IE500: Musical Genre Ontology
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Introduction

In the past decade, information technology has become an increasingly important tool in a number of fields. Semantic Web technologies have been adapted in the field of medicine, military, manufacturing, and much more. It is no surprise that it has extended to multimedia outlets as well. In particular in the domain of music, there is a need for a systematic way of retrieving information whether it be the finding which artist is on a specific album or the workflow in producing music. In this paper we will be focusing on a portion of this domain: Music Genre.

Music genre is a category of music that identifies a piece of music by shared musical style and convention. When tackling music genres there are a number of ways to categorize music. A number of factors can affect how one interprets a certain music genre. Some of these criteria include period, region, instrumentation, origins, and social aspects. It would be helpful to have this information for different music genres.

To do this we will develop an ontology of musical genres. An ontology is a specification of a concept. It is basically explicit formal definitions of terms within a domain and how they relate to each other. So in order to create an ontology of music genres there is a need for certain information such as sub-genres, time periods and instruments to start. The rest of this paper will divulge the details that went into creating the ontology for this project.

Project Scope

The scope of this project includes creating an ontology that relates basic information about music genres. This goes further than to just categorizing songs by genres or information like track listings or artists. This ontology should be able to deal with music genre related information such as date of origin and what main instruments are used. It provides background information on an up to date list of music genres. It will have updated music genres, as well as instruments. It serves as an extension to existing music ontologies.
Definitions

In any ontology is it important to address important terms within the domain. There are certain questions to think about when deciding on terms that will affect the development of the ontology in later stages. Some of these questions include:

- What is the scope of the ontology?
- What terms do we need to discuss?
- What are the properties of these terms?
- What do you want to say about these term?

To reflect the information we want to present to the user it was determined that the following 5 terms were to be the main classes and most important terms:

*Instrument* - Any of various devices or contrivances that can be used to produce musical tones or sound.

*Music* - Vocal or instrumental sounds (or both) combined in such a way as to produce beauty of form, harmony, and expression of emotion.

*Music Genre* - An expressive style of music.

*Vocal* - Rendered by or intended for singing.

*Time Period* - The categorization of time into discrete named blocks is called periodization.

It is important to try to create an extensive list of terms that do not overlap different concepts but this is not always possible. The list of terms should be complete enough to cover all information within the domain. To do this research was done into various different instruments, music genres, and types within each class. Other terms include different classifications of time periods and musical terms that are relevant to the domain. Instruments were sub-classed into types for examples aero phone, chordophone, electric phone, and percussion. Time periods were divided into centuries starting from the 16th century due to the nature of the ontology and its needs.
Class Hierarchy Relation ("is a")

- Vocal
- Music
- Has origin in
- Century
- Is in a
- Decade
- Instrument
- Type of Instrument
- Sub Type of Instrument
- has
- use
- Type of
- Music Genre
- is a
- Sub Genre
- Type of Music Genre
- is a
When creating an ontology one of the most important things is to define classes and class hierarchies. This can be tricky since there is no standard method for creating hierarchies within each domain. A number of factors can affect the logic behind a class hierarchy. Some of these include application of the ontology, amount of specification necessary, compatibility with other ontologies, and sometimes it’s as simple as preference. Due to the ambiguous nature of the subject there are certain guidelines to following when creating a class hierarchy.

For the musical genre ontology we followed a “is a” relationship to obtain the general outline for the class hierarchy. Firstly we referenced the list of important terms that were defined in the previous section. The most important term was chosen as the starting point in creating the relationships. From there we went deeper in saying that music genres are a type of music. The next layer includes individual music genres, which is a music genre. These genres were then split into sub genres, which is still apart of the general genre. The lowest layer that would be considered is the actual track listing, which would not be included in the class hierarchy.

To represent the information we wanted to relate to the user we also included a class for vocals, instruments, and time period. For the proposes of this ontology vocals was not sub-classed and further and just represents any lyrical sounds produced in music. Instrument was first divided down into sub-classes of different types of instruments. It does not show in the graph but there are 4 main types of instruments. Here we verify the hierarchy with the “is a” relation: a type of instrument is an instrument. This is further sub-classed into sub-types of instruments. Again this follows the relation that a sub-type of instrument is a type of instrument. For time periods we followed the same guidelines and sub-classed it to centuries and then decades. Century relates to time period with a “is a” while decades relates to century with a “is in a” relation.

Finally to tie the information together we relate all the main classes to each other. From music we see that it has vocals, uses instruments, and has origin in time period. This is the general outline that will be followed when creating the actual ontology file.
Existing Work

When creating an ontology it is always helpful to look at existing ontologies on the subject matter. It not only gives ideas but general layouts and guidelines in creating a successful ontology. There is also the option to import pertinent information relating to the ontology you are trying to build.

There are several ontologies on the semantic web that deal with musical genre as well as ontologies that relate to musical genre in one way or another. Some deal with the categorization of music genres while others discuss music as a whole. The following section we will look at a number of ontologies that have similar goals and provided the framework for the Music Genre Ontology created.

-The Music Ontology

The music ontology is intended to provide a vocabulary to link a wide range of musical data on the web. This ontology utilizes two core elements: the timeline ontology and event ontology. It is also open to the public to make extensions and revisions.

-Instrument Ontology

Is an extension of the music ontology. It includes instruments extracted from Musicbarinz instrument taxonomy and uses the Simple Knowledge Organization System. It provides definitions of instruments used in the music ontology.

