

ACMUS-MIR: A new annotated data set of Andean Colombian music

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ABSTRACT

The music from the Andean region of Colombia has many particularities in terms of tempo, meter complexity and sesquialteras, tuning systems, scales, timbre, and texture. These particularities make its analysis with state-of-the-art music information retrieval (MIR) methods both interesting and challenging. To support future research efforts in the context of Andean Colombian music, a new public data set was compiled and annotated by expert musicologists in Colombia. Our collection comprises three subsets: (1) The *rhythm set* with tempo and meter annotations, (2) the *instrumental format set* including number and types of instruments for each recording, and (3) the *scale set* reporting the musical scale of each audio segment. The data set was conceived with the goal of supporting the development of MIR techniques better suited for extraction of semantic information in Andean Colombian music. We hope that our data set will also encourage a wide range of studies in the fields of musicology, ethnomusicology, and music information retrieval.

KEYWORDS

Digital music archives, Andean Colombian music, music information retrieval, computational ethnomusicology.

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1 INTRODUCTION

This work is a multidisciplinary endeavour that aims to support computational ethnomusicology research in the context of traditional Colombian music. Besides bringing awareness of the research conducted in the context of traditional Colombian music, this work

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aims to develop suitable computational tools to support and enhance current studies on the various musical aspects of Colombian music, in particular that of the Andes region. In this sense, elements from disciplines including musicology, engineering, music information retrieval, and machine learning are evident in the entirety of this work. Similar to [6, 13], our work touches on aspects of digital archive management; following similar work on other music traditions [2, 15, 16], we deal with the development of culture-specific music information retrieval methods [10], and build upon state-of-the-art information retrieval and machine learning methods applied to music [8, 11].

In this paper, we first present a general overview of the music from the Colombian Andes, focusing on the three main elements covered in the ACMUS-MIR data set: rhythm, instrumental format, and scales. Section 3 describes the ACMUS research project and its aims, and section 4 presents a detailed description of the ACMUS-MIR data set.

2 ANDEAN COLOMBIAN MUSIC

The Colombian Andes is one of the five major geographical and cultural regions in which the country was divided in an attempt to understand its physiographic and sociocultural diversity.¹ Although the acceptance of this division has become widespread, the diversity that the region encloses in itself is undeniable, with exercises of greater rigor resulting in further subdivisions: Andes central east, Andes southwest, and Andes northwest, each region having specific musical typologies frequently used in peasant contexts.

However, what is generally known as Colombian Andean music responds to a category built in part from an imaginary idea of nation that imposed certain symbols at the expense of the obliteration of others [9]. This idea of nation favored a cultural approach generated from the centers of economic power, and imposed their cultural aesthetic values on the periphery or sub-regions, not only of the Colombian Andes but of the rest of the country. These impositions were additionally supported by the mass media and the recording industry [7]. This notion of Colombian Andean music comprises an instrumental ensemble of plucked strings (tiple, bandola, guitar), and occasionally small percussion. This format has become widespread throughout the region, mainly being used to perform *pasillos*, *bambucos*, *guabinas*, and dances. These music genres and

¹Amazon, Orinoquía, Pacific Coast, and Atlantic Coast are the other four major regions [3].

their repertoires coexist between the traditional-popular and academic worlds,² with clear tendencies towards the chamber music paradigm.³ Additionally, all these genres acquire stylistic nuances in each of the sub-regions mentioned.

To further elucidate some of the main characteristics of Andean music, its main rhythmic characteristics, instrumental formats, and scales are described in the following sections.

2.1 Rhythm characteristics

The rhythms (genres) performed in Colombian Andean music correspond first⁴ to derivations of the European Hispanic ternary colonial songbook [1],⁵ whose genre with the greatest impact in America has been the waltz, but also includes other salon genres and peasant dances. Besides the waltzes themselves, this group also includes pasillos and guabinas, among others.⁶



Figure 1: Rhythm patterns

The second group includes the bambuco, considered one of the "national rhythms", which presents typical characteristics of ancient Iberian Hispanic [4, 5] and Colombian peasant dances, typified as sesquialteras [14], whose main characteristics is the bi-metric behavior (3/4-6/8) within the melodic line or between the melody line and the rhythmic-harmonic accompaniment. This is illustrated in the basic patterns of rhythmic accompaniment in Figure 1.

