

...Construction of the Chinese Traditional Music Culture Knowledge Base (Knowledge Graph in Linked Data) from a “Digital Humanities” Perspective

Junjun Cao
— June

- Invited expert, Library of China Conservatory of Music (Beijing), musicologist of morphology etc.
- Former Postdoctoral Researcher & Linked Data Scientist for Distributed Digital Music Archive and Library Laboratory (DDMAL), McGill University (Montreal)

Slides will be available via GitHub:
[linkedmusic-datalake]



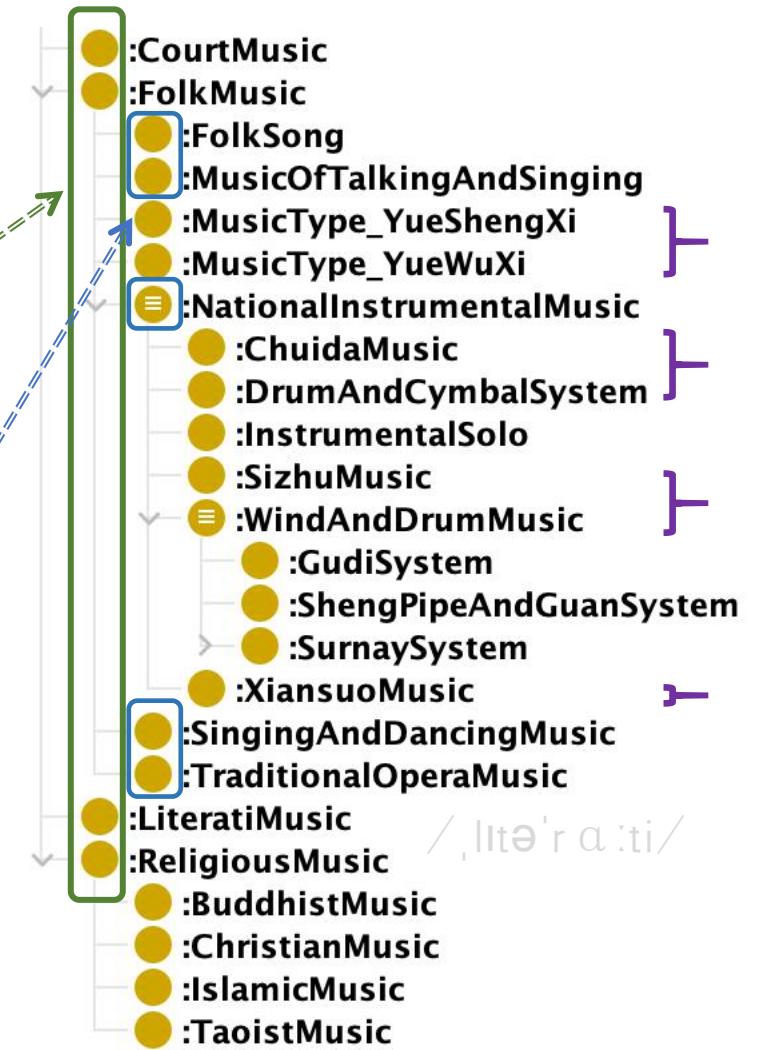
Background 1 : Introduction of Chinese Traditional Music Culture

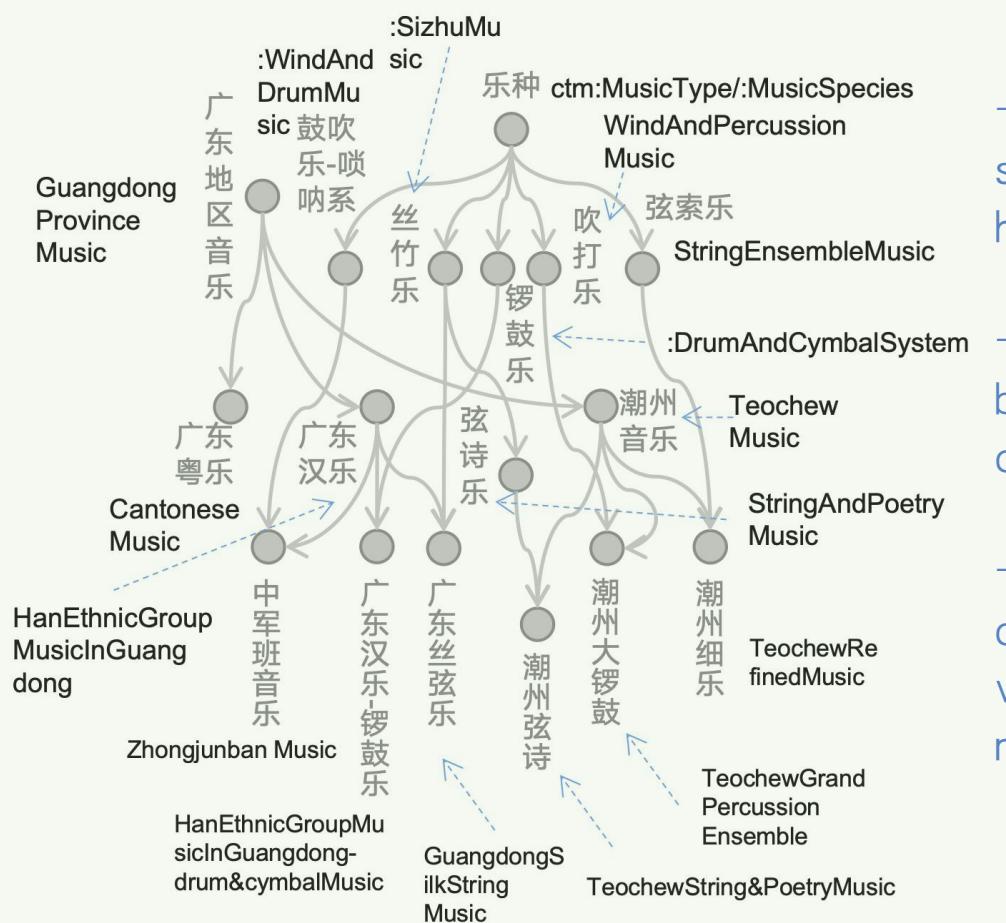
- Characteristics of Contemporary Chinese Musicology :

(1) ethnomusicology + (2) Chinese traditional Music morphology → applied to music composition, blending Eastern & Western Music flavors

- —— 1. classification (top → bottom)
- Chinese Traditional Music Culture, categorized via:
- sociological perspective: **4 classes, one of which is**
- morphological perspective: FolkMusic **5 classes**
- for instrument-associated music (music species perspective): **7 classes**

VocalIntegratedInstrumentalMusicSpecies ; DanceIntegratedInstrumentalMusicSpecies ; Wind and Percussion Music Species ; StringEnsembleMusicSpecies... —— Drew upon the viewpoint of orchestration

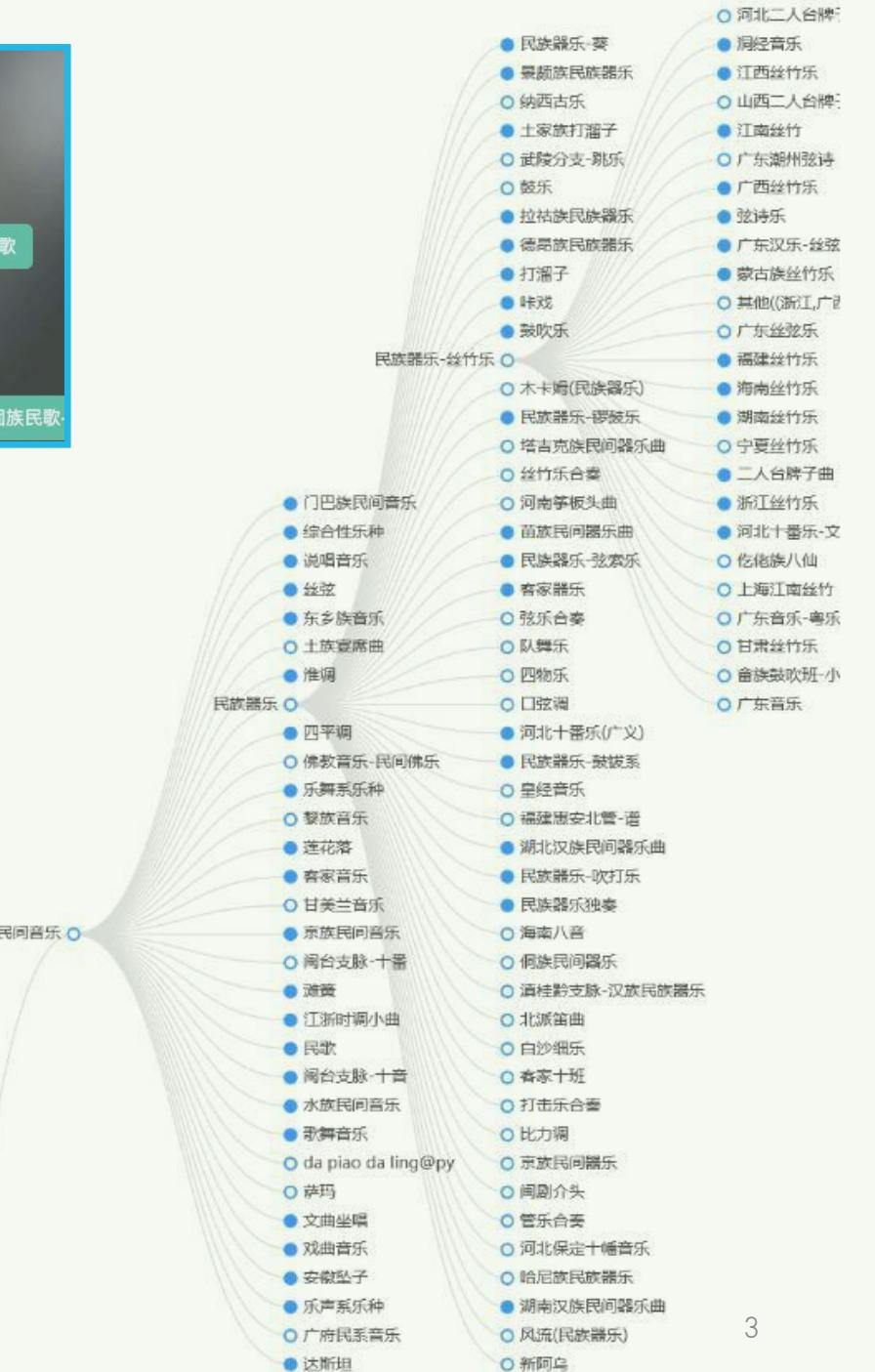




→ directed acyclic
structure rather than tree
hierarchical structure →

— a child-class may belong to more than one parent class

- use tree structure only for display which will yield redundant nodes



Background 1 : Introduction of Chinese Traditional Music Culture

- 2. cataloging (bottom → top)
- Chinese Traditional Music Culture Resource Warehouse (database)
- (1) 20 years old
- (2) folk collection and fieldwork , visual ethnography
- (3) a “Music Map” vision



The image shows a screenshot of the Chinese Traditional Music Culture Resource Warehouse database interface. At the top right, there is a search bar with dropdown menus for '搜索设置' (Search Settings), '检索' (Search), and categories like 民歌 (Folk Songs), 说唱 (Sung Poetry), 器乐 (Instruments), 戏曲 (Operas), 歌舞 (Dances), and 其它 (Others). Below the search bar is a grid of five small thumbnail images showing various scenes related to traditional music.

The main content area features a large, light-colored background image of a landscape with birds flying. On the left side of this image, there is vertical text: '中国音乐学院' (China Conservatory of Music) and '中华传统音乐文化资源库' (Database of Chinese Traditional Music Culture). Below this, there is a table with five columns: 视 (Video), 音 (Sound), 圖 (Image), 文 (Text), and 譜 (Score). Each column lists several entries with brief descriptions.

视	音	图	文	谱
贵州黔东南从江县采风实录 (二)	拉祜族创世史诗《牡帕密帕》演唱专辑 (之一)	甘肃庆阳唢呐马自刚乐班所用的乐器	走访北京的民间曲艺票房：好的就是这一口儿	甘肃庆阳唢呐马自刚乐班演出乐谱
贵州黔东南从江县采风实录 (一)	拉祜族创世史诗《牡帕密帕》演唱专辑 (之二)	甘肃庆阳唢呐马自刚乐班来我院进行学术展演	民间鼓曲的组织与机制建设	豫剧唱段100首
辽宁复州鼓乐学术展演	拉祜族创世史诗《牡帕密帕》演唱专辑 (之三)	采访四川清音伴奏琴师李长元	从新媒体新经济视角研究赫哲族“伊玛堪”的传播	兰州鼓子清唱选段
四川省凉山彝族自治州彝族传统音乐访谈 (三)	拉祜族创世史诗《牡帕密帕》演唱专辑 (之四)	采访四川清音伴奏琴师曹正礼	黑龙江省赫哲族传统音乐学术演出节目单	四川清音《羞月亮》
四川省凉山彝族自治州彝族传统音乐访谈 (二)	甘肃庆阳唢呐马自刚乐班采访录音	采访四川清音演员王小平	甘肃庆阳唢呐马自刚乐班演出节目单	四川清音《赶花会》

Background 2: Technology (and My Research Journey)

- 1. social network analysis (homogeneous network, Web 2.0) -> lots of following graph instances
 - 2. knowledge graph (heterogeneous network) in "linked data" format
 - triples + URI (unified resource identifier) => linked data/RDF (Resource Descriptive Framework)
 - Why linked data?
 - FAIR principle: e.g., especially semantic web (Web 3.0)
 - 3. a semantic turn of knowledge organization:
music metadata -> "metadata ontology"
evolve toward
-> knowledge base (an ontology-driven knowledge graph) that supports intelligent knowledge retrieval, visualization, network analysis...
to be introduced later
- tomorrow
- a normal database ->
Findable,
Accessible,
Interoperable,
Reusable