-Dbpedia MusicGenre & daml.org

Dbpedia is the RDF repository that extracts information Wikipedia. In this case it takes all information found on Wikipedia about music genres and the relationships between them. Daml.org is an ontology of music and music styles. It provides terms as well as a structure for class hierarchies.

-www.furia.com

This is a website that graphically depicts music genres. It is a flash site that has a similar taxonomy to many music genre ontologies. Main genres are bolded while sub-genre are smaller nodes. When a user clicks on any genre or subgenre the site will provide a sample clip of that specified genre or sub-genre. This site is useful in obtaining data on trend genres and subgenres in the modern music scene.

-Movie Ontology

While this is ontology was not a music genre ontology it provides insight on the structure music genre ontology should be built. Movie and music genre have many
similar characteristics and should have similar structures. This ontology includes things like ratings, awards, actors, genres, movies, and region.

**Differences**

There are a number of key differences between the musical genre ontology and the existing ontologies found on the web. Most ontologies focus on the categorization of music genre into sub genres and ultimately provides information such as album/track listings, artist, duration, release dates, etc. Our ontology deals with relation of information such as date of origin and what instruments are used within each music genre.

In the musical genre ontology there are five main classes: Instrument, Music, Music Genre, Time Period and Vocal. The music genre class has a taxonomy greatly influenced by the information found in Dbpedia in the category:MusicGenre. We pulled information about music genres and the general structure of the taxonomy found in dbpedia and other online sources.

Certain genres were altered to better reflect the genre of modern ideas in music genres. Genres were altered and added using information found on the Internet about modern genres. For example new genre and subgenres have recently surfaced especially in the area of dance music. One in particular that comes to mind is dubstep. It is a relatively new genre that was not around a couple of years ago but in recent years has gained large-scale popularity.

The instrument taxonomy also need to be updated, there was a lack of modern instruments in the electronic field. Electric instruments and electric sounds need to be added. These instruments include electric keyboards, synthesizers, dj sets, and even computer software.

Another key difference is the changes made to the taxonomy of the music genre as a class. The existing ontologies that we have encountered possess a number of multiple inheritances. Several sub-genres are housed in different classes, to avoid confusion and conflicts within the ontology multiple inheritances were avoided as much as possible. For cases where there were multiple inheritances they were moved to the class were they were most representative instead of spreading them across classes.
Examples from Musical Genre Ontology

- Main Classes

To begin the ontology 5 main classes were created: Instrument, Music, Music Genre, Time Period, and Vocal. These classes will be explored in-depth in the following section. The Music and Vocal classes are important to describe the music domain but we will primarily be concerned with the instrument, time period, and music genre classes.

-Instrument Class

The first class was to be created was the instrument class as shown in the figure below. The instrument class contains all sub-classes that pertain to musical instruments. This will be used to describe what common instruments belong in each musical genre. For example, how guitars are used in the rock genre or how electronic instruments and synthesizers are used in house music. In the ontology there are 4 main subclasses of instruments: aerophone, chordophone, electricphone, and percussion. These 4 main classes are then sub-classed further. The figure below includes all the subclasses used in the main class. This class will be used to relate information regard common instruments used within a specific music genre. In this ontology individual instances of each type of instruments are provided.
**Music Genre Class**

The music genre class is the most important class in the ontology, it provides all the different music genres as well as various different sub-genres. For the proposes of this ontology, sub-genres of music were limited to 3 sub-classes for the first iteration. In future work sub-genres can be flushed out accordingly. The main music genres are listed as shown in the figure below. There is everything from alternative to hip-hop and rap. The genres are then categorized further into sub-genres, for example within the main genre alternative sub-genres include: CollegeRock, ExperimentalRock, GothRock, HardcorePunk, IndieRock, NewWave, ProgressiveRock, and Punk. For the ontology to be successful there has to be a lot of emphasis on this main class. The other classes can be tied into this one through object properties to reflect the information we need.
**Time Period Class**

The time period class is divided into different centuries starting from the 15th Century all the way to the current century. This is meant to show when each sub-genre first emerged. The main class is sub-classed into individual centuries and then sub-classed again to individual decades. Exact origins dates could not be found so it would be best for experts in the field to fill in this information. The class was saved for future work.

**Object Properties**

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Object properties were created to apply to the music genre class. The properties “has” and “used” referred to whether not a certain music genre used or had a specific instrument or vocal. Properties such as “hasOriginGenre”, “hasSubgenre”, “isTypeOf” and “originatedIn” are used to describe the individual music genres and correlate them within the musical domain. To convey the information we want to the user, overly complex object properties were not needed. As the figure above shows they are rather simple and self-explanatory.

Application and Future Work

There are number of applications for a music genre ontology but the main purpose of this one is an improved iteration of existing work. It is intended to be an extension of any music ontology. It provides a way to categorize music as well as basic information on each individual genre and used in the music domain as a whole. It can add to the wide range of information already available on musicontology.com. Elements of this ontology could also be used for research purposes such as a semantic workspace for music analysis or an information retrieval tool.

For the time period classification for each genre, it would be wise to leave it for experts in the field who know exactly when each genre originated opposed to the estimated times found online. Some other future areas to explore in this domain are the regions that are associated with each music genre. This could prove to be valuable in music and cultural studies.