The third large group includes the genre called danza, which comes from the habaneras connected to the European Hispanic contradanzas. The main rhythmic characteristic of Colombian danza is its simple binary metric, the occasional "stressing" of the first pulse and an accompanying rhythmic pattern as illustrated in Figure 1.

2.2 Musical Instruments and formats

Tiples, bandolas, and guitars are arranged in different instrumental and mixed formats (vocal-instrumental). The most common formats include:

- Duets
 - 2 tiples
 - 2 guitars
 - 1 tiple, 1 bandola
- Trios:
 - 1 tiple requinto, 1 tiple, 1 guitar

²This situation can be explained by the way music is learned and circulated, increasingly in formal learning spaces with processes mediated by musical literacy.

³Within the diversity hidden behind this generalization are the bands of carrizo flutes and drums, typical of the northwestern and southwestern Andean region; as well as the groups of quenás, pan flutes, charangos and bombos, i.e. kick drums, from southwestern Colombia, today quite widespread in urban contexts of the entire Andean region.

⁴The order obeys only the criterion of enunciation.

⁵The category of songbook was proposed by Carlos Vega in 1944 in his *Panorama of Popular Music in Argentina*, and later revised by Isabel Aretz and Luis Felipe Ramón y Rivera [1].

⁶Other rhythms include mazurcas, redovas, torbellinos, gallinazos, vueltas.

- 1 bandola, 1 tiple, 1 guitar

- Quartet: 2 bandolas, 1 tiple, 1 guitar

- Quintet: 3 bandolas, 1 tiple, 1 guitar

- Larger ensembles: estudiantinas and orchestras that expand the number of each of the instruments

In addition, in recent decades, any of these conformations is usually supplemented with the electric bass.

The roles that the instruments play within these sets have seen an important transformation in the last decades. They have gone from traditional compositions of melodic instruments (bandola and tiple requinto) and accompanying instruments with a rhythmic-harmonic function (tiple and guitar), to instruments and chamber sets where each instrument plays a leading role. Every instrument can play the main melody, melodic or rhythmic-harmonic accompaniment and even bass lines. In that sense, textures have gone from being commonly homophonic, to becoming increasingly polyphonic.

2.3 Scales

The repertoires within the generalized format of the plucked strings follow the guidelines of common practice, and are essentially tonal (major-minor), modulating and eventually chromatic.⁷ Some drifts worth mentioning are those represented by composers whose influences manifest themselves, either in different schools of jazz or Bossa nova, in 20th century academic music or in other popular music of the world. In addition to the traditional accompanied melody (homophony), the use of contrapuntal textures, novel syncopated figures, chromatic harmonies, the use of modal mixes, chords built by thirds, new scales, and linking techniques, among other innovations appear intentionally and more frequently [12]. In addition, traditional string music is influenced by languages from the classicism, romanticism, impressionism, and 20th-century currents, and the styles are mixed by combining nationalism with jazz, rock, and other popular music [12].

3 THE ACMUS PROJECT

The ACMUS-MIR data set has been compiled in the context of the ACMus research project: *Advancing Computational Musicology. Semi-supervised and unsupervised segmentation and annotation of musical collections*.⁸ The ACMus project is a collaboration between Fraunhofer IDMT (Germany), the Technische Universität Ilmenau (Germany), the Universidad de Antioquia (Colombia), and the Universidad Pontificia Bolivariana (Colombia).

The ACMus project was motivated by the relatively scarce availability of computational tools suitable for extracting semantic information from digital music archives of traditional Colombian music. Our project uses the music collection in the *Músicas Regionales* archive at the Universidad de Antioquia in Medellín, Colombia as its main source of music data (see Sec 3.1 for more information about the archive). In practice, annotated data of traditional Colombian music is extremely scarce. Efforts to produce high-quality annotations require domain expertise, are time-consuming, and costly. With this in mind, our project focuses on developing MIR

⁷Some peasant and indigenous genres, particularly those of Caucañ flute bands, have modal repertoires, and even un-tempered tuning systems [14].