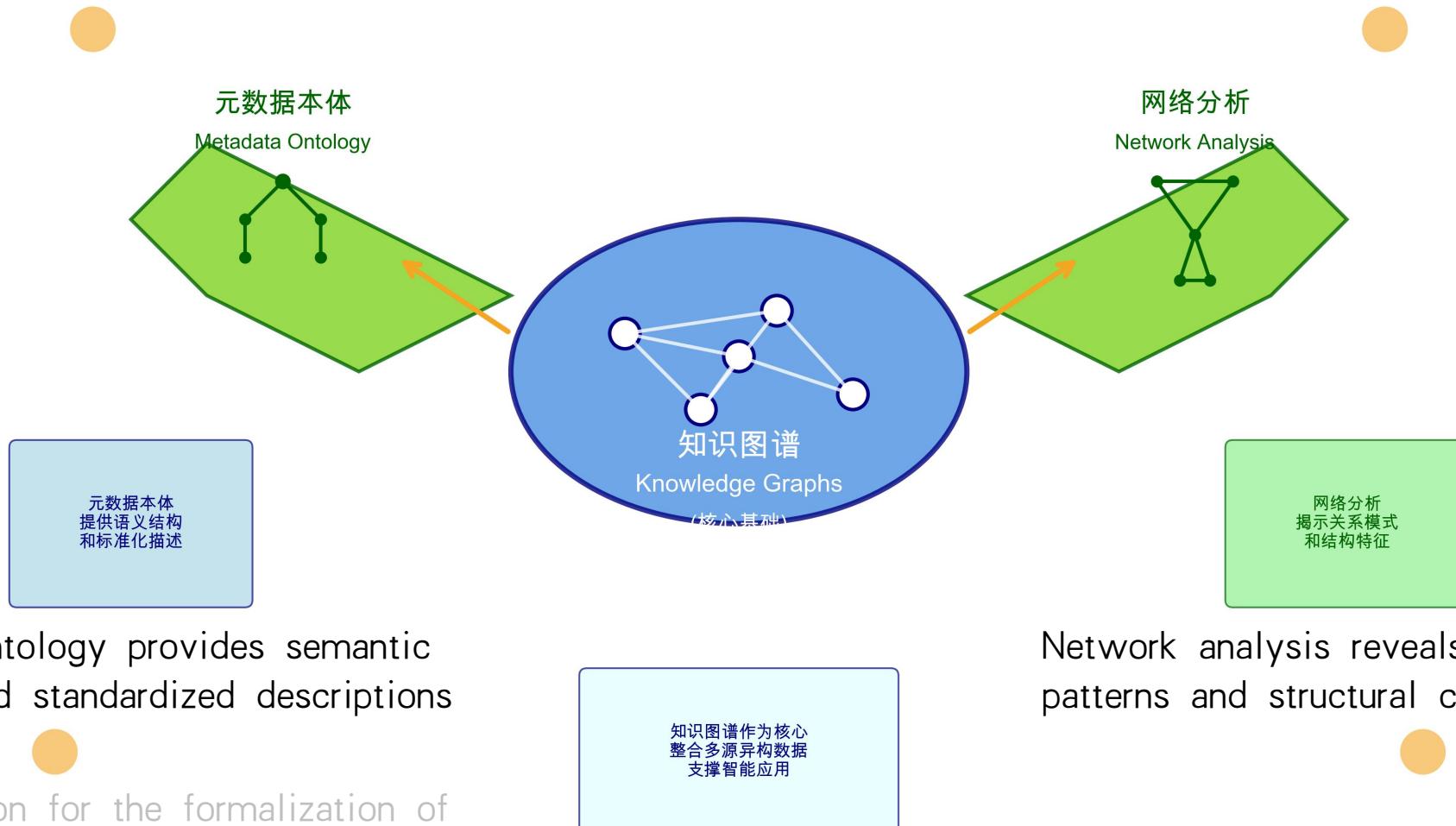
Background 3: Digital Humanities

core appeal of digital humanities lies in ... approach

- connecting data science to serve humanities
 - an ideal joint point: **structuralism and semiology** —[corner stone]
 - —> focus on text—structuring...with such recognition, to find a common set of digital humanities discourse system (*which requires even no mathematics foundation at early stage*):
- “以知识图谱为体，以元数据本体和网络分析为两翼” (Junjun , 2024 , Feb) slogan
 - translation:
- — Knowledge graphs serve as the **the "body"**
- — Metadata ontology and network analysis serve as **the "two wings"**:

一体两翼数字人文框架

Digital Humanities Framework: One Body, Two Wings



Metadata ontology provides semantic structure and standardized descriptions

Network analysis reveals relationship patterns and structural characteristics

Provides a foundation for the formalization of academic systems, disciplinary systems, and discourse systems

中华传统音乐文化知识库建设的理论框架

Theoretical Framework for Chinese Traditional Music Culture Knowledge Base Construction

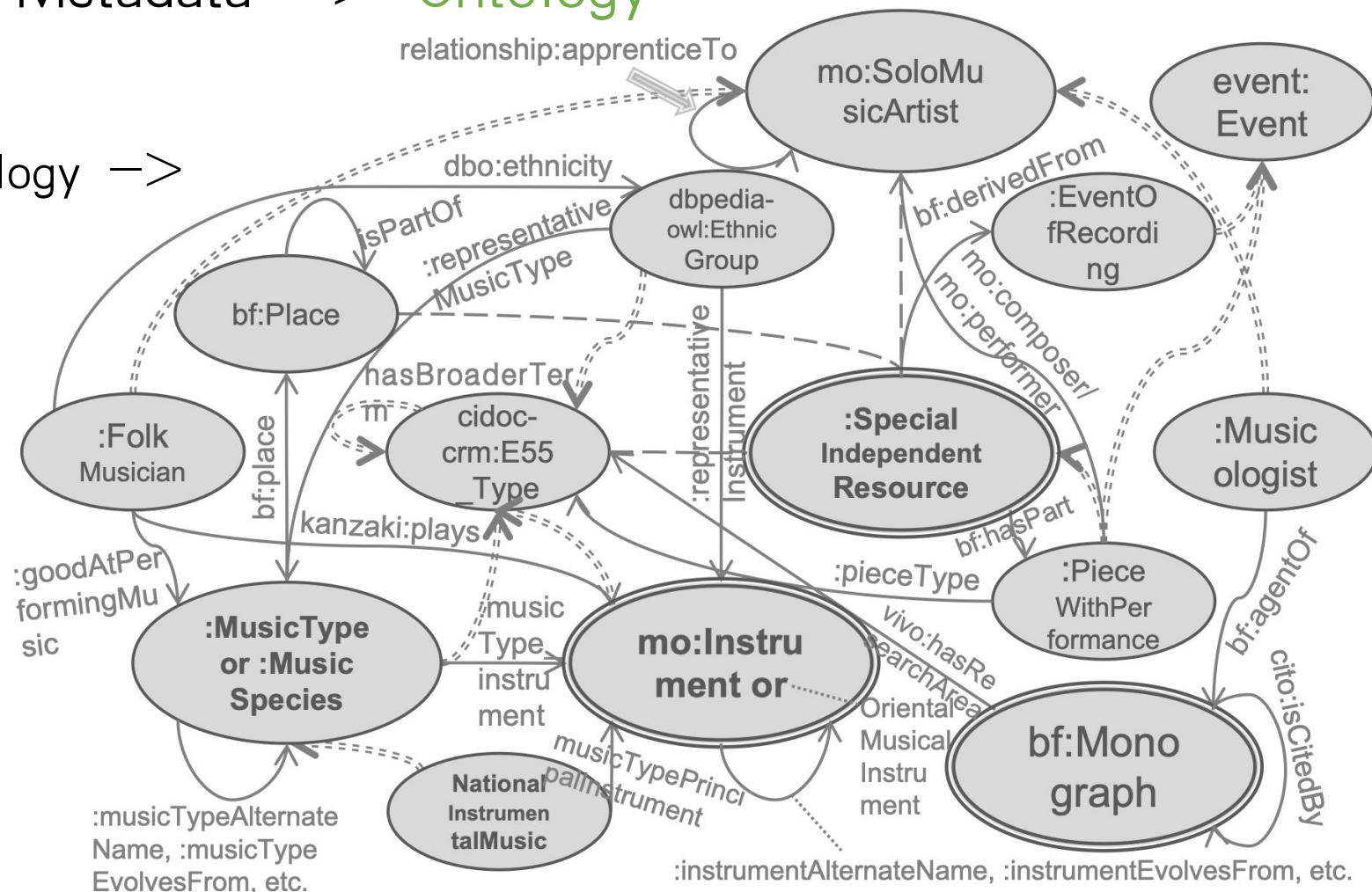
Semantic Organization of Metadata → Ontology

- (rendered in OWL—a special RDF language)
- A graph database with ontology is a genuine knowledge graph. **Definition:**
- Ontology reflects knowledge structure and knowledge organization method, involving **nodes as instances of classes**, and **edges as shared semantic relationships or properties**, such as hierarchical relations between parent and child classes. Ontology embodies the way of defining knowledge and classification methods...and even what kind of **knowledge inference** effects can be formed. An ontology serves as the foundational model of the semantic web and is also a descriptive language, such as those using **RDF Schema and OWL formats**.
Metadata has shown a trend toward ontologization, so it is appropriate to collectively refer to them as "metadata ontology."

Semantic Organization of Metadata → Ontology

- [a “knowledgeBase” with ontology → superceeds a normal “dataBase”]
 ← a more intuitive & flexible approach of :
 - – organizing knowledge ;
 - – displaying knowledge ;
 - – retrieving knowledge .
- Ontology : Chinese TraditionalMusicCulture Knowledge Base (**CTM**)

schematic diagram



Legend: -----> hierarchical relationship: such as rdfs:subClassOf
 ——— bf:relatedTo ————— other semantic relation

Single-box Search on the Main Page

Full library search ▾ Enter any keyword, which can involve the type of music (music) | musical inst

Type of music (music) Instrument library Specially Collected Independent Resources - Works ▾ Metadata ontology ▾

Knowledge graph ▾ The AI Assistant About Us

Full library search ▾ Enter any keyword, which can involve the type of music (music) | musical inst

the global/holistic ontology: background

中華傳統
音樂文化
知識庫

中国传统音乐，来自宫廷、文人、宗教、民间，又有歌曲、说唱、歌舞、戏曲、器乐等形态，还可以从族性、乐器、地理、宗派等角度观照。探索“知识网络”中的各式群落，一同领略音乐文化的异彩纷呈……

translation: Chinese traditional music comes from the ancient courts, literati circles, religious groups and folk communities, manifesting in forms as songs, narrative rap (speech-song fusion), singing-dancing integration, instrumental music, which can also be observed from viewpoints as ethnicity, instrumentation, geography and factions. Let's explore various communities within the "knowledge network", reveling in their dazzling multiplicity.

Single-box Search, e.g., after inputting “福建南音” (translation:Fujian Nanyin/South Sound)

18号字 (dark color 15)



中國音樂學院
CHINA CONSERVATORY OF MUSIC

CHINA CONSERVATORY OF MUSIC

library

Music type Instrument Library Special Collection Independent Resources_Works ▾ Metadata Ontology

Knowledge Graph ▾ AI Assistant about Us

Knowledge Graph

Query

This references China's ancient gongche notation system (工尺谱) – a traditional musical tablature using Chinese characters to represent pitch and rhythm.

This references China's ancient gchepu notation system (工尺譜) – a traditional musical tablature using Chinese characters to represent pitch and rhythm.

RESOURCE TYPE

- MUSIC TYPE (221)
 - MUSICAL INSTRUMENTS (81)
 - SPECIAL COLLECTION RESOURCES (NON-REPERTOIRE) (36)
 - PERFORMANCES OF THE TRACK (21)
 - (MUSICIAN) (17)

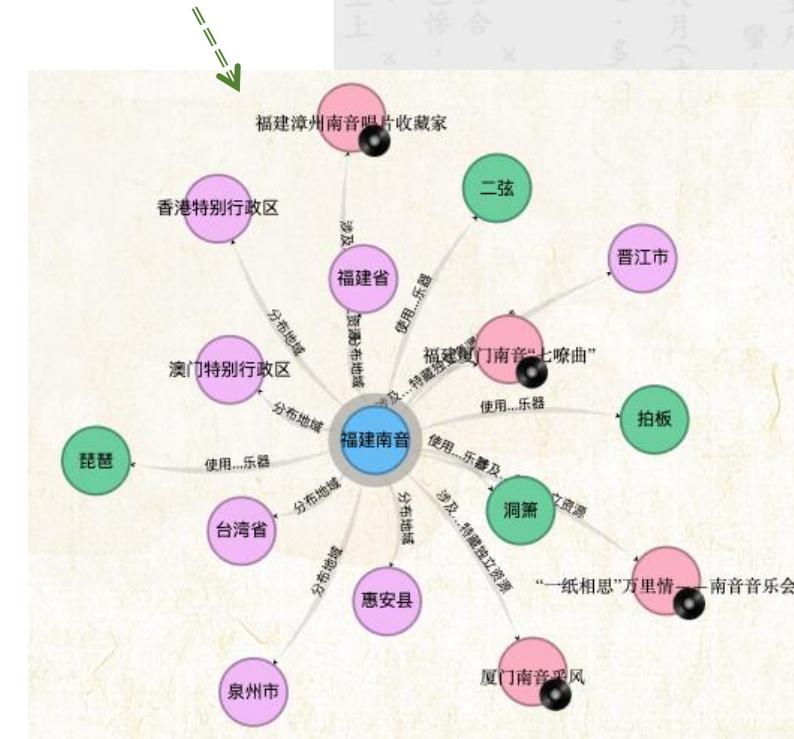
next page

Matched to 221 music types (music genres) Records

- Fujian Nanyin - refers to the knowledge graph
 - Fujian Nanyin-score knowledge graph
 - Fujian Nanyin-Music Knowledge Graph
 - Fujian Nanyin-Upper Four-pipe-Quality Control Knowledge G
 - Fujian Nanyin-Shangsiguan Knowledge Graph
 - Fujian Nanyin Knowledge Graph
 - Fujian Nanyin-Xia Si Guan Knowledge Map
 - Fujian Nanyin-Upper Four-Tube-Dongguan Knowledge Map
 - Liyuan Opera-Silk String Music Knowledge Map
 - Knowledge graph of String and bamboo music ensemble
 - Nanyin Knowledge Graph
 - Quanzhou Nanyin-Music Knowledge Graph
 - Quanzhou Nanyin-score knowledge graph
 - Quanzhou Nanyin-refers to the knowledge graph
 - Guangdong Chaozhou string.poetry knowledge map
 - Chaozhou Music-String Poetry Knowledge Graph
 - Guangdong Music-Cantonese Music Knowledge Graph
 - Knowledge map of Hebei Errentai brand songs
 - Su Nan Shiban Gonggu-Qing Gonggu Music Knowledge Map
 - Knowledge graph of Shiban gongs and drums
 - Huidiao-Siping Knowledge Graph
 - Yichang Xile Knowledge Graph
 - Huidiao-Kunyi Opera Knowledge Map
 - Knowledge map of Shanxi Errentai brand songs
 - Jiangnan Sizhu Knowledge Graph
 - Knowledge graph of Zhanzaigu
 - Knowledge Graph of the Eight Immortals

knowledge graph : graph query

→ visualization



migrated to the “[Linked Data Publishing Platform](#)”; Each blue field links to other URI-linked nodes.

