A CRITICAL SURVEY OF RESEARCH IN MUSIC GENRE RECOGNITION

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ABSTRACT

This paper surveys 560 publications about music genre recognition (MGR) published between 2013–2022, complementing the comprehensive survey of [474], which covered the time frame 1995–2012 (467 publications). For each publication we determine its main functions: a review of research, a contribution to evaluation methodology, or an experimental work. For each experimental work we note the data, experimental approach, and figure of merit it applies. We also note the extents to which any publication engages with work critical of MGR as a research problem, as well as genre theory. Our bibliographic analysis shows for MGR research: 1) it typically does not meaningfully engage with any critique of itself; and 2) it typically does not meaningfully engage with work in genre theory.

1. INTRODUCTION

Despite much more work [1–560] music genre recognition (MGR) still remains a compelling problem to solve by a machine. This work comes on top of the 467 publications surveyed over a decade ago by Sturm [474]. Of principal concern in that survey is the question: "How does one measure the capacity of a system to recognize and discriminate between abstract characteristics of the human phenomenon of music?" The survey catalogues each of the 467 publications along several dimensions. [1] Sturm determined whether each publication is mainly a review of MGR research, a contribution to evaluation methodology, or a description of experimental work in which an MGR system is built and tested. For each experimental work (438 of 467 publications) Sturm recorded its experimental designs (of which there are 10), datasets (16), and figures of merit (9).

Now that at least 560 more publications have entered the domain, where does the problem of MGR stand? This paper aims to complement and extend the survey of [474] by exhaustively surveying research published between 2013–2022 related to MGR—as well as any earlier publications discovered to have been missed in Sturm's original work—such that the two surveys give a comprehensive account up to 2022. It also aims to answer several critical questions. Is the experimental design *Classify* and figure of merit accuracy still the most frequent, despite their noted serious flaws threatening the validity of conclusions drawn from them [470, 471, 561, 562]. Is GTZAN [563] still the most used public dataset, despite its noted faults [400, 467, 471, 564]? How have these faults been considered or even *re*considered in the past decade? How has all this new research in MGR engaged with work that is critical of MGR as a research problem, i.e., [231, 232, 329, 401, 467, 469–471, 473, 475–478, 561, 562, 564–574]? How has all this work engaged with genre theory such as [575–598]?

The next section describes the methodology we use to collect and catalogue publications. Section 3 presents our analyses of this collection along several dimensions. Section 4 gives broad observations and recommendations to guide future work in MGR. The resulting catalogue, bibliography and analysis code are available online. [2]

2. METHODOLOGY

We assembled a corpus of 560 publications in the following way. We performed a broad search across *Google Scholar* for publications appearing from 2013 onwards using search terms like 'music genre', 'recognition OR classification "music genre"'. This gave over 67 pages of results that we manually browsed. We supplemented these results with searches of the ISMIR proceedings, TISMIR and arXiv. We added each relevant publication we found to a dedicated Zotero collection, [3] which is a convenient means to gather, share and organize bibliographic data.

For each publication in our collection, we read it and manually enter data into a spreadsheet. As done by Sturm [474], we catalogue each publication according to its type, then note the experimental designs, datasets and figures of merit it uses. Additionally, we note whether each publication cites or engages with two kinds of published work: genre-related work from the social sciences and humanities; and work that is critical of MGR. We note what moti-

[1] The data of that survey can be found here: https://github.com/boblsturm/Music-Genre-Recognition-Survey--1995-2012