⁸<https://acmus-mir.github.io/>

methods that minimally rely on the availability of large amounts of annotated data, and hence, its focus on semi-supervised and unsupervised methods for information retrieval. As a starting point, three main MIR tasks will be addressed. First, we will develop methods for automatic recognition of simple and compound meters. The *rhythm set* in the ACMUS-MIR data set was compiled for this purpose. Second, we will develop algorithms for automatic recognition of instrumental format. The *instrumental format set* in the ACMUS-MIR data set was compiled for this task. Finally, we will develop algorithms for the automatic recognition of musical scale. The *music scale set* in the ACMUS-MIR data set was compiled for this task. A detailed description of the ACMUS-MIR data set is provided in Sec. 4.

3.1 The Músicas Regionales Archive

Músicas Regionales is a music research and documentation unit holding a significant number of collections acquired through various research processes on traditional and popular music from Colombia, and through the purchase, donation, and exchange of specialized volumes. Many of these materials capture much of the musical memory that composers, performers, and bands have built throughout their lives: 2,000 books, 7,000 scores, 6,000 sound volumes (reel tapes, cassettes, acetates, discs), 5,000 photographs, and an archive of more than 2,000 documents (musicological analyses, song lyrics, posters, press, hand programs) converge in a repository that is now heritage and memory of traditional and popular Colombian music. The archive is hosted by the Universidad de Antioquia in Medellin-Colombia.

4 THE ACMUS-MIR DATA SET

The ACMUS-MIR data set is a selection of music taken from the Músicas Regionales Archive in Medellin, Colombia. The data set currently contains a total of 337 segments of annotated music.

The data set was compiled to support the development of computational methods for three main tasks: 1) Recognition of simple and compound meters, 2) instrumental format recognition, and 3) scale detection. For this reason, the ACMUS-MIR data set currently comprises three independent sets (one for each task): the rhythm set, the instrumental format set, and the scale set. Following this structure, the ACMUS-MIR data set is saved as follows:

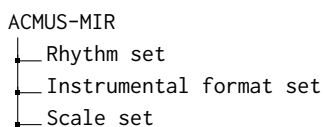


Figure 2 shows the distribution of files in the three sets of the ACMUS-MIR data set.

Annotations and Conventions: All the tracks in the data set contain the following *General Annotations*:

- File Name: Name of the corresponding audio file.
- Title: Title of the tune where the segment was extracted from.
- Genre: Bambuco, pasillo, danza, march, guabina, intermezzo, joropo, waltz, huayno, chacarera, torbellino, pasaje, bolero,

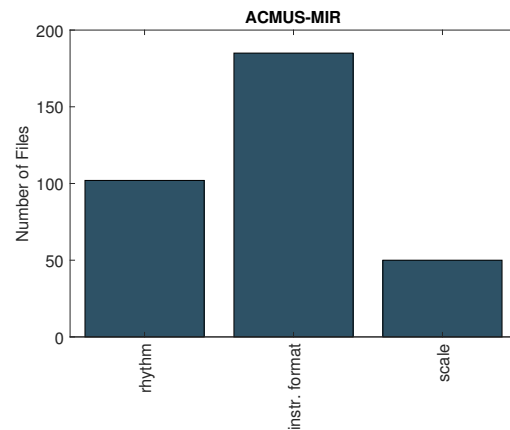


Figure 2: File distribution in the ACMUS-MIR data set

pasodoble, ballade, contradanza, fox, cumbia, currulao, danza, habanera, mazurca, tango, unknown.

- Composer: Composer of the tune.
- Collection: Identifier of the collection in the Músicas Regionales Archive.
- Original file: Location and file name of the original recording as stored in the Músicas Regionales Archive.
- Sampling rate: in Hz of the audio file.
- Bits: Bit depth of the audio file.
- Duration: in seconds of the music segment.
- Channels: Number of audio channels in the recording.

For each of the sets, a unique identifier (Set id) has been defined to help easy browsing of the data: **rh** for the rhythm set, **if** for the instrumental format set, and **sc** for the scale set. All files in the ACMUS-MIR data set are saved according to the following naming convention: <Set id>_<File Name>.<ext>. All the annotations in the ACMUS-MIR data set have been reviewed by at least two annotators in Colombia.