The screenshot shows the China Conservatory of Music library website. At the top, there is a logo for the China Conservatory of Music (中国音乐学院) and a search bar with the placeholder "library". The navigation menu includes links for Music type, Instrument Library, Special Collection, Independent Resources_Works, Metadata Ontology, Knowledge Graph, AI Assistant, and about Us.

The main content area displays the "Fujian Nanyin RDF" page. It features a table with two columns: Attributes/Fields and Property Value. The table contains various facts about Fujian Nanyin, such as its music type (Musical genre; literati music), distribution area (Taiwan Province, Hui'an County, Jinjiang City, Quanzhou City, Macau, Special Administrative Region, Fujian Province, Hong Kong, Special Administrative Region, Southeast Asia), and representative tracks ("Heartbroken"; "Thinking of the Rest"; "Spring"; "Enjoying the Lanterns").

A specific row for "Representative tracks:" is highlighted with a red box. This row lists four tracks: "Heartbroken"; "Thinking of the Rest"; "Spring"; and "Enjoying the Lanterns". Below this row, a section titled "Definition/Explanation:" provides a detailed explanation of Fujian Nanyin, mentioning its status as a UNESCO Representative List of Intangible Cultural Heritage of Humanity entry and its classification into finger, score, and song categories.

On the right side of the page, there is a vertical decorative column with traditional Chinese musical notation symbols like "宫" and "商" repeated vertically.

Linked Data Publishing Platform for Fujian Southern Sound

福建南音

<https://lib.ccmusic.edu.cn/data/musictype/aS923pRv9J00BirG>



数据格式: RDF/XML JSON NT GRAPH

AN ENTITY OF TYPE: MusicType

skos:definition

(1)南音也称“弦管”“泉州南音”，福建省闽南地区的传统音乐，联合国教科文组织人类非物质文化遗产代表作名录内容之一(百度百科词条“南音”)(2)福建南音的音乐分为“指”“谱”“曲”三类，各类曲式结构形态均不相同(《中国乐种学》p.548)(3)笔者认为五代至宋以来，洞箫是曲子调（宋以后称词调）音乐的一件伴奏乐器，五代西蜀曲子调音乐是泉州南音的形成之发端（《中国乐种学》p.547）

rdfs:label

福建南音

fu jian nan yin @py

ctm:musicTypeOrInstrumentAlias

南音

福建南曲

fu jian nan qu @py

nan yin @py

If we say the previous page resembles a Wikipedia display, this page mirrors the structured-data interface of linked knowledge bases like DBpedia or Wikidata.

ctm:nameOfMusicTypeOrInstrument

福建南音

fu jian nan yin @py

ctm:originationPeriod

五代

ctm:place_DP

东南亚

ctm:representativePiece

《心肝跋悴》 《思得下》 《春令》 《趁赏花灯》

ctm:representativeQupai

[一封书] [古轮台] [四朝元] [杜韦娘]

rdf:type

ctm:MusicType

↳ 音乐类型(乐种)

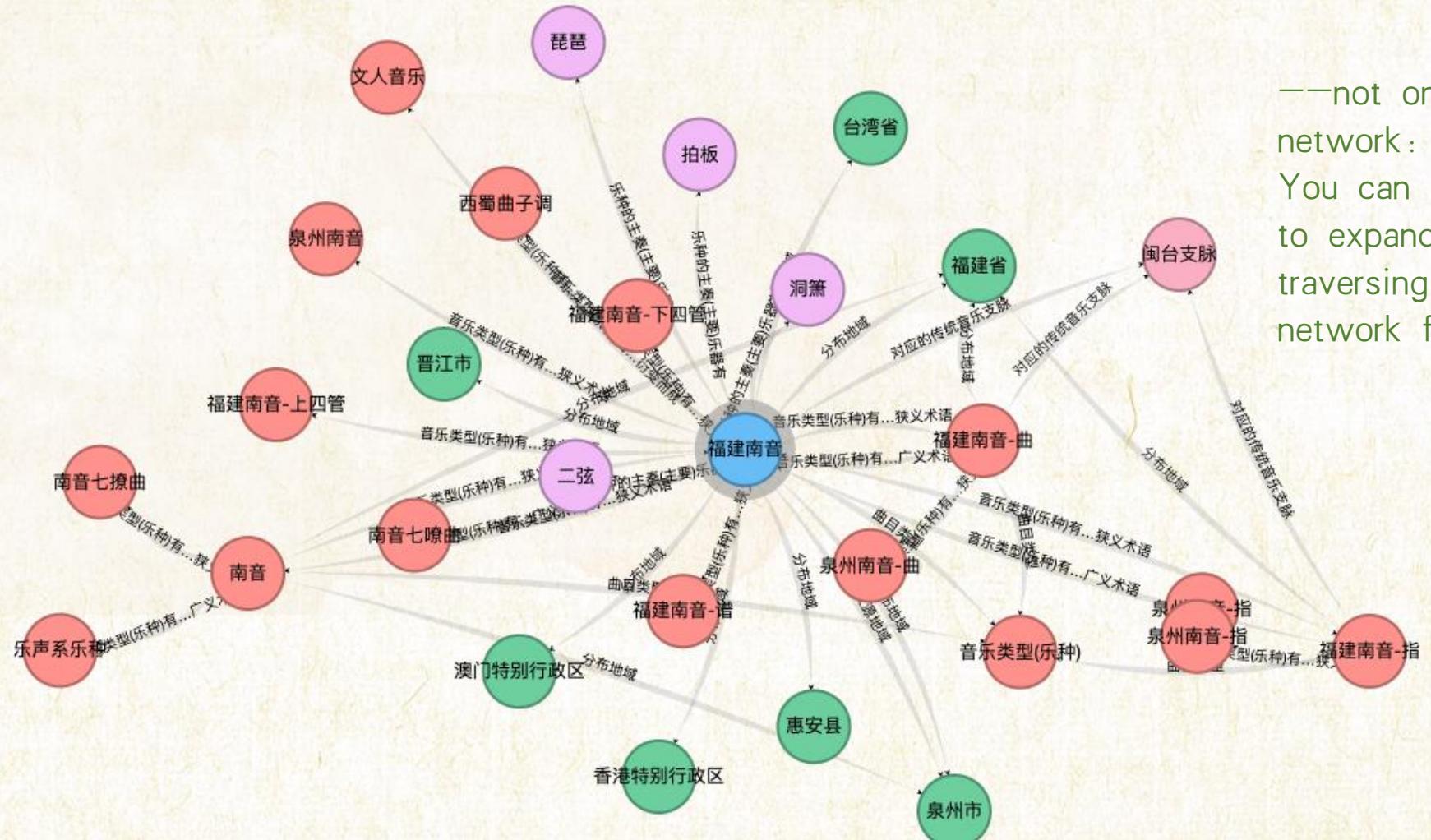
ctm:MusicType_YueShengXi

↳ 乐声系乐种

ctm:LiteratiMusic

↳ 文人音乐

scroll down to see the **egocentric network** for “福建南音” (translation: Southern Music/Sound in Fujian Province)



--not only one-step ego network :
You can double-click nodes to expand the scope, traversing the knowledge network for exploration

Can also enter the “Music type” tabular interface to retrieve Fujian South Sound. Advanced query interface with multiple filtering condition (intersection relationship)

- (1) musicType
- (2) instrument
- (3) traditional music branches

professional search syntax

MUSIC TYPE
• FOLK SONGS (914)
• OPERA MUSIC (541)
• RAP MUSIC (418)
• DANCE MUSIC (407)
• GONG AND DRUM MUSIC (153)
• NATIONAL INSTRUMENTAL MUSIC-DRUMS AND CYMBALS (153)
• DRUM AND CYMBAL MUSIC GENRES (153)
• TRADITIONAL INSTRUMENTAL MUSIC-WIND AND PERCUSSION MUSIC (123)
• WIND AND PERCUSSION MUSIC (123)
• WIND AND PERCUSSION MUSIC (123)

DISTRIBUTION
• YUNNAN PROVINCE (362)
• FUJIAN PROVINCE (205)
• HUNAN PROVINCE (186)
• GUANGXI ZHUANG AUTONOMOUS REGION (182)
• GUANGDONG PROVINCE (175)
• HUBEI PROVINCE (163)

Matched to 3182 Records data reusable [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [>](#) [>>](#)

Music type	Category Tags	Distribution	Use a musical instrument	Corresponding nationality	Traditional music branch
Abalasi Spring Dance	folk song	-	-	-	-
Achang Nationality Song and Dance Music	Dance Music	Longchuan County, Mangshi City, Dehong Dai and Jingpo Autonomous Prefecture , Yunnan Province	-	Achang Nationality	Yunnan-Guizhou-Qiangxi branch-Diqiang branch
Achang stick dance	Dance Music	Yunnan Province	-	Achang Nationality	Yunnan-Guizhou-Qiangxi branch-Diqiang branch
Achang Gourd Flute Song	Folk instrumental solo	Yunnan Province	-	Achang Nationality	Yunnan-Guizhou-Qiangxi branch-Diqiang branch
Achang sacrificial songs	folk song	-	-	Achang Nationality	-
Achang folk songs	folk song	Longchuan County, Mangshi City, Dehong Dai and Jingpo Autonomous Prefecture , Yunnan Province	-	Achang Nationality	Yunnan-Guizhou-Qiangxi branch-Diqiang branch

- (4) distribution area
- (5) ethnic group
- (6) originates from historical period (dynasty)

Special Collection Resources (bf : hasPart = PiecePerformance Chinese or Eastern Music Instruments Warehouse



中国音乐学院 library

Music type Instrument Library Special Collection Independent Resources_Works ▾ Metadata Ontology ▾

Knowledge Graph ▾ AI Assistant about Special Collection Resources (Non-repertoire)

Title/alias of the performance The Performance of the track

The composer is / the performer is / the performer is

The national style of the piece is

Query Leave blank Download (RDF)

中国音乐学院 library

Music type Instrument Library Special Collection Independent Resources_Works ▾ Metadata Ontology ▾

Knowledge Graph ▾ AI Assistant about Us

Musical instrument -Select Performance Type- Corresponding to...
Distribution yes Query Leave blank Download (RDF)

PERFORMANCE TYPE
• CHINESE MUSICAL INSTRUMENTS (289)
• ORIENTAL MUSICAL INSTRUMENTS (174)
• WIND INSTRUMENTS (50)
• PERCUSSION INSTRUMENTS (32)
• STRINGED INSTRUMENTS (20)
• STRINGED INSTRUMENTS (5)
• UNPITCHED PERCUSSION INSTRUMENTS (2)

Matched to 321 Records

1 2 3 4 5 6 > >>

Aga

Musical instrument nickname:-

Performance Type:-

Acoustic classification: Earth sound

Corresponding to...ethnic group: Tibetan

Recommended collection resources:-



ACOUSTIC CLASSIFICATION
• EDGE SOUND (13)
• DOUBLE REED AIR BELL (11)
• PLUCKED STRINGS (9)
• PERCUSSION BODY SOUND (8)
• LIP REED AIR SOUND (8)
• STRINGS (4)
• PERCUSSION MEMBRANE SOUND (4)
• FREE SPRING AIR BELL (4)
• STRING SOUND (4)

Matched to 1108 Records

1 2 3 4 5 6 > >>

RESOURCE TAGS

- VIDEOS - MUSIC FESTIVALS, CONCERTS, COMPETITIONS, ETC. (297)
- VIDEO - LECTURE OR CLASS, ETC. (218)
- SPECIAL COLLECTION INDEPENDENT RESOURCES_WORKS (151)
- VIDEO-FIELD TRIP OR FIELD INVESTIGATION (122)
- VIDEO-INTERVIEW (104)
- VIDEO-ACADEMIC CONFERENCE (102)

Matched to 1108 Records

1 2 3 4 5 6 > >>

TYPES OF MUSIC INVOLVED

- FOLK SONGS (54)
- SICHUAN QINGYIN (42)
- DANCE MUSIC (36)
- RAP MUSIC (33)
- FOLK INSTRUMENTAL MUSIC (20)
- FOLK INSTRUMENTAL SOLO (18)
- XI'AN DRUM MUSIC (13)
- SONG (12)
- NATIONAL INSTRUMENTAL MUSIC-DRUMS AND

CORRESPONDING ETHNIC GROUP

Bagua

Musical instrument nickname:-

Performance Type:-

Acoustic Classification:-



PERFORMANCE TYPE

Matched to 321 Records

1 2 3 4 5 6 > >>

Matched to 1108 Records

1 2 3 4 5 6 > >>

- CHINESE MUSICAL INSTRUMENTS (289)
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Matched to 1108 Records