[2] https://www.kth.se/profile/bobs/page/research-data

[3] https://zotero.org

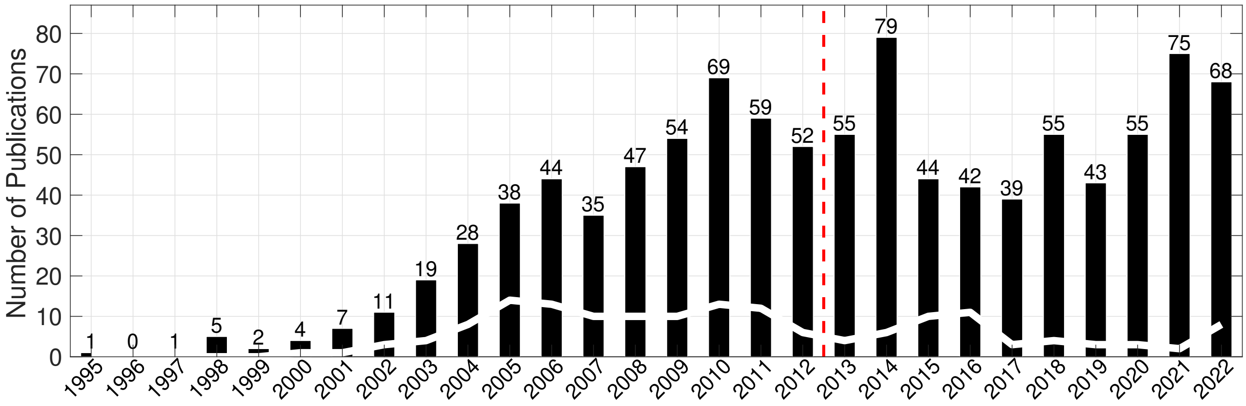

Figure 1. Annual numbers of publications related to music genre recognition between 1995 and 2022. Dashed vertical line demarcates the end date of publications surveyed in Sturm [474]. The present survey adds ten references before 2013 [115, 149, 155, 181, 194, 202, 209, 354, 423, 426], but 550 other publications surveyed herein are published after 2012. The white plot line shows the number of publications appearing at ISMIR or in the Transactions of ISMIR.

vations the paper describes for researching MGR.

To conduct our analyses of the collection, we query entries in our spreadsheet and Zotero library, but also use python and relevant libraries. We export our collection as a BibTex-formatted file, and the spreadsheet as a text file of comma-separated values. In the following subsections we describe in more detail each dimension of our catalogue. (Further details are given in the Supp. Mat.)

Publication Type We assign each publication to at least one of three categories. A *review* publication is concerned with surveying the domain of MGR, e.g., [474, 599]. An *evaluation* publication is concerned with evaluation methodology in MGR, such as proposing a dataset, e.g., [113, 600], experimental design, e.g., [571, 601], or taking a critical look at work in the domain, e.g., [471, 566]. Finally, an *experimental* publication is concerned with engineering and testing MGR systems, e.g., [563, 602].

Dataset For experimental publications, we note what data sets are used, whether private data was used, and the modality of data used: musical audio (waveform or extracted features), symbolic data, or other types (e.g., lyrics, WWW, playlists). We also note if a publication works with non-Western musics.

Experimental Design Following the categorisations described by Sturm [474, p. 32], we note the design(s) used in the experiments described by a publication. These ten designs are: *Classify*, *Features*, *Generalize*, *Robust*, *Scale*, *Cluster*, *Retrieve*, *Rules*, *Compose*, *Eyeball*. (Supp. Mat. S1.5 describes and gives examples of each of these.)

Figure of Merit (FoM) We note the figure(s) of merit used in the evaluation of experiments [474]. The main FoM we look for include *Accuracy*, *Recall*, *Precision*, *F-measure*, *Receiver Operating Characteristic (ROC)* and the *Confusion Table*. Where a confusion table has been used we note whether or not there is an accompanying interpretative discussion, and whether specific instances of confusion are discussed. (Supp. Mat. S1.6 defines these.)

Referencing In a direction different from Sturm [474], we record if a publication cites at least one of a collection of 26 publications we deem are *critical* of MGR, i.e., [231, 232, 329, 401, 467, 469–471, 473, 475–478, 561, 562, 564–574]. We also determine whether the citation is accompanied by any discussion or concrete effects on the experimental design in the publication. We also record if a publication refers to work on musical genre from the social sciences and humanities, i.e., [575–591, 593–598], and record if that citation is accompanied by substantive discussion. Supp. Mat. S1.7 discusses both sets of references.

Motivation for MGR Where authors explicitly state a motivating rationale for MGR work, we record which of four non-exclusive categories they appeal to: *industrial need*, *public good*, coping with *information overload*, or are appealing to *precedent*. There is a degree of unavoidable subjectivity in this designation, and so we opt for parsimony and look only for explicit statements of this kind to avoid unwarranted inference. Supp. Mat. S1.8 provides examples of each of these.