Audio Quality: Given that the recordings in the Músicas Regionales Archive include digitized versions of analog tape recordings as well as more recent digital recordings, the quality of the data in the ACMUS-MIR data set can vary depending on the original recording of the music segment. Digitized versions of analog recordings have been saved with a 96 kHz sampling rate. Regardless of the origin of the segment, the sampling rate, bit depth, and number of channels in the recording are reported as part of the *General Annotations* for each track. In terms of the types of recordings available, the archive holds material from live, studio, and field recordings. **Availability and Usage:** The full ACMUS-MIR data set, including audio files and annotations, is released under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International license. The data set has been made available as a Zenodo ⁹ repository. General information about the data set can be found on the project website ¹⁰, and resources and code on the project Github page ¹¹.

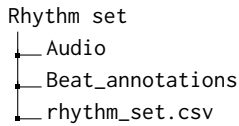
⁹<https://zenodo.org/record/3268961#.XR-Dz48RVPY>

¹⁰<https://acmus-mir.github.io/>

¹¹<https://github.com/ACMUS-MIR>

4.1 The rhythm set

The rhythm set was especially compiled to support the development of algorithms for classification between simple and compound meter. The set is also suitable for a variety of rhythm analyses, such as beat tracking, microtiming variations, and sesquialtera studies. The rhythm set is saved with the following file structure:



The rhythm set currently comprises 102 music segments of varying lengths from 10-30 sec, stored in .wav format in the *Audio* folder of the set. Beat annotations were manually performed by expert musicologist in Colombia using Sonic Visualiser.¹² All beat annotations can be found in the *Beat_annotations* folder, stored in a text file for each track *rh_<File Name>.txt*. The beat annotations are saved as a list of beat times in seconds.

Besides the *General Annotations*, the rhythm set also includes the following annotations saved in the *rhythm_set.csv* file:

- Time signature: 2/4, 3/4, 4/4, 6/8
- Meter tag: 0=simple, 1=compound
- Tempo: in BPM. Obtained as the mean beat duration from all the beat annotations in the track, and converted to BPM.

For the specific case of the tracks of the bambuco genre, the time signature was annotated as per convention in 6/8. However, in order to support studies on sesquialtera in bambucos (a long-standing discussion in Latin American musicology [14]), the beat annotations for all bambucos have been annotated both in 6/8 and 3/4 time signature. These annotations can also be found in the *Beat_annotations* folder, with **0** and **1** as suffixes for simple and compound meters, respectively.

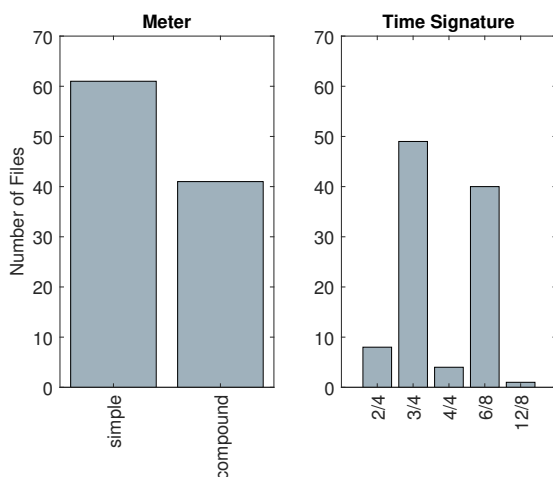


Figure 3: Meter and time signature distribution in the rhythm set

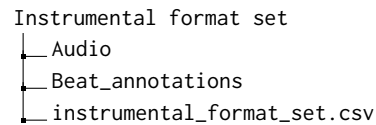
¹²<https://www.sonicvisualiser.org/>

Figure 3 shows the distribution of simple and compound meter, as well as the distribution of time signatures in the rhythm set.