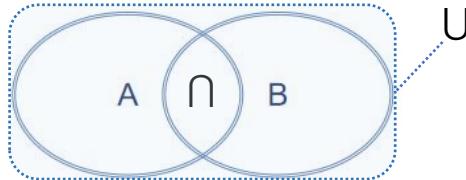
1 2 3 4 5 6 > >>

Matched to 1108 Records

1 2 3 4 5 6 > >>

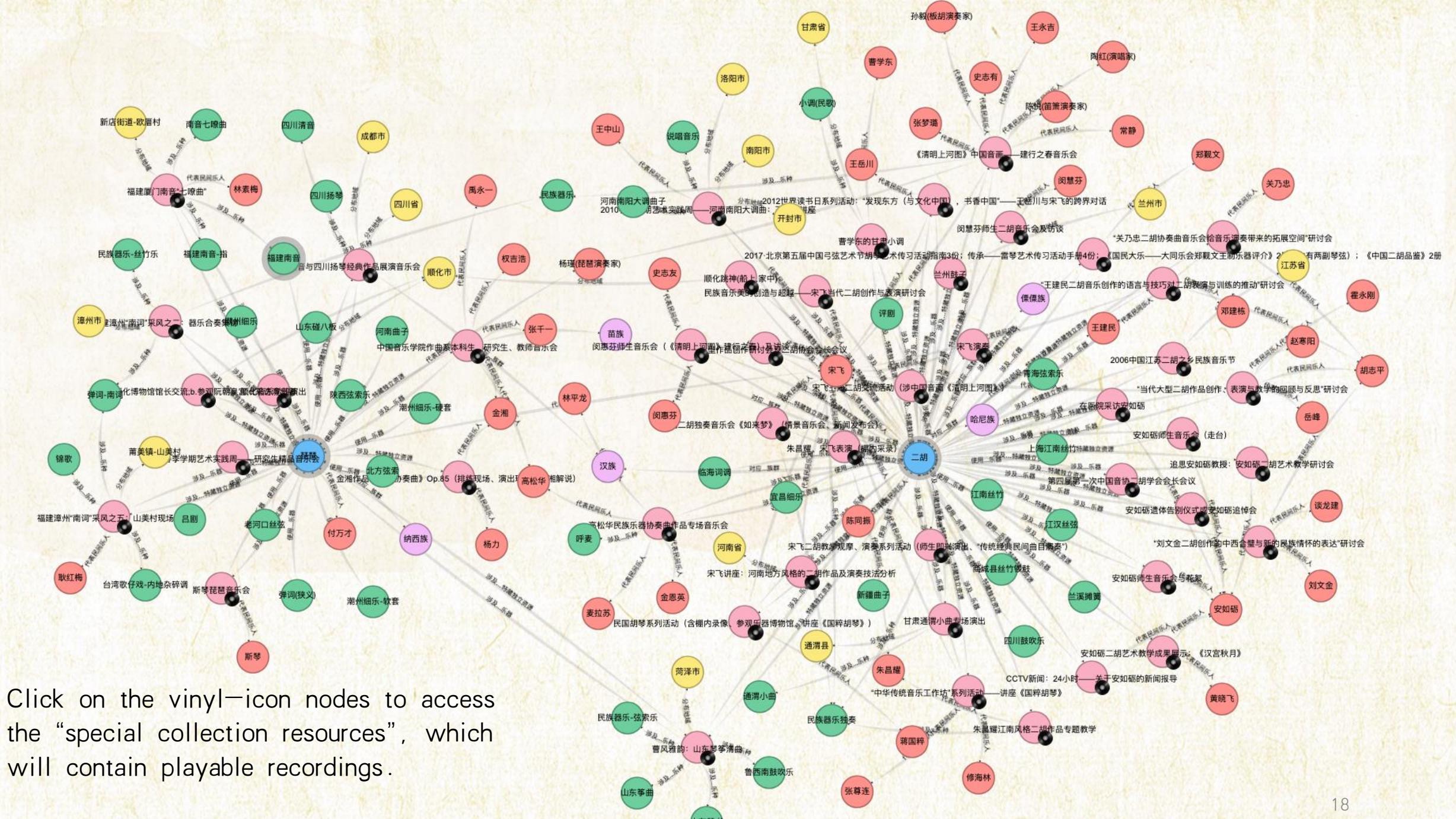
[1] Search results are derived from the backend server.

Graph Query 1: facilitate both union and intersection relationship



You can select multiple related keyword—nodes as starting points. By expanding their respective neighborhoods simultaneously, the visualization reveals topological community structures. E.g., the bridge part between 2 densely clustered communities may represent $\cap \dots$.

The screenshot shows the China Conservatory of Music Knowledge Graph interface. At the top, there are search fields for 'Music type', 'Instrument Library', 'Special Collection Independent Resources_Works', and 'Metadata Ontology'. Below the search fields are three input boxes: 'area' (containing 'area'), 'Step 1' (containing 'name : "Fujian Nanyin"'), and 'Step 2' (containing 'size : "25"'). To the right of these are buttons for 'Generate Graph', 'Leave blank', 'Download (RDF)', and 'full screen'. A green arrow points from the 'Step 1' input field to the graph area, with the text 'to switch between 1-step or 2-step length ego network'. The graph itself is a 2-step ego network centered on 'Fujian Nanyin'. Nodes include provinces like Hong Kong, Macau, Taiwan, and Jiangxi, cities like Jinjiang, Quanzhou, and Xiamen, and instruments like Pipa and Erhu. Edges represent relationships like '分布地域' (distributed in), '使用...乐器' (uses... instrument), and '涉及...资源' (involves... resources). A green arrow also points from the graph area to the right panel, which displays 'Node Information' for 'Fujian Nanyin' and 'Type'. The text 'next page--- query condition: MusicType:福建南音;西安鼓乐;Instrument:二胡;琵琶;area/place:江西省' is displayed at the bottom right.



Click on the vinyl-icon nodes to access the “special collection resources”, which will contain playable recordings.

[2] Search results are derived from data periodically uploaded by the music librarian.

Graph Query 2:

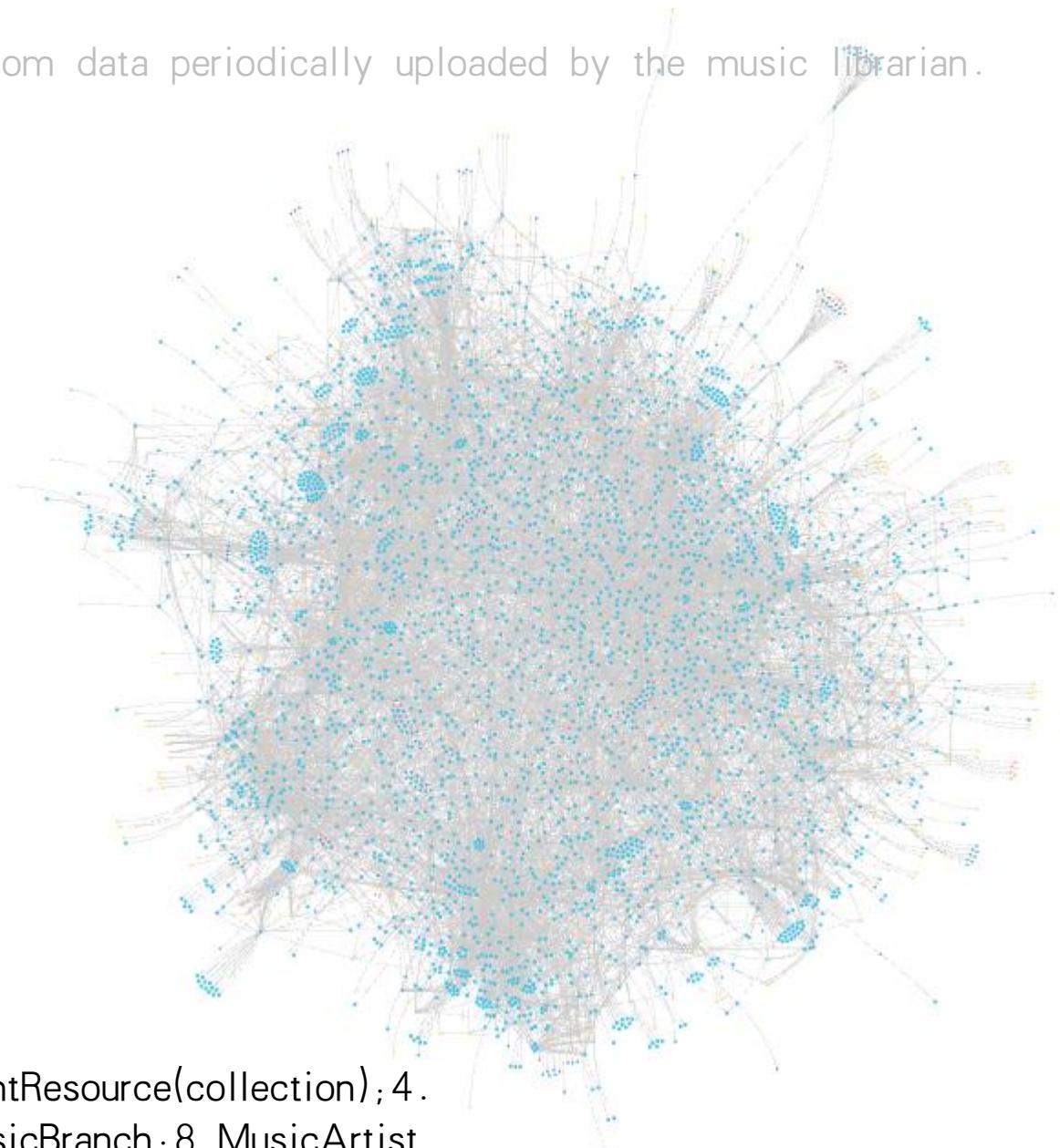
- node neighbourhood retrieval
- panoramic visualization :
/pænə'ræmɪk/
- A->B path traversal

THEME_DEFAULT ▾

乐种 乐器 特藏资源(非曲目) 曲目 地域 民族 音乐支脉 乐人



1. MusicSpecies ; 2. Instrument ; 3. SpecialIndependentResource(collection) ; 4. PieceWithPerformance ; 5. Place ; 6. EthnicGroup ; 7. MusicBranch ; 8. MusicArtist



知识图谱

知识图谱

不安全 http://dh.usources.cn:8280/mcdemo/semantic

火狐官方站点 新手上路 常用网址 中华传统音乐文化知... 中华传统音乐文化知...

中国音乐学院 图书馆 CHINA CONSERVATORY OF MUSIC

音乐类型(乐种) 乐器库 特藏独立资源_作品 元数据本体 知识图谱 AI助手 关于我们

input keyword

THEME_DEFAULT

等待 grapheco.github.io...

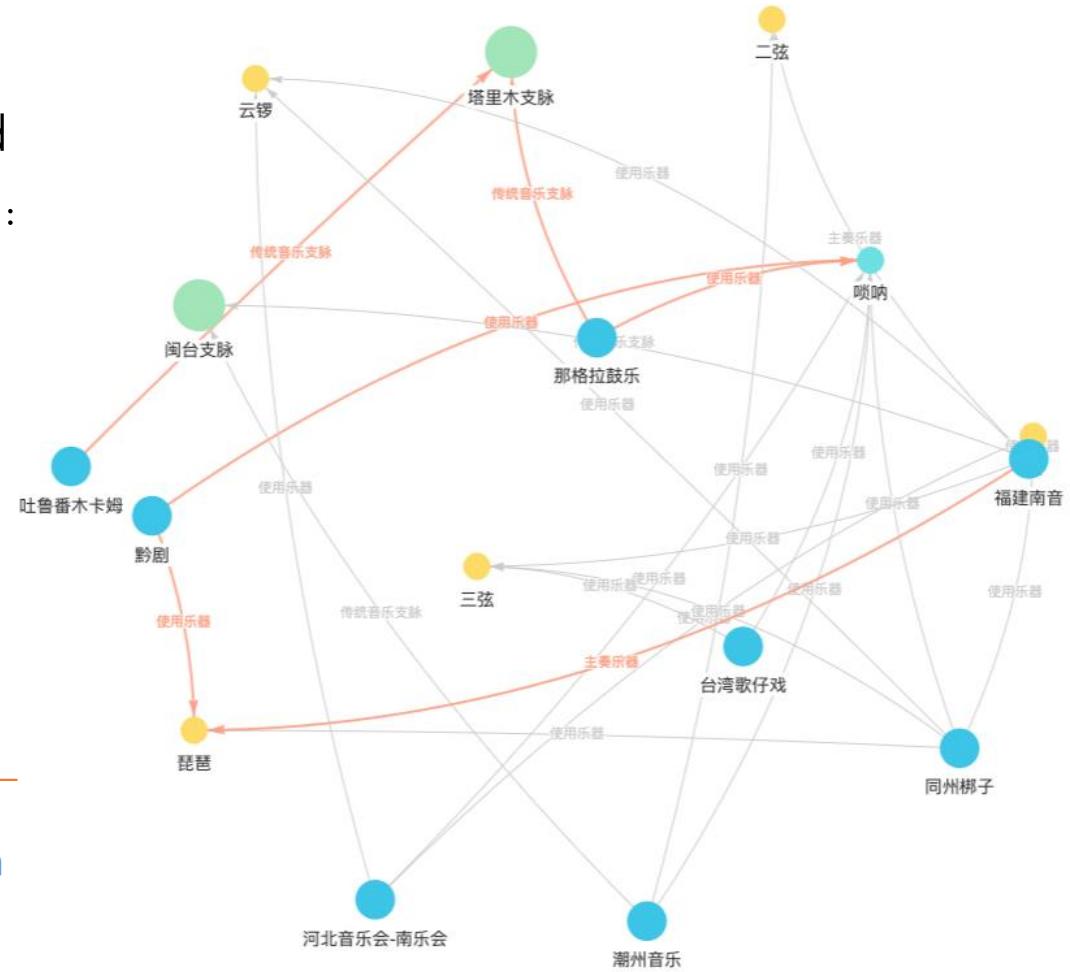
20 2025/07/04 09:18:29

graph query 2: A->B path traversal

- to explore the relationship with distance threshold
 - to explore the shortest path between 2 nodes:

e.g., What's the potential relationship between Turpan Muqam in northwest China and Fujian South Sound in southeast China?

