CHALMERS

A natural language interface for a music database

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Introduction

What is the problem?

- We have:
  - Big sets of data becoming available
  - Communities forming to tag and classify
- But:
  - Access systems still rely on listing and browsing
  - Users feel information is buried under layers

MusicBrainz

- ~500.000 artists, ~800.000 albums, 10.000.000 tracks
- Extensive network of relations between entities
- Common users only get browse/listing access

Found 75 results for "rolling stones"

Score	Name	Sort Name	Type	Begin	End
100	The Rolling Stones	Rolling Stones, The	Group	1962	
75	Muddy Waters & The Rolling Stones	Muddy Waters & Rolling Stones, The	unknown		
75	Andy Anderson & The Rolling Stones	Anderson, Andy & Rolling Stones, The	Group		
75	AC/DC & The Rolling Stones	AC/DC & Rolling Stones, The	unknown		
61	Vitamin String Quartet	Vitamin String Quartet	Group	1999	
11	Stones	Stones	unknown		
8	Rolling Stock	Rolling Stock	unknown		
8	Hills Rolling	Hills Rolling	Group		
8	Rolling Home	Rolling Home	Group		
8	Rolling Contact	Rolling Contact	Group		
8	Rolling Corpse	Rolling Corpse	Group	2007	
8	Rolling Thunder	Rolling Thunder	Group		
8	Rolling Rabbit	Rolling Rabbit	Person		
8	Rolling Band	Rolling Band	Group		
8	Rolling Chunder	Rolling Chunder	unknown		
8	K. Rolling	K. Rolling	unknown		
7	Stone's Throw	Stone's Throw	unknown		
7	12 Stones	12 Stones	Group	2000	

The Rolling Stones

~ Group

Overview | Releases | Recordings | Works | Relationships | Aliases | Tags | Details | Edit

Annotation

- *Jamming With Edward!* is listed under *Nicky Hopkins, Ry Cooder, Mick Jagger, Bill Wyman & Charlie Watts*.

Annotation last modified on 2009-11-14 15:15 UTC.

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Album

Year	Title	Rating	Releases
1964	The Rolling Stones	★★★★☆	10
1964	12 x 5	☆☆☆☆☆	4
1965	The Rolling Stones No. 2	☆☆☆☆☆	1
1965	The Rolling Stones, Now!	☆☆☆☆☆	5
1965	Out of Our Heads	★★★★★	8
1965	December's Children (And Everybody's)	☆☆☆☆☆	4
1966	Aftermath	★★★★½	10
1967	Between the Buttons	☆☆☆☆☆	8
1967	Their Satanic Majesties Request	☆☆☆☆☆	6
1968	Beggars Banquet	★★★★½	10
1969	Let It Bleed	★★★★½	8
1971	Sticky Fingers	★★★★★	11
1972	Exile on Main St.	★★★★★	15
1973	Goats Head Soup	★★★☆☆	4

The solution

- Interface in front of the developer backdoor
- “Search engine” look
- Gets and returns natural language
- Multilingual

