "TinhTau"$ dances of $x = "TayPeople"$ in $y = "Community"$. Therefore, the answer of ethnic community performing is Tày ethnic group and some videos relevant to "Tính tẩu" dance.

In research process, we have seen a problem in the VTDs. Particularly, the overlapping in the dance names of VTDs would be a large challenge as well as the remarkable points regarding building application. It would leads to existing the inconsistences in query-answering and reasoning. Considering an evidence for this case as "hat dance (múa nón)", it could be a dance performance possessing either a specific story or without plot, while between "Story" concept and "Non-Story" concept is disjointed. Dealing with inconsistences in VTDs is necessary to face and to be interested.

V. Conclusion and Future Works

Developing an application to preserve the values of ICHs is one of the most interested trouble in Vietnamese community. Substantially, the ICHs of the ethnic group dance are quite difficult to identify exact values and great significance. It is not only bringing the aestheticism and entertainment in dances but also being the useful tools to connect community groups together as well as encouraging in the education domain. For preservative motivation, we developed an application based on ontology-base modelling for VTDs through DL-Lite language in order to aim at creating the firm foundation for building a semantic web of VTDs by OWL 2 QL. Using lightweight description logic (DL-Lite) for representation, reasoning and querying is discussed in this paper.

The work presented in this paper is one of the initial steps in a long-term effort to create a universal VTD repository to aim to support for advanced heterogeneous digital storage, indexing, classification, reasoning and searching dance videos. In addition, it also one of the basis to develop the other applications relevant to Vietnamese dance domain in general. Our next plans in the future work include handling with specific inconsistent cases in VTDs, developing the VTD

ontology from distinguishable aspects and views with our proposed approaches as in introduction section *(dance region-zone, fundamental movements)*.

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