3. ANALYSIS AND RESULTS

We now analyze the 560 publications in this survey in relation to the 467 in Sturm [474]. Figure 1 shows the annual number of publications related to MGR since the earliest reference cited in Sturm [474]—Matityaho and Furst [603]. This shows that MGR publications grew to a high point in 2010 after being established in the MIR community a decade earlier as a “flagship problem” of music information retrieval [604]. Thereafter the mean number of publications related to MGR each year is 56.7 (std dev. 13.1). We see that the annual number of publications related to MGR appearing at ISMIR or in its Transactions since 2010 is less than ten in all but two years (2011, 2016). Our survey does not include 28 publications [605–632] because we cannot get access (e.g., behind a paywall), or the language of the paper is not English.

3.1 Publication Types

Of the 560 publications we survey in this paper, we find only nine review articles or book chapters discussing MGR

[98, 193, 247, 323, 325, 339, 467, 474, 493]. Among these, Corrêa and Rodrigues [98] reviews MGR using symbolic data. Kostek [247] is a review of MIR and has a section about MGR; and Tzanetakis [493] is a book chapter reviewing music informatics generally, where music genre appears in one section. Sturm [467] reviews all publications using the GTZAN dataset up to 2012; and Sturm [474] is the survey we extend in this paper.

We find 19 of our 560 publications that primarily discuss evaluation in MGR research [113, 199, 231, 232, 329, 341, 367, 400, 401, 424, 467, 469–471, 473, 474, 476–478]. In addition to those already described in Sec. 2, Palmason et al. [341] investigates the agreement of music genre ground truth between different stakeholders. Porter et al. [367] discusses enriching the AcousticBrainz audio feature dataset [633] using metadata collected from a variety of online sources, include genre information. Schreiber [424] extends the Million Song Dataset; and Defferrard et al. [113] introduces the FMA dataset. Finally, Hossain and Al Marouf [199] discusses the creation of a dataset of song lyrics exemplifying different genres of Bengali music.

Of the 560 publications we survey in this paper, we find 545 that make experimental contributions. Of these, the next three subsections discuss the datasets, experimental designs, and figures of merit used in this subset of publications, comparing and contrasting with the previous survey [474]. We then go further than Sturm [474]. Subsection 3.7 looks at how all 560 publications we survey engage with work critical of MGR. Subsection 3.8 investigates the extent to which they engage with music genre theory. The penultimate subsection 3.5 looks at how MGR is being motivated as a research problem. Subsection 3.6 looks at the kinds of venues at which MGR research is being published.

3.2 Datasets

Sturm [474] finds the GTZAN dataset [563] from 2002 is the most used public dataset, appearing in 100 out of 435 publications with an experimental component. We find that GTZAN remains the most frequently used dataset, appearing in 254 of 545 publications that have an experimental component. Some publications use GTZAN for learning bases, which are then used for building MGR systems tested in other datasets, e.g., Jao et al. [213] and Markov and Matsui [295]. Some publications we survey use only a portion of GTZAN. For instance, Agarwal et al. [5] uses only five of ten classes; and Rajesh and Bhalke [390] uses only two. Others add classes to GTZAN, e.g., Iloga et al. [205, 206] adds Cameroonian music, Conceicao et al. [95] adds music from Brazil, Wibowo and Wihayati [519] adds Malaysian Dangdut music, and Shashirekha [440] adds songs sung in an Indian language (Kannada). Moving briefly to the entire collection we survey, we find considerations of music from non-Western traditions to appear in only 61 of the 560 publications; Sturm [474] finds 47 in its survey of 467 publications.

Some publications analyze GTZAN as a dataset. Flexer [150] analyzes hubs in GTZAN, and tests methods of outlier detection using it. Lu et al. [286, 287] attempt to automatically find the faults in the dataset identified in Sturm [467]. Rodriguez-Algarra et al. [400] investigates why a particular MGR system performs so well on GTZAN, and finds infrasonic information confounded with labels—more formally explored in Rodriguez-Algarra et al. [401]. Kang and Lin [224] looks at inferring taxonomies of classes in datasets, including GTZAN. Lu et al. [286, 287] use GTZAN as a testbed for anomaly detection.