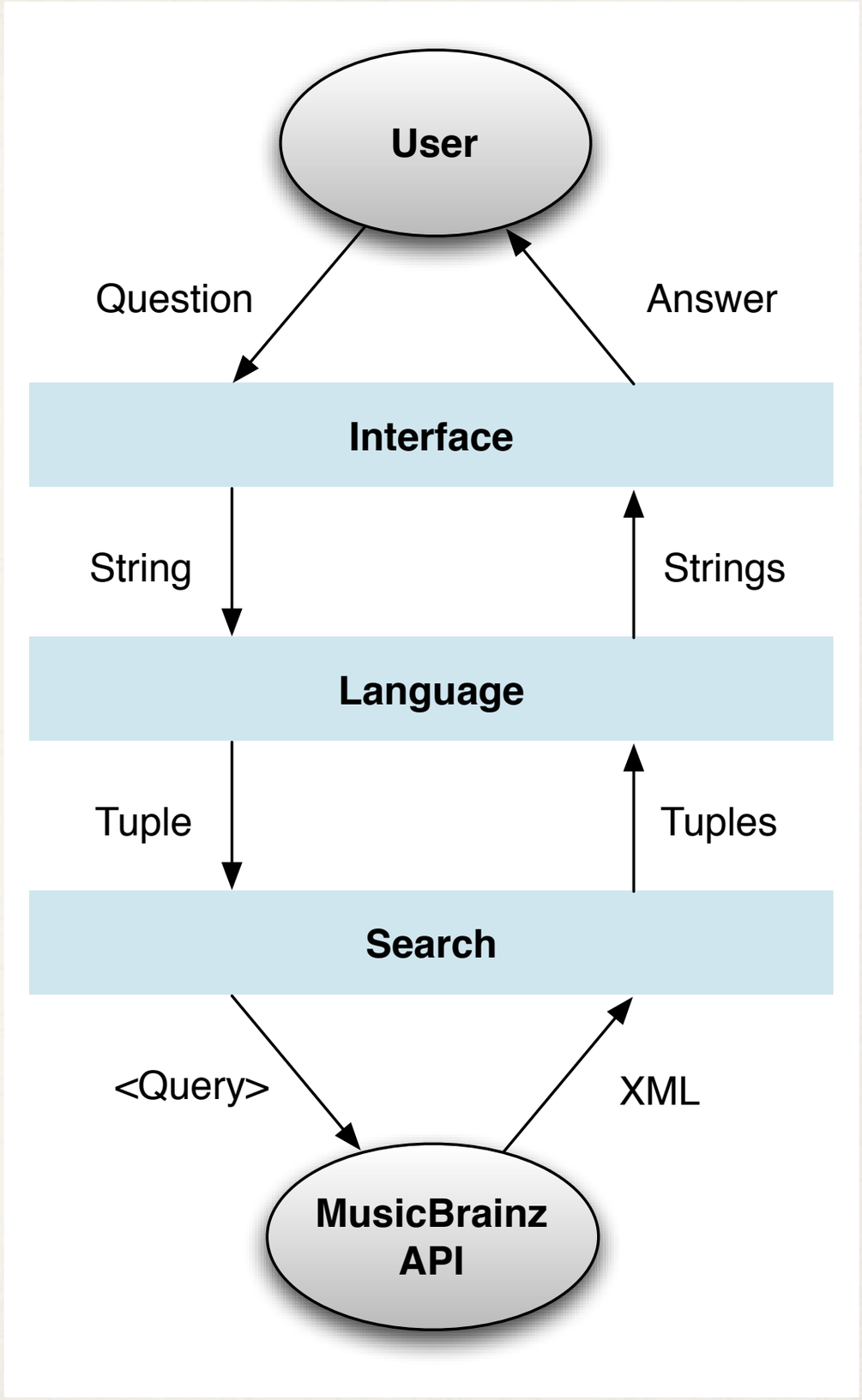
Overview

The database

- Artists, Releases, Tracks, Labels
- Downloadable dumps
- Web service following REST
  - HTTP requests: Lookup / Search
  - XML replies

The application

- Haskell, with web interface
- Modular
  - Interface (user access)
  - Language (semantics)
  - Search (data fetching)



Architecture

Galego | English | Castellano

As meigas son mulleres místicas que gustan da natureza, da menciña... e da **música**. De feito disque na saia das meigas hai un lagarto pintado, e cando as meigas bailan, o lagarto move o rabo ;)

A través desta páxina podes facerlles chegar as túas preguntas sobre **música**, e elas remexerán no seu caldeiro e contactarán os espritos dos devanceiros para responderche. Lembra que podes empregar calisquera dos tres idiomas soportados que queiras, independentemente daquel no que esteas a ve-las suxerencias neses intres!

Estas son algúns exemplos de preguntas en galego:

- En que ano se lanzou "Estou na lavadora"?
- En que ano sacou "Luar na Lubre" o seu tema "O son do ar"?
- Cando saiu o primeiro disco dos Resentidos?
- En que ano naceu "Amancio Prada"?
- Cando morreu "Andrés do Barro"?
- Cando se formou Milladoiro?
- Cando se separaron Heredeiros?
- En que ano se uniu "Xurxo Souto" aos Diplomáticos?
- En que ano marchou "Xurxo Souto" dos Diplomáticos?

... ?