- TurpanMuqam-[traditionalMusicBranch]->(1)TarimMu
sicBranch<-[traditionalMusicBranch]-(2)NgalraDrumMusic-
[usesInstrument]->(3)surnay<-[usesInstrument]-(4)QianOpera-
[usesInstrument]->(5)pipa<-[hasPrincipallInstrument]-(6)Fujian
SouthSound





中国音乐学院

CHINA CONSERVATORY OF MUSIC

Copyright ©中国音乐学院

地址：北京朝阳区安翔路一号 中国音乐学院图书馆2023年校内科研专项
2022年中国图书馆学会、中国博士后科学基金、2023年北京市（含朝阳区）等项目资助

SPARQL query : referring to ontology list from the frontend

- SPARQL — an RDF specific query language;
- Structurize any NLQ (Natural Language Question) into SPARQL syntax prior to mapping with the schema (e.g., ontology) the way knowledge was originally organized. **Ontology elements :**

The screenshot shows the China Conservatory of Music Library website. The top navigation bar includes links for Type of music (music), Instrument library, Specially Collected Independent Resources - Works, Metadata ontology (which is highlighted with a green box), Knowledge graph, The AI Assistant, and About Us. Below the navigation is a search bar labeled 'ONTHUB.NET (本体服务中心)'. The main content area features a title '中华传统音乐文化知识库本体 (ctm) Chinese Traditional Music Knowledge Base' and a 'Table of Content' section with links to various ontology classes. To the right, there is a detailed ontology entry for '笙' (Sheng). This entry includes the IRI (<http://dbtune.org/musicbrainz/page/instrument/68>), labels ('笙'), and super-classes ('ctm:BlowPipeInstrument'). Below this is another entry for 'bf:Audio', followed by 'bf:Instance' and 'bf:Item' entries.

中华传统音乐文化知识库本体 (ctm) Chinese Traditional Music Knowledge Base

This Version:
2.0

Publisher|Contributor:
曹军军 (中国音乐学院中国音乐研究基地), 中国音乐学院图书馆技术部、数字人文工作坊全体成员

Description:
以中国音乐学院图书馆“中华传统音乐文化资源库”的实践为基础，尤其结合其“影像志”特点，进行基础本体方案设计；再结合传统音乐文化关联多领域的特点，构建相应类、关系和语义约束方式，如涉及乐种、乐器、民族主题词表，及对曲目、乐人、地域、文字文献等领域的语义关联。该方案将有利于传统音乐分类研究和垂直领域的知识检索，且具有音乐地理学、音乐人类学社群分析等方向上的应用前景。相关论文可参考《中国传统音乐知识库的“元数据本体”构建研究》（《数字人文研究》2022年第4期）。联系我们：①邮箱：alienmusedh@gmail.com; 529360500@qq.com②微信：MuseDH
关于versionInfo: 该版本是在原有的乐种元数据本体之上扩展而形成的，即 2.0 版，针对武汉大学文化遗产智能计算实验室（教育部）开放基金课题“基于‘东方乐器’的音乐类文化遗产知识图谱构建研究”而设计。特此注明"""; owl:versionInfo "2.0 highlighting Oriental Instruments"^^rdfs:Literal ; ctm:logForUpdating """从领域知识角度来看，已知目前知识推理尚存在问题：(1) :ethnicGroup (2) :representativeInstrument (3) :representativeMusicType (4) :relatesInstrument (5) :relatesMusicType (6) :relatesWork (如上供参考) Since 2025Feb25, following modifications are as belows: (1) ObjectProperty `:musicType_Instrument` is updated to `:musicType_instrument` (2) ... (3) Add name space and prefix. See geo

Table of Content

1. Classes
2. Object Properties
3. Data Properties
4. Annotation Properties
5. Namespace Declarations

Classes

<http://dbtune.org/musicbrainz/page/instrument/68> bf:Audio bf:Instance bf:Item bf:Monograph bf:MovingImage bf:MusicInstrument bf:NotatedMusic bf:Place bf:StillImage bf:Text bf:Work musicbrainz:Track event:Event bibo:Book bibo:Periodical mo:Composer mo:Conductor mo:Instrument mo:MusicGroup mo:SoloMusicArtist place:City place:County place:Province place:Town place:Township place:Village fabio:JournalArticle cidoc-crm:E24_Physical_Man-Made_Thing cidoc-crm:E53_Place cidoc-crm:E55_Type kanzaki:Player kanzaki:Singer

Metadata ontology

<http://dbtune.org/musicbrainz/page/instrument/68>

Labels: 笙

IRI: <http://dbtune.org/musicbrainz/page/instrument/68>

has super-classes
[ctm:BlowPipeInstrument](#)

[back to ToC or Class ToC](#)

bf:Audio

Labels: 录音

IRI: <http://id.loc.gov/ontologies/bibframe/Audio>

Resources expressed in an audible form, including music or other sounds.

has super-classes
[ctm:SpecialIndependentResource](#)

[back to ToC or Class ToC](#)

bf:Instance

Labels: 独立资源_实例

IRI: <http://id.loc.gov/ontologies/bibframe/Instance>

has sub-classes
[ctm:InstanceOfInstrument](#)

is in range of
[bf:hasInstance](#)

[back to ToC or Class ToC](#)

bf:Item

Labels: 实体单件

IRI: <http://id.loc.gov/ontologies/bibframe/Item>

has sub-classes
[ctm:ItemOfInstrument](#)

[back to ToC or Class ToC](#)



SPARQL Query Example

1 Database overview, exploration of internal structure

- [1.1 Querying the size of the database](#)

That is, the total number of instances of the main name guest triple

- [1.2 Returning a part of the triple](#)

For example, the 50 articles.

- [1.3 Exploring how many classes are in the knowledge base](#)

And with each class how many examples, do the descending order arrangement

- [1.4 Querying an instance of a class](#)

If you look for examples of folk songs.

- [1.5 The weight of the relationship](#)

The number of predicates (or attributes)

- [1.6 Uploading of specific collections of resources in addition to metadata in the knowledge base](#)

Find out which "specially independent resources_works" have been associated with specific readable sounds and like resources

Click to view the default namespaces

```

1 Does my library have any special resources related to Ganmei Lan music, and if so, where is the area involved in this resource?
① 2 define input:inference 'urn:owl:ccmusicrules0214' #Activate Reasoning Mechanism
3 PREFIX ctm: <https://lib.ccmusic.edu.cn/ontologies/chinace_traditional_music#>
4 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
5
6 The select? The resource? The resourcelabel? place? placeLabel WHERE {
7   # Find unique resources
8   ? resource a ctm: SpecialIndependentResource .
9   ? Resource rdfs:label? ResourceLabel .
10
11   # This resource involves the Gammelan music genre
12   ? Resource ctm: relatesMusicType ctm: relatesMusicType? MusicType .
13   ? musicType rdfs:label "Gammelan music" .
14
15   # Geographic areas of the resource
16   ? Resource ctm: deletesPlace? place .
17   ? Where rdfs:label? placeLabel .
18 }
```



Table

Raw Response



Showing 1 to 3 of 3 entries

Gamelan Music

Resource	ResourceLabel	place	PlaceLabel
https://lib.ccmusic.edu.cn/data/sdresource/82KtNL8305adF0E0	Gamelan Music (Department of Music)	https://lib.ccmusic.edu.cn/data/place/southeastasia	Southeast Asian
https://lib.ccmusic.edu.cn/data/sdresource/XumB0bv3mNe3Mk	Chen Ming Dao's trip to Bali, Indonesia	https://lib.ccmusic.edu.cn/data/place/bali	Balinese
https://lib.ccmusic.edu.cn/data/sdresource/XumB0bv3mNe3Mk	Chen Ming Dao's trip to Bali, Indonesia	https://lib.ccmusic.edu.cn/data/place/bali	Balinese

Showing 1 to 3 of 3 entries

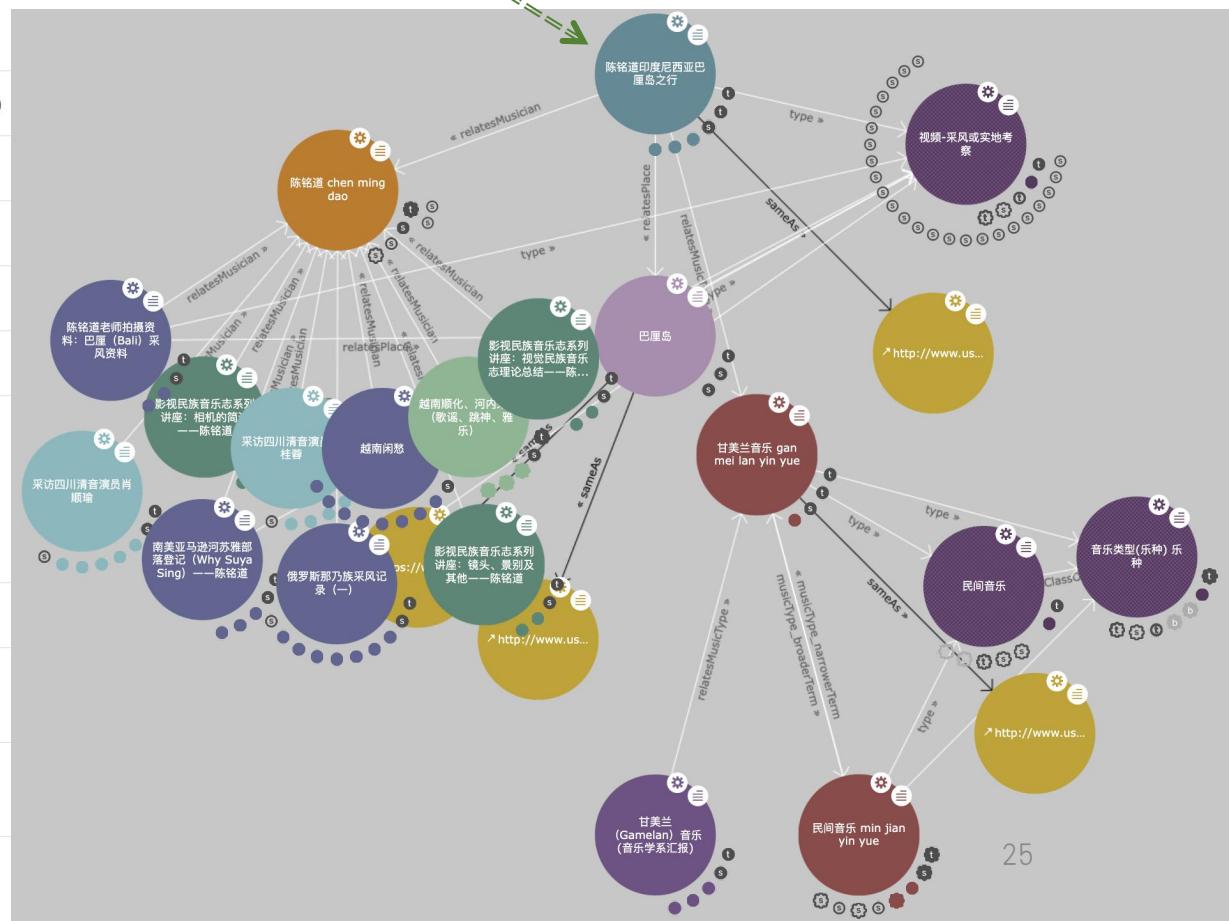
nodes as URI are accessible to linked data publishing platform

SPARQL query result → linked data publishing platform

陈铭道印度尼西亚巴厘岛之行	
https://lib.ccmusic.edu.cn/data/sdresource/XumB0bv3mNe3XnMk	
rdfs:label	陈铭道印度尼西亚巴厘岛之行
bf:mount	《传承与变异：印度尼西亚巴厘岛考察的一点想法》(DATA16 (成品1) -8, 含ppt与图片)
< http://www.cidoc-crm.org/cidoc-crm/P3_has_note >	由“特藏部数字音视频及图片资料硬盘登记表(合并)张家琪交接, 总表, 重要”引入
bf:subject	陈铭道印度尼西亚巴厘岛之行
bf:identifiedBy	_927
< http://rdfs.co/juso/locator_address >	印度尼西亚巴厘岛
rdf:type	bf:StillImage ↳ Still image
properties inFormOf name SpacePrefix+FragmentID...	
owl:sameAs	< http://www.usources.cn:8480/music/data/sdresource/XumB0bv3mNe3XnMk >
ctm:relatesMusician	< https://lib.ccmusic.edu.cn/data/agent/v2KV2PkfJ6ezU3g > ↳ 陈铭道
ctm:relatesMusicType	< https://lib.ccmusic.edu.cn/data/musictype/G4dTvrSu85i1d3qb > ↳ 甘美兰音乐
ctm:relatesPlace	< https://lib.ccmusic.edu.cn/data/place/bali > ↳ 巴厘岛