4.2 The instrumental format set

The instrumental format set was annotated for the development of algorithms that can determine the number of active instruments in a musical piece: solo, duet, trio, quartet, etc. For this set, only instrumental segments were selected, including instruments such as: acoustic guitars, bandolas, tiple, electric bass guitars, and occasionally percussion instruments such as the maracas. The annotations in the set include the ensemble size, as well as the quantity of each instrument in the ensemble, enabling the usage of this set also for tasks such as instrument recognition.

The instrumental format set is saved with the following file structure:



The instrumental format set contains 185 music segments of varying lengths from 7-62 seconds summing up to a total of 70 minutes. All files are stored in .wav format in the *Audio* folder. Figure 4 shows the distribution of instrumental formats included in the instrumental format set.

Besides the *General Annotations*, the instrumental format set also includes the following annotations:

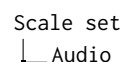
- Number of instruments
- Number of guitars, bandolas, tiple, bass, and percussion instruments
- Noise at 64Hz: some files contain noise (possibly from the digitization process) at 64Hz. For avoiding possible biases in models built with this set, the presence of noise has been manually annotated.
- Tempo: in BPM. Obtained as the mean beat duration from all the beat annotations in the track, and converted to BPM.

Additionally the beat onsets were also annotated in this set to allow tempo and meter analysis. Beat annotations were manually performed and saved in the same manner as in the rhythm set. All annotations were reviewed by at least two annotators.

Preliminary results on instrumental format classification using different deep network architectures using the instrumental format set can be found in [10].

4.3 The scale set

The scale set was compiled to support the development of algorithms for scale detection in traditional Colombian music. In its current release, the set contains a collection of 50 music segments of string music from the Andes region with scale type and key center annotations, among others. The scale set is saved with the following file structure:



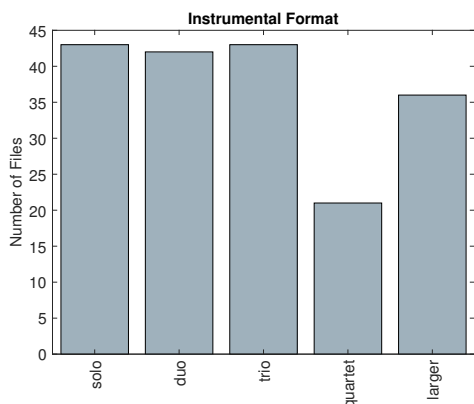


Figure 4: Instrumental format distribution in the instrumental format set

scale_set.csv

Besides the *General Annotations*, the `scale_set.csv` file also includes the following annotations:

- Ensemble Tag: 0=string ensemble.
- Instrumental Format: Number of instruments playing in the audio segment including percussion instruments.
- Percussion Tag: 0=No percussion, 1=percussion.
- Scale Type: Major, minor.
- Estimated key center: The key center is annotated using English notation for pitch classes, i.e, A, Bb, C, D#, etc.

Figure 5 shows the distribution of major and minor scales, as well as of instrumental formats included in the scale set.

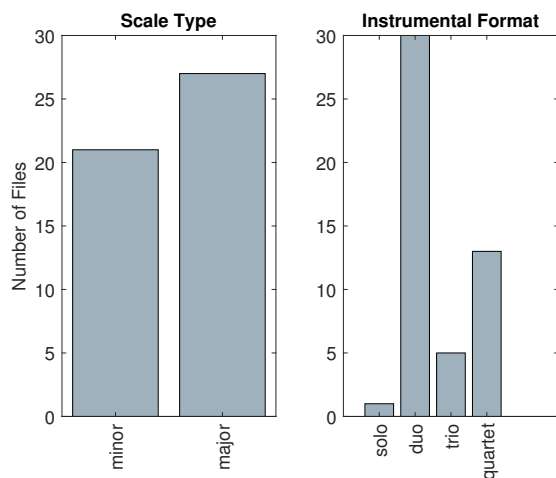


Figure 5: Scale type and instrumental format distribution in the scale set

5 CONCLUSIONS

The ACMUS-MIR data set is a growing collection of annotated music from the Andes region in Colombia. In this initial release, annotated music with meter, instrumental format and scale information has been made available to the wider research community with the hope that it will support further research efforts in similar fields. A full description of the data set has been presented, as well as a description of the context and the musical characteristics of the music contained in it.

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