The next four most popular datasets we find are ISMIR2004 [634] from 2004 (appearing in 50 publications), FMA [635] from 2016 (36), the Million Song Dataset [600] from 2011 (32), and the Latin Music Dataset [636] from 2008 (23). We find that data that is not publicly available (e.g., in-house data, or undisclosed data) appears in 176 of 545 publications. Of those, we find 146 of them exclusively use non-publicly available data.

The predominant data modality in our catalogue is acoustic (or features extracted from acoustic data), which appears in 482 of 545 publications with an experimental component. Sturm [474] finds 344 of 435 publications use such a modality. We find symbolic modalities are used in 40 publications, while Sturm [474] finds them used in 81 publications. We find 11 publications use both modalities [2, 23, 187, 189, 209, 270, 359, 360, 362, 507, 556]. Other modalities (e.g., lyrics, WWW, playlists) appear used in 66 of our publications, while Sturm [474] finds these used in 27 publications.

3.3 Experimental design

The three most used experimental designs we find in the 545 publications we survey with an experimental component match those found by Sturm [474]. The most used design in both is *Classify*: we find 514 publications use this, and of those 264 exclusively use this design; Sturm [474] finds this appears in 397 of 435 publications with an experimental component. The second most used design is *Feature*, which appears in 145 of 545 publications we survey; Sturm [474] finds this appears in 142 of 435 publications. The third most used design is *Generalize*, which appears in 127 of 545 publications we survey; Sturm [474] finds it appears in 69 of 435 publications.

The two least-used designs we find are the same as in Sturm [474]: *Rules* and *Compose*. Among our 545 papers with an experimental component, we find *Rules* appears in six publications [63, 70, 97, 209, 246, 402]. For instance, Campobello et al. [63] derive an analytic formulae for GTZAN genres whereby specific feature values extracted from an audio signal are used to compute the relevance of a class. We find the *Compose* design appears in five [175, 209, 476, 485, 489]. For instance, Sturm [476] inspects the correspondence between randomly generated rhythmic patterns classified with high confidence by a state-of-the-art system trained in the BALLROOM dataset [637], and the classes in that dataset.

3.4 Figure of merit

We find accuracy is the figure of merit that appears the most: 449 out of 545 publications with an experimental component. Sturm [474] finds this appears in 385 of 435 publications. The confusion table is the next most common figure of merit, appearing in 193 publications surveyed here. In those publications with a confusion table, we find no discussion about it in 78 publications—that is, it is merely presented as a table without interpretation. When a confusion table is discussed, musical motivations for confusions are often given. For example, Chathuranga et al. [73] writes, "[In our confusion table] Rock music is mostly misclassified as country and blue. This is due to the facts that rock music and country music have similar roots and rock music came from a combination of country music and rhythm and blues." Chen and Ramadge [77] writes, "Rock music is easily confused with other genres—perhaps because of its broad nature."

Specific instances of confusions are only discussed in nine papers [63, 201, 231, 232, 341, 467, 470, 472, 475]. For instance, Sturm [467] and Campobello et al. [63] show tables of confusions made by classifier for specific excerpts in GTZAN, e.g., Sturm [467] shows GTZAN country excerpt 69 "My Heroes Have Always Been Cowboys" by Willie Nelson is mislabeled "Classical", and Campobello et al. [63] shows GTZAN filename "country.00069" is mislabeled "Blues", "Classical" and "Rock". Sturm et al. [472] do the same but for the Latin Music Dataset. Hsu et al. [201] look at four specific music recordings from a test set they create and inspect how classifications of them differ between systems they test. Finally, Kereliuk et al. [231, 232] and Sturm [470, 475] make use of a set of ten different songs and show how each can be confidently classified in any GTZAN class.