Chen Mingdao's Trip to Bali, Indonesia and related resources



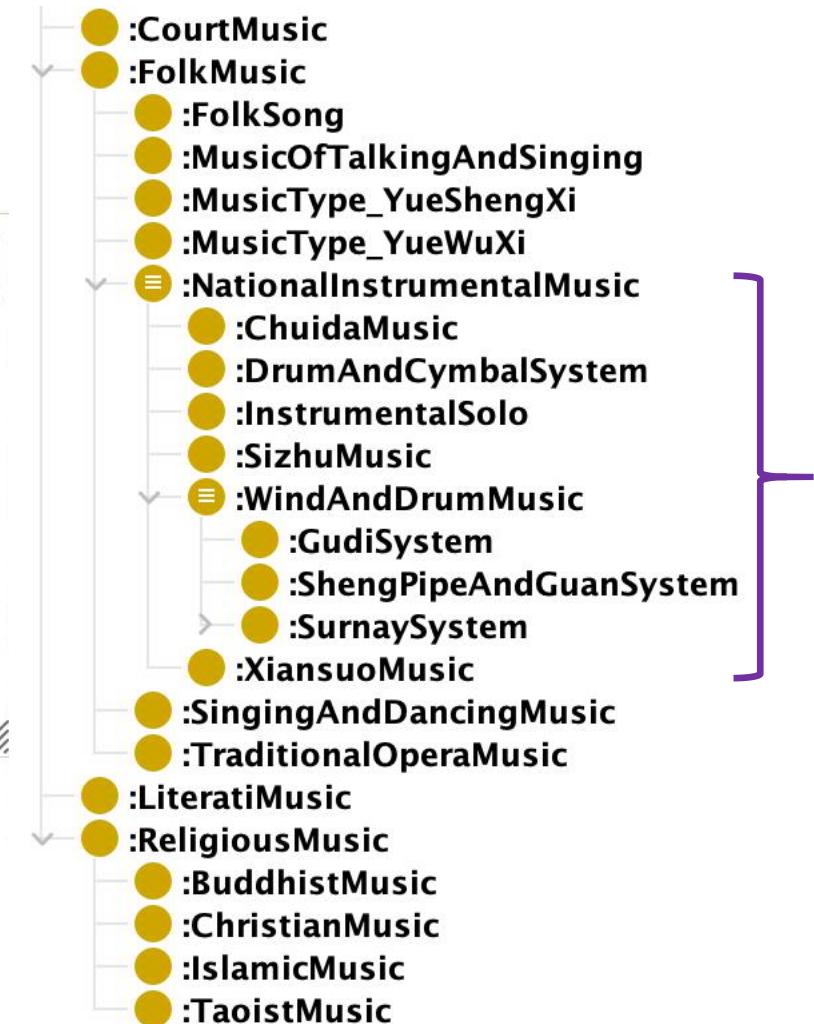
SPARQL query based on knowledge reasoning/inference

- ontology-based reasoning activation

```
1 # note:  
2 # Users can remove the hash symbol (#) before 'define' to  
3 # activate the reasoning engine, so that inferred and completed  
data can be obtained during queries.  
4 # define input:inference 'urn:owl:ccmusicrules0214'  
5 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>  
6 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>  
7 SELECT * WHERE {  
8   ?sub ?pred ?obj .  
9 } LIMIT 10
```

Table Raw Response  retrieved data can be downloaded as RDF

e.g., Find the national instrumental music.



SPARQL query based on knowledge reasoning/inference

- ontology-based reasoning activation

e.g., Find the national instrumental music

```
define input: inference 'urn:owl:ccmusicrules0214'  
PREFIX ctm:  
<https://lib.ccmusic.edu.cn/ontologies/chinese_traditional_music#>  
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>  
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>  
SELECT * WHERE {  
    ?MusicSpecies a ctm:NationalInstrumentalMusic;  
                rdfs:label ?label }
```

without supplementation from reasoning: 132 entries → 1290 entries



Through the activation of reasoning capabilities, resources belonging to child-classes of NationalInstrumentalMusic are automatically retrieved. This effectively addresses the inherent limitations of conventional flat cataloging and classification methodologies.

Digital Humanities Application: correspondence between geo music branches and language branches / language families

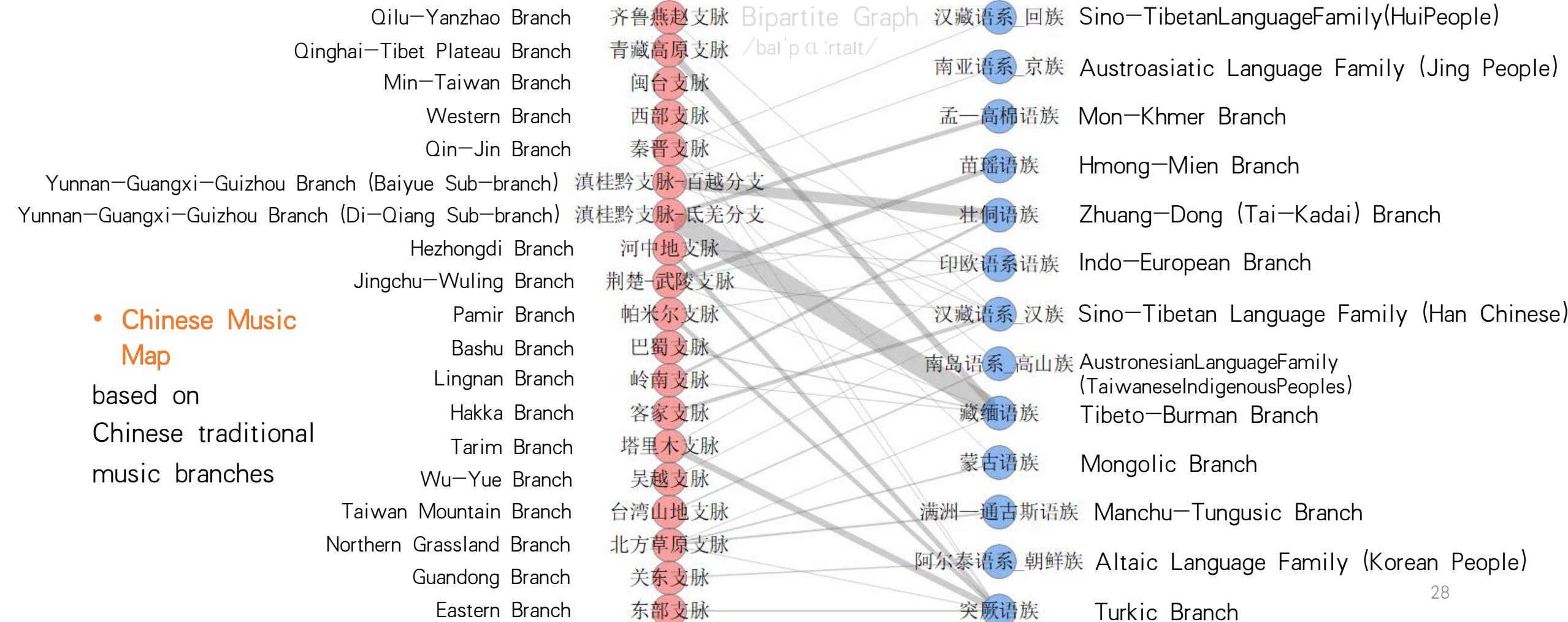


Table

Raw Response

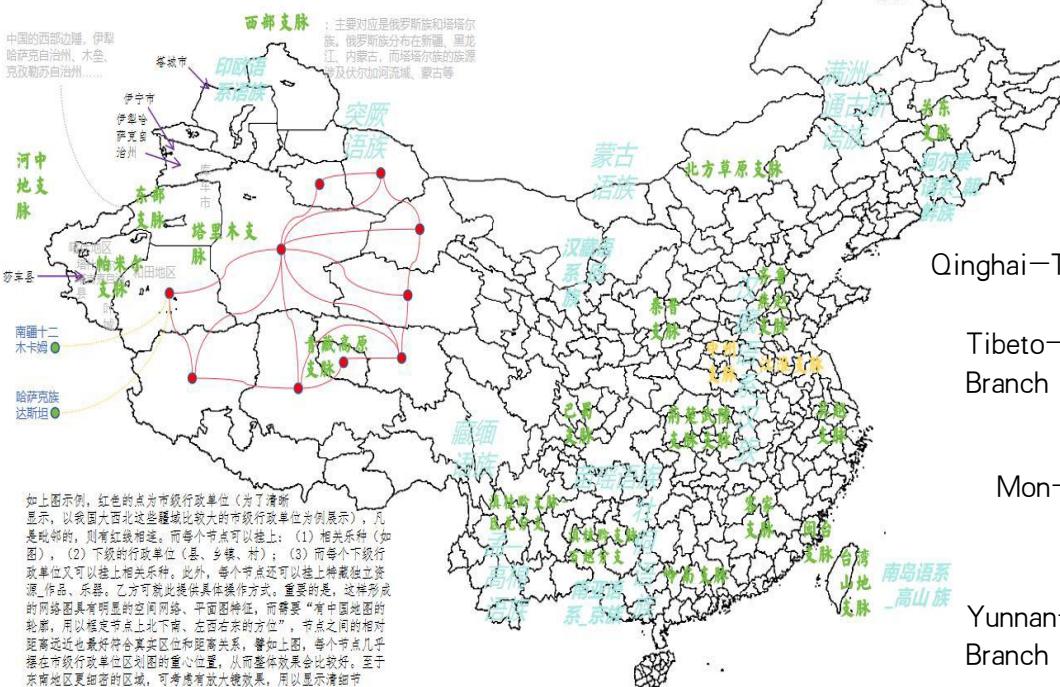


retrieved data can be downloaded as RDF



Digital Humanities Application

- Chinese music map based on Traditional music branches

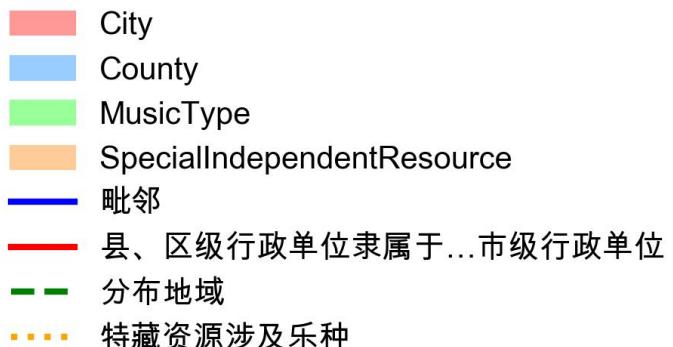


Digital Humanities Application: geographical music research

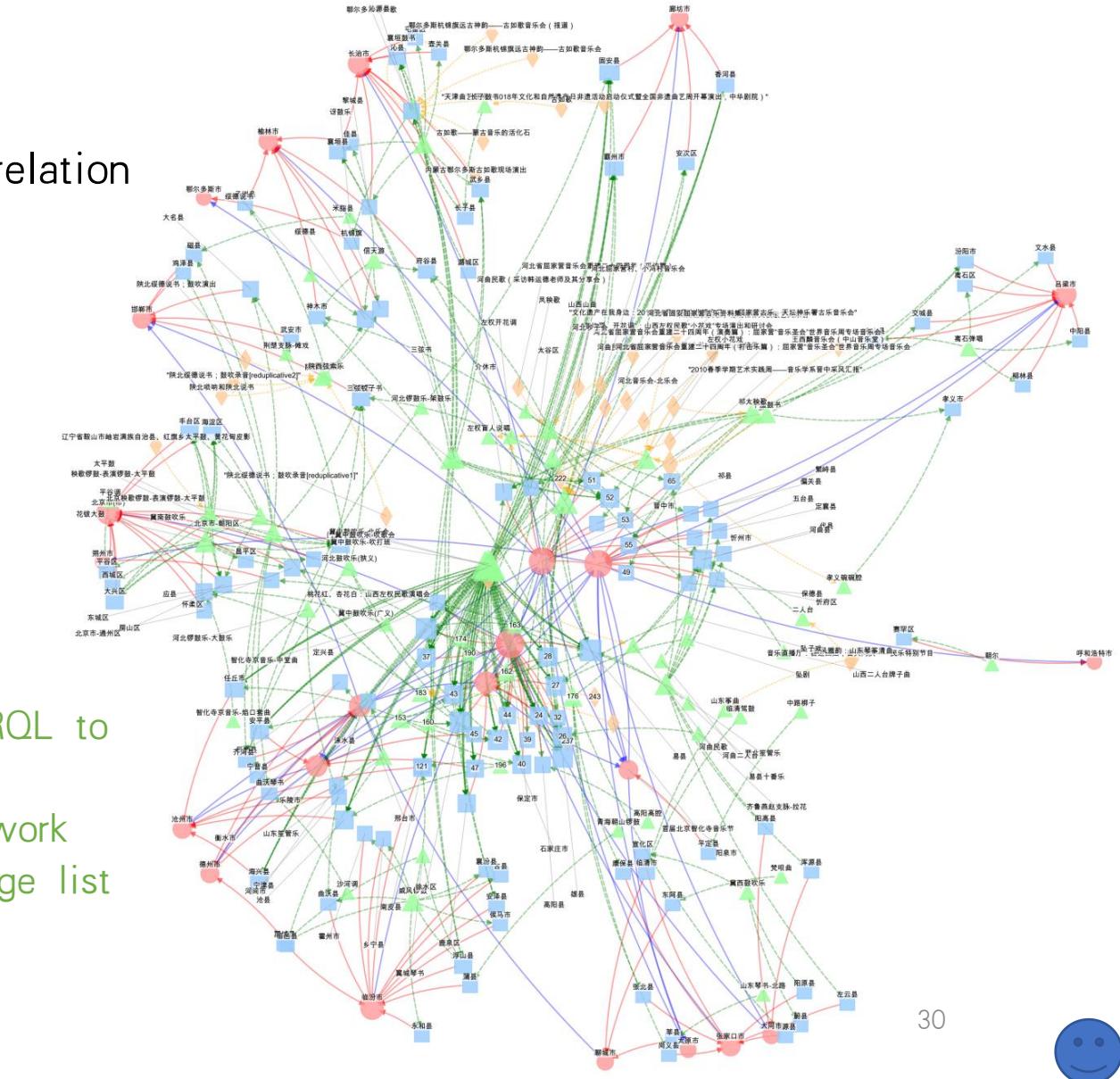
- 1. retrieval based on geographical neighbouring relation

What musical genres exist in other cities within a 2-step range adjacent to Shijiazhuang City, Hebei Province, and their subordinate administrative units at all levels? Regarding these musical genres, does our library/museum have any special collections or resources?