Screenshot

Available at http://diz.es/tese/

Interface

- Carries data unmodified
- Asynchronous communication
- Logging of interaction

Language

- Question:
  - Detect language, generate syntax tree
  - “Understand” semantics, send to appropriate path
- Answer
  - Build syntax tree
  - Linearize to text
- Fixing strings before parsing and after linearizing

Search

- Fetches relevant XML
- Strips superfluous information
- Filters, returns

Individual cases

- Lots of possible questions
  - *when was X released?*
- Group in functions :
  - `findReleaseDate (String token, String type)`
  - type: Album, Single, Track... or unknown
  - Big pattern matching with lots of branches

Release date of a single

```
a_treleasebySingle =
  (fetchSingleByTitleArtist
    >>> ((getMyTitle &&& getArtistName) &&& getEventDate)
  ) >>. s_treleasebySingle
```

```
a_treleasebyBandSingle =
  (second
      (fetchArtistByName >>> isTypeGroup
        >>> filterArtist >>> getMyId)
    >>> fetchSingleByTitleArtistId
    >>> ((getMyTitle &&& getArtistName) &&& getEventDate)
  ) >>. s_treleasebySingle
```

Grammars

The Grammatical Framework

- Sentence ⇔ Tree
- One abstract tree, many concrete trees
- Same tree for same idea in different languages
- English, Spanish, Galician

How GF works

- Categories and functions to form phrases:
  - `TARelease: Author -> Work -> Date -> Answer;`

- Operations to declense words:

```
oper copula : Number -> Str = \n ->
       case n of {
          Sg => "is" ;
          Pl => "are"
          } ;
```

Operations for clauses

- New approach that focuses on concepts
- Phrases are formed by operations that return tables
  - By prepending articles and prepositions as needed
- Number of categories is kept to a minimum:
  - No articles, prepositions, noun phrases, etc...
  - *Author, Work, Date*

Adding an article to a noun

```
oper artflex : Str -> (Article => Str) = \x ->
  table {
    AThe => "the" ++ x;
    ANone => x
  } ;
```

```
ANamedUnit u t = { s = artflex (u.s ++ t.s) ;
                   n = u.n } ;
```

```
TBorn t a = let time = t.s in
            let as = variants { a.s ! AThe ;
                                a.s ! ANone }
            in { s = time ++ "was"
                   ++ as ++ "born"; };
```

The English grammar

- Simple morphology
- Little gender and number variation
- Possessives can be accepted in user input...
  - ...but not produced: agreement in gender with owner
  - Usually a token, so gender is unknown
  - `Björk released her first single Human Behaviour in 1993-06-07`

The Spanish grammar

- Possesives only depend upon the number of the object
- Every noun is gendered; agreement inside every clause
- Categories have Number, Gender
- Contractions for some combination of preposition and article

Flexing with contractions (ES)

```
oper stdflex : Str -> (Genero*Numero) =>
    ((Preposicion*Determinante) => Str) = \s ->

  table {

<GMasc,NSg> => table {
     <PAa,DEl> => "al" ++ s ;
     <PDe,DEl> => "del" ++ s ;
     <p,d> => pf ! p ++ df ! <GMasc,NSg> ! d ++ s
   } ;

<g,n> => table {
     <p,d> => pf ! p ++ df ! <g,n> ! d ++ s
   }
} ;
```

The Galician grammar

- Categories with Gender and Number
- All preposition and article combinations are contractions
- Possessives require determiners in front of them

```
<XFem,NPl> => table {
    <PAa,DOo> => "ás" ++ s ;
    <PAa,DPos> => "ás súas" ++ s ;
    <PEn,DOo> => "nas" ++ s ;
    <PEn,DPos> => "nas súas" ++ s ;
    <PDe,DOo> => "das" ++ s ;
    <PDe,DPos> => "das súas" ++ s;
    ...
  }
```

Lessons learned

About user interaction

- Text is skimmed, rely on heavy imagery
- Error messages are never clear enough
- Offer spellchecking
- Offer syntax help when parsing fails

About the architecture

- Heavy use of types:
- Overloading
- Encapsulating data
- Error handling, etc.

About the grammars

- New approach lacked flexibility
  - Too much repetition
  - Code was messy to understand, follow, debug
- Normal syntax categories
  - Stripped in the application

About the database

- One-second delay
  - Restrained accuracy in answers
  - Some replies painfully slow
- Avoid web service, install on mirror server
  - Power of SQL

Questions now. Thank you!