3.5 Justifications of MGR

How is MGR as a research problem being justified? We noted two major shades of justification where one was offered. 155 papers were found that explicitly invoke imagined applications for the music industry (106) or end users (49). In 150 of these papers, applications of MGR were presented as useful or necessary in due contemporary information overload. Conversely, 103 papers were noted to make no direct utilitarian appeal for MGR work, but instead to call upon precedent: MGR problems are important because there has been work on MGR.

In the 150 papers that invoke information overload as a problem that MGR can help solve, a common presumption is that there are problematic quantities of unlabelled musical data that would be more tedious or error-prone to organize by hand than with MGR, e.g [174, 439]. Sometimes, the urgency of dealing with such a problem is emphasised. For example: "a lot of music data has become available recently …in order for users to benefit from them, an efficient music information retrieval technology is necessary." [294]; "Given the vast number of current collections, automated genre classification is critical for music organization …" [376]

Publications seldom motivate through learning something about *music* rather than classifier performance. [301] sets out to understand the temporalities of musical change over a 50 year period. [329] argues that MGR classifiers can be repurposed towards greater understanding of genre as musico-social. [189, 505] argue that more interpretable models more useful for musicologists and listeners. [348] investigates the potential of MGR for studying underrepresented traditions. [140] examines the 'tenuous' relationship between rhythmic similarity and genre.

3.6 Venues for MGR publications

Of the 560 publications we review, 350 are conference papers and 156 appear in journals. The most common venue for MGR publications is the ISMIR conference (43 papers). The next most common conferences are *Int. Conf. Acoustics Speech and Signal Processing* (ICASSP) (12), *Int. Joint Conf. Neural Networks* (IJCNN) (9), and Interspeech (5). Six publications appear at the music computing conferences ICMC, SMC and DaFx. The most common journals were *IEEE Access* (7), *Int. Research Journal of Engineering and Technology* (6), then *IEEE Signal Processing Letters*, *Int. Journal of Computer Applications*, *Journal of Intelligent Information Systems*, *IEEE Trans. on Multimedia*, *Journal of New Music Research*, *Trans. of the Int. Society for Music Information Retrieval*, *Expert Systems with Applications*, and *Applied Soft Computing* (4 publications each).

After stripping edition indicators from conference names, we estimate that papers appeared at 235 unique conferences, of which 195 hosted a single paper in our corpus. Similarly, the 156 journal articles we reviewed appeared across 101 journals, 74 of which hosted a single article from our corpus. 82 publications appear in conferences or journals under the umbrellas of the ACM and IEEE, including ICASSP and WASPAA. In addition to 9 more PhD theses containing work related to MGR [2, 23, 160, 183, 336, 501, 518, 545] we reviewed 14 master's theses [11, 35, 64, 112, 220, 262, 289, 308, 333, 374, 453, 465].

Elsevier publishes the greatest proportion of the journals encountered (11), followed by Springer (9), IEEE (8), MDPI (5), Hindawi (4), IET (3) and ACM (3). 20 publications were on ArXiv or similar pre-print hosting providers with no corresponding official publication. Many publications appear in venues not specifically concerned with music, audio or informatics, but with computing topics more generally or—more general still—with topics like 'engineering' or 'technology'. Some publications appear in venues apparently unrelated to music informatics. For example, [176] appears in the *International Journal of Early Childhood Special Education*. Others appear in venues whose existence we could not confirm, e.g. [193] was apparently presented at a 2018 ACM Symposium on Neural Gaze Detection of which we can find no online trace.

3.7 Engagement with work critical of MGR

We now turn to another aspect not explored in Sturm [474]: How does research in MGR engage with work that is critical of MGR? How many of the 560 publications we survey cite 26 critical publications [231, 232, 329, 401, 467, 469–

471, 473, 475–478, 561, 562, 564–574]? Do any implement proposed recommendations or alternatives? We find that only 163 of the 560 publications cite at least one of these critical references; and of these, only 77 engage in some way with the critique. Such engagement can be simply applying artist filtering. It can also be motivating the use of a specific experimental design.

Let us look specifically at criticism around GTZAN [563], the most-used dataset in MGR research. Ten years after its creation, this dataset was carefully analyzed by Sturm [467, 471, 564], resulting in a catalogue of its faults and an index of its contents. Kereliuk et al. [231, 232] created and used the first partitioning of GTZAN that considers its contents. [4] (See Supp. Mat. S2 for an overview of the on-line availability of these materials.)