图例 (Legend)



We can use SPARQL to obtain heterogeneous network data (in typed edge list format)



Digital Humanities Application: geographical music research

- 2. retrieval based on geographical coordinates

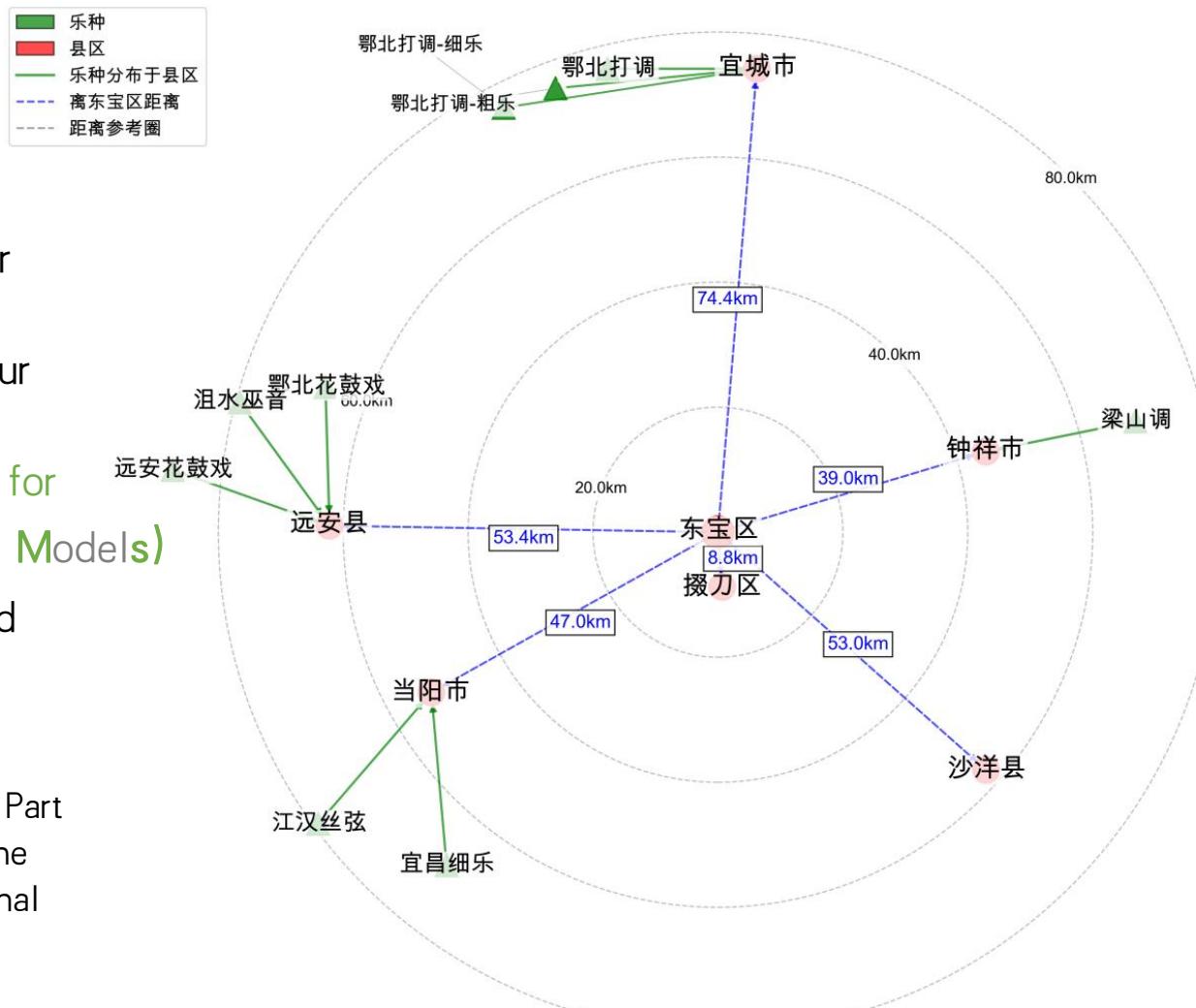
- What music genres exist within a 75-kilometer radius of Jingmen City (Dongbao District), Hubei Province, and among these, which ones are in our library's collection?

—SPARQL results → LLMs → python scripts for visualization:
(short for Large Language Models)

- The distances and positions precisely correspond to the real map.

- Answer :

There are 3 items related: 'Hubei Xianghe Daozhuizi Series Part One: Hubei "Xianghe Daozhuizi" Performance', 'Hubei Xianghe Daozhuizi Series Part Two: "Xianghe Daozhuizi" as a Regional School and Its Formation (Yao Yijun)', and 'Hubei Xianghe Daozhuizi Series Part Three: "Xianghe Daozhuizi" Lecture'.



up to now

Question: Should music librarians master SPARQL before conducting complicated retrieval?

--Not Necessarily!

prevalence · LLMs to convert users'

Natural Language Question (NLQ) to
SPARQL with "prompt engineering"

· Context: ontology snippet (serving
as the schema) that

reflects the structure of the NLQ

brings up · Issue: How to find a corresponding
ontology snippet for varied questions?

If we provide the whole, LLMs may
not concentrate...

straightforward line of thought

The screenshot shows the official website of the China Conservatory of Music library. At the top, there is a navigation bar with links to 'Music type', 'Instrument Library', 'Special Collection', 'Independent Resources_ Works', 'Metadata Ontology', 'Knowledge Graph', 'AI Assistant', and 'about Us'. The main content area features a large green banner with the text 'intelligent Question' and '智能问答助手' (Intelligent Question Answering Assistant). Below the banner is a search input field with the placeholder '请输入您的问题:' (Please enter your question:) containing the query '我馆有什么特藏资源涉及甘美兰音乐, 该资源涉及的地域在哪?'. Underneath the input field are two configuration boxes: 'Entity Count' (Entity Count, according to entity quantity, range 10~50, default 25) set to 25, and 'Max Retries' (Max Retries, report error reattempt times, up to 3 times, default 3) set to 3. A large blue button labeled '开始问答' (Start Asking) is positioned below these fields. Below the button, there is a section titled '示例问题' (Example Question) with the heading 'questions for instance'. It lists five example questions with expandable arrows:

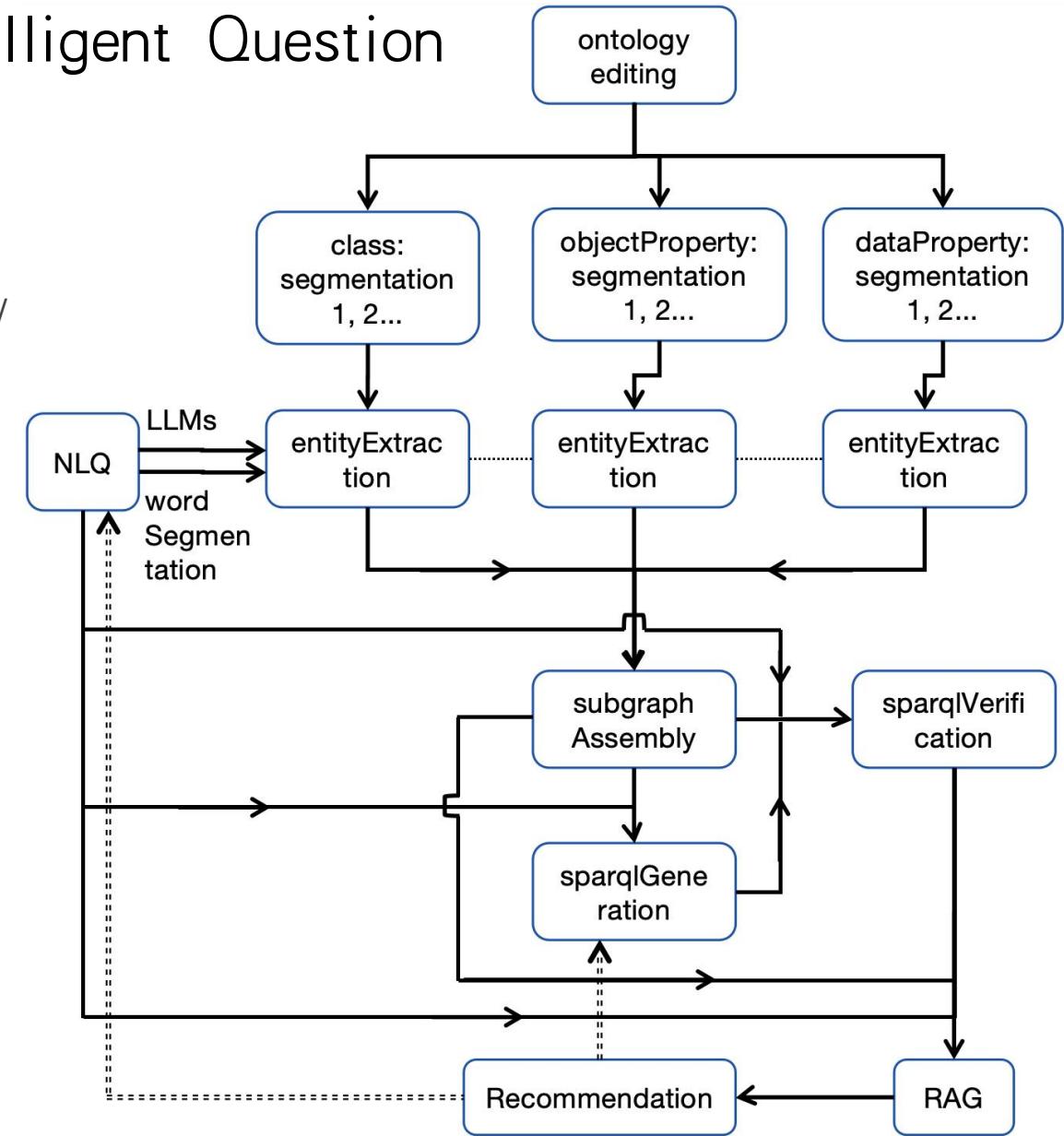
- 沮水巫音的主要乐器有哪些?
- 有没有涉及泉州北管这个乐种的曲目?
- 我馆有什么特藏资源涉及甘美兰音乐, 该资源涉及的地域在哪?
- 云南省有哪些音乐类型(乐种), 这些乐种可能用到什么乐器, 这些乐器又可能涉及哪些族群(这些族群又可能属于哪些语族)?
- 我想看看乐器中, 哪些是涉及新疆维吾尔自治区(地域)或中国的大西北地区的, 尤其是它的弹拨乐器(也可以考虑从霍萨分类法的角度来考察)。再如, 这些乐器可能用在我们的哪些特藏资源或者演出的曲目中?

Digital Humanities Application: Intelligent Question—answering System

- my paper: *ESEA (East-and-Southeast-Asian) Traditional Music and Its Ontology-Subgraph-Driven NLQ2SPARQL Intelligent Question-Answering System Research* (to be published on *Cataloging and Classification Quarterly*)

- **Workflow:**

- 1. Specific Ontology Editing
- —Protege
- (1) Clarification and Enrichment of ...
- (2) Semantic reinforcement. Eg: inverse
 - use ontology to replace shapes
- (3) Simplification



Intelligent Question—answering System Workflow

- 2. Ontology Segmentation: into 3 parts
- 3. Entity Extraction from the Ontology Segments

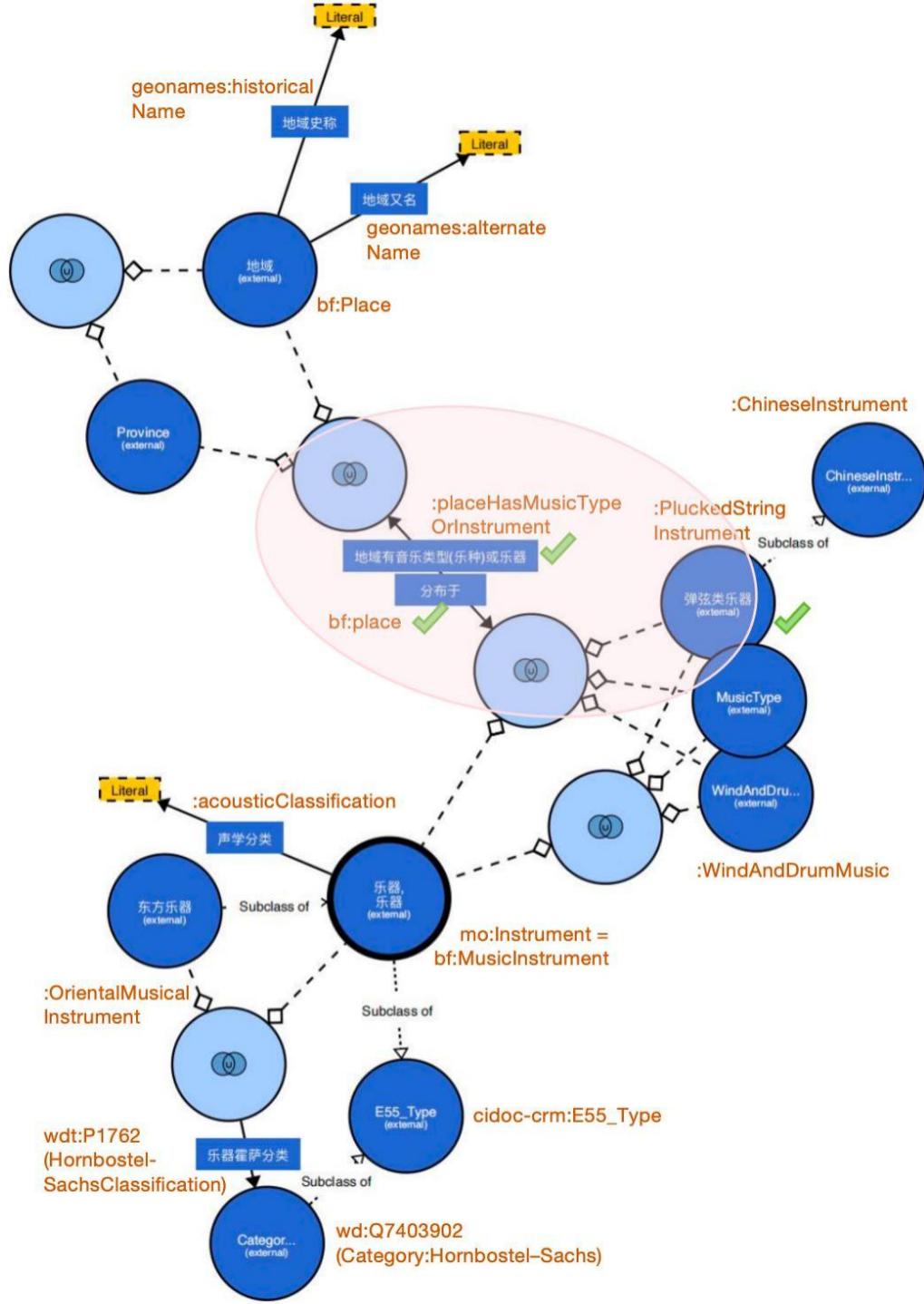
LLMs are prompted to extract (isolated) entities from an NLQ by mapping them with all segments of the ontology. Hereby, the “entities” also include class, property, or instance.

---key point! It decides whether this approach is robust enough

- 4. (Ontology) Subgraph Re—Assembly
 - Ontology is also a special graph! The nodes represent classes,
 - Ambiguity of NLQ—>extract more entities than actually need—>basis for recommendation

intelligent Question–answering System Workflow

- mainbody
- 5. SPARQL Generation and Verification Based on Subgraph
 - (1) claude 4 (2) reflection: ontology for validation instead of shapes
 - 6. Retrieval Augmented Generation(RAG)
 - Illustration on the retrieval result...
→ A combination of LLMs' general knowledge and Knowledge Graph's domain-specific knowledge
 - 2 scenarios of the results:
 - (1) If the result is too large or complicated (2) If the result is too small or even empty:
broaden the retrieval scope by relaxing query conditions/constraints in the SPARQL query, and other possible query patterns can be recommended
 - 7. Recommendation System: based on the neighborhood in the ontology subgraph



The Ontology Subgraph with Its Neighbourhood for the NLQ:

/'dɒbrəʊ/

- Where is the "dongbula" (dobro/dombra, 东不拉) distributed, and what other plucked string instruments are distributed in the same regions/places? → Light Red Area
- define input: inference 'urn:owl:ccmusicrules0214'
 - PREFIX bf: <http://id.loc.gov/ontologies/bibframe/>
 - PREFIX ctm: <https://lib.ccmusic.edu.cn/ontologies/chinese_traditional_music#>
 - PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

```
SELECT ?place ?placeLabel ?otherInstrument ?otherInstrumentLabel WHERE { ?dongbula rdfs:label "东不拉" ; a ctm:PluckedStringInstrument .
```

```
?dongbula bf:place ?place . ?place rdfs:label ?placeLabel ; ctm:placeHasMusicTypeOrInstrument ?otherInstrument . ?otherInstrument a ctm:PluckedStringInstrument ; rdfs:label ?otherInstrumentLabel .
```

```
FILTER(?otherInstrument != ?dongbula) }
```

intelligent question—answering system workflow

- The recommended pairs of NLQ & SPARQLs are based on the neighbourhood of the subgraph
inversely
 - ontology neighbourhood + other SPARQL => other NLQs (e.g.):
 - (1) What acoustic classification does the Dobro belong to, and what other instruments are in the same acoustic classification?
 - (2) In the regions where Dongbula is distributed, besides plucked string instruments, what other types of instruments are there?
 - (3) What music types or genres are found in the regions where Dongbula is distributed?
 - knowledge reasoning
 - knowledge Question—Answering
 - knowledge recommendation
- 
- => a robust system with nearly 100% recall rate and 80% precision

Fu Xiaodong

Fu Xiaodong, PhD in Music Acoustics, Professor, Doctoral Supervisor, Visiting Scholar at the Music Technology Center of Georgia Institute of Technology (2014-2015), Beijing Great Wall Scholar (2017). He is currently the Director of the Academic Affairs Office and the Director of the Library of the China Conservatory of Music. He is also a member of the Chinese Musicians Association, a director of the Chinese Electronic Music Society, the Deputy Director of the Musical Instrument Technology Professional Committee of the China Performing Arts Equipment Technology Association, a member of the Performance Venue Equipment Professional Committee, a member of the Music and Sound Professional Committee of the China Higher Education Film and Television Society, and a member of the Art and Reading Professional Group of the Tenth Council of the Chinese Library Association. His main research direction is music acoustics and music technology. He has published more than 40 papers and three monographs, and has presided over more than ten projects of the National Social Science Fund, the Ministry of Culture and Beijing Municipality.

Cao Junjun

Si Shaojun (Cao Junjun), PhD in Music Communication and Information Intelligence, Postdoctoral Fellow at the Chinese Music Research Institute of China Conservatory of Music and the Department of Music Technology of Schulich School of Music of McGill University, Part-time Researcher at China Music Research Base, Visiting Scholar at Cultural Heritage Intelligent Computing Laboratory of Wuhan University. Chief Expert of LinkedMusic Project of McGill Distributed Digital Music Archive Laboratory (2024-2025), Member of International Music Library Association, Member of Chinese Traditional Music Society, etc. His main research directions are music knowledge base and knowledge graph, etc. He has been the editor-in-chief of the "China Book and Audiovisual Publishing Industry Development Report" issued by the Industrial Development Research Center of Communication University of China for many years. He has published more than 30 papers, published several music works, participated in 1 major project, and presided over 4 provincial and ministerial projects.

Chen Tao

Chen Tao, PhD in Engineering, is a talent introduced by Sun Yat-sen University's "Hundred Talents Program". He is an associate professor and a master's supervisor. He is a postdoctoral fellow jointly trained by Shanghai Library (Shanghai Institute of Scientific and Technical Information) and School of Information Management of Nanjing University. He has served as the project manager of the Shanghai Library System Network Center and an engineer at the Shanghai Life Science Information Center of the Chinese Academy of Sciences. He is also a member of the China Open Data Forest Index Evaluation Expert Committee of Fudan University, a member of the Digital Humanities Professional Committee of the Chinese Society for the History of Science and Technology, a member of the Digital Humanities Professional Committee of the Chinese Indexing Society, and a reviewer for many journals. He has long been engaged in research on emerging technologies such as semantic web, linked data, machine learning, and knowledge graphs in digital humanities and big data. He has rich theoretical and practical experience and has been responsible for more than ten horizontal projects related to linked data and digital humanities. In recent years, he has published dozens of papers in core journals such as Journal of Library Science in China, Journal of University Libraries, and Library and Information Work.

The project has received strong support from the Technical Department of the Library of the China Conservatory of Music and teachers and students of the Digital Humanities Workshop; it has also received attention and professional support from a series of experts and scholars in the field of traditional music in China. The works of some experts and scholars are important sources of metadata cataloging information for this project: such as Du Yaxiong (Overview of Folk Music of Ethnic Minorities in China), Wang Yaohua (Introduction to Traditional Chinese Music, 2020 edition), Ying Youqin (Dictionary of Chinese Musical Instruments), Yuan Jingfang (Introduction to Chinese Musical Species, 2021 edition), Lu Yingkun, Zhao Xiaonan, Wu Xiaoping, Jing Entao, Huang Siqi, Wan Xiaodong, etc. The project database construction has received foreign support from Professor Wang Xiaoguang, Director of the Cultural Heritage Intelligent Computing Laboratory of Wuhan University, Professor Ichiro Fujinaga of the Schulich School of Music of McGill University, Professor Jia Junzhi of the School of Information Resources and Resource Management of Renmin University of China, Professor Ou Shiyuan of the School of Information Management of Nanjing University, and Mr. Zhu Houquan, General Manager of Beijing Yuanyin Technology Co., Ltd. Special thanks!

questions and interaction

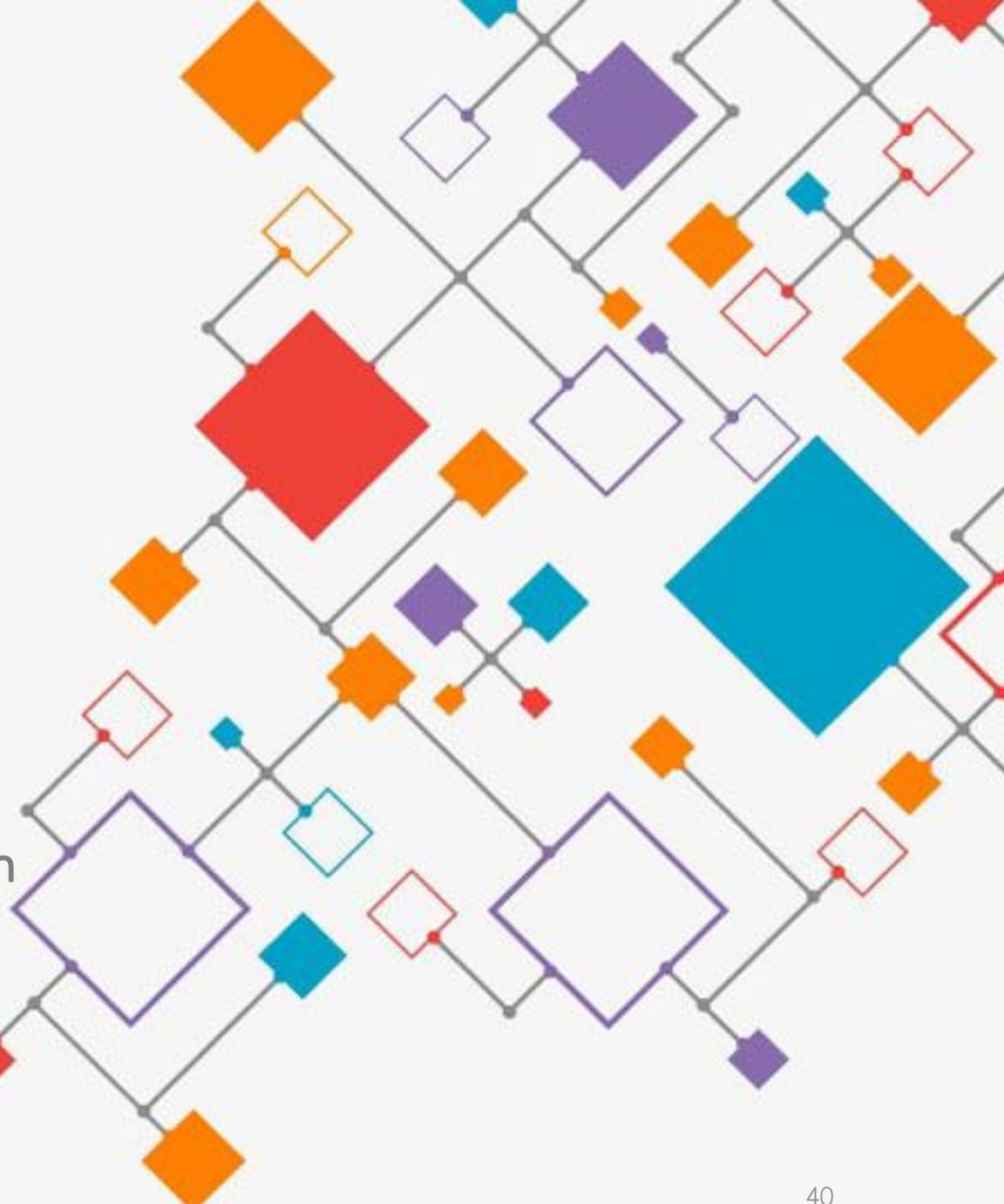
- I would greatly appreciate it if you could talk slowly and clearly with me.
- For the consecutive information about linked data/semantic web technologies application in music database, please refer to the session of Wednesday (tomorrow):
- Session: [Databases for Music Libraries and Archives](#)
- Our Paper Title: [LinkedMusic Project: Integrating Online Music Databases](#)
- <https://linkedmusic.ca/>



Conseil de recherches en
sciences humaines du Canada

Social Sciences and Humanities
Research Council of Canada





Thanks for your criticism
& suggestion!

Email :

alienmusedh@gmail.com

Junjun Cao

-- June

This is supported in part by funding from
the Social Sciences and Humanities Research
Council (SSHRC) in Canada



Conseil de recherches en
sciences humaines du Canada

Social Sciences and Humanities
Research Council of Canada

Canada

Potential Questions

- 1. Your abstract references a comparative analysis between Symbolic AI embodied in knowledge graphs and Connectionist AI. Could you elaborate on how the two **paradigms** were implemented or represented in your research framework?
- 2. Given your observation that Connectionist AI (notably large language models) currently dominates music technology, what strategic recommendations would you propose for balancing this trend with symbolic knowledge systems in the development of music digital humanities or library infrastructures?

Q: Your abstract references a comparative analysis between Symbolic AI embodied in knowledge graphs and Connectionist AI. Could you elaborate on how the two paradigms were implemented or represented in your research framework?

- **R:** Symbolic AI is actually less of what AI appears nowadays such as ChatGPT, deepseek—the intelligent large language models. It's based on structure and symbols, logic and reasoning. Knowledge graph, especially one with embedded ontology is already on the way of Symbolic AI. Ontology-based knowledge reasoning is very typical of Symbolic AI.
- On the other hand, LLMs are a representative of Connectionist AI. We use LLMs to extract entities with context of ontology, to even verify ontology, and to perform NLQ2SPARQL, which are typical **synergy** of Symbolic AI and Connectionist AI.
- What is worth mentioning is, the building of the robust question—answering (Q—A) system workflow, incorporating knowledge's reasoning, Q—A, recommendation and Retrieval Augmented Generation (RAG) is a close combination of the 2 branched of AI.

Q: Given your observation that Connectionist AI (notably large language models) currently dominates music technology, what strategic recommendations would you propose for balancing this trend with symbolic knowledge systems in the development of music digital humanities or library infrastructures?

- **R:** A good time to revitalize symbolic AI with the assistance of LLMs. We can handle that, because it requires low threshold, and echos the spirit of DH.
- symbolic AI → white box. It can serve the formalized and specialized representation of musicology knowledge, which lays the foundation of a flexible AI Q—A system.
- Focus on knowledge graph!
 - Is knowledge graph to be obsolete in the future?  quite adaptabe in the library's ecosystem
 - philosophical proposition: **structured info** vs. non-structured info
 - philosophical proposition: Human are born to respect or like knowledge in a both **structured** and **intuitive** way.
- To avoid clash with **Music AI**, we can advocate **Music DH** where humanitarians will play a decisive and vital role: one body and two wings