Considering the faults of GTZAN have been known since 2012, let us focus on the 250 papers published after 2012 that use GTZAN with a *Classify* experimental design reporting accuracy as a figure of merit. Of these, we find only 62 acknowledge the existence of faults in GTZAN, and 46 of those essentially ignore or dismiss them. For instance, Sigtia and Dixon [447], Nanni et al. [320], Jeong and Lee [218], Senac et al. [428] and Palmason et al. [340] are five papers that dismiss consideration of the faults by appealing to the popularity of GTZAN as a benchmark dataset: "Although the GTZAN dataset has some shortcomings [564], it has been used as a benchmark for genre classification tasks" [447]. Others claim that their experimental results are not harmed by such problems, e.g., "Despite [its faults], we still used [GTZAN] because these small problems can not seriously damage our results" [205]. We find 15 publications use the fault-filtered partitions of Kereliuk et al. [231, 232]: [66, 81, 144, 145, 218, 236, 267, 271, 302, 305, 329, 349, 364, 540, 554]. Foleiss and Tavares [152] create their own partitioning following Sturm [467], which was then used by Ng et al. [327] and Cai and Zhang [62]. Three other publications [15, 63, 374] acknowledge the faults in GTZAN and perform their own fault-filtering and partitioning.

The fact that 188 of these 250 publications using GTZAN do not mention its faults could be partly explained by the fact that websites linking to the dataset make no mention of them. At least up to March 20 2022, the original source of GTZAN [5] makes no mention of any faults or of the cataloguing work of Sturm [467, 471, 564]. There currently exist several online copies of GTZAN (or features computed from the dataset), but none of these mention faults; and at this time we find only two online repositories of GTZAN that mention faults (See Supp. Mat. S2).

Another criticized aspect of MGR research is its use of *Classify* as an experimental design. Sturm [470, 471, 473, 478, 561, 562] argue that this design is essentially a "horse show": systems are tasked with tapping their hooves the correct number of times, but no reliable measurement of musical intelligence can be made without controlling for numerous independent variables. While the survey in Sturm [474] finds *Classify* appears in 91.3% of its surveyed publications, the present survey finds it appears in 94.3%. Furthermore, we find 264 publications *only* use *Classify*. While we see at least some work in MGR has cited and engaged with the faults in GTZAN, very few publications in the present survey (outside of those by Sturm and collaborators) meaningfully engage with the criticism of *Classify*. To the best of our knowledge, there are no publications that dispute the argument of Sturm [470, 471, 473, 478, 561, 562]; and we find only 17 publications citing those six publications and engaging with them in any meaningful way when it comes to experimental design [47, 48, 63, 67, 98, 140, 175, 244, 286, 327, 329, 374, 375, 393, 421, 507, 518], e.g., cautiously interpreting results of classification, or motivating additional experimental designs.

3.8 Engagement with genre theory

We now turn to the question: how have the 560 publications in our survey engaged with genre theory from the social sciences and humanities? We find 36 references to such work citing 23 sources [575–598]. Of these 36 publications, 10 go further than just citation [139, 146, 219, 329, 341, 375, 421, 453, 469, 471]. Useful indicators of the ways in which musical genre is a more complex concept than just distributions of acoustic or other features are scattered across these contributions. The following key points emerge from engagements with genre theory in our corpus:

Relational The interrelationships between genres are crucial to understanding them, yet more complex than can be captured through simple taxonomies [329, 341, 375, 469, 471].

More-than-sonic The character of genres is determined not only through sonic traits but that other modalities can be of crucial importance, often as proxies for the social roots of genres [146, 329, 375, 421].

Social The relationships between genres and social formations / identities is complex and bidirectional: genres can articulate identities, but genres can also be used as part of demarcating social groupings. The agency in defining and consolidating genre terms is distributed across different social planes, including the institutions of industry, as well as musicians, critics and fans [219, 329, 341, 421].

Perspectival Genres and their relationships can be understood quite differently by different groups of people [375, 469, 471].

Dynamic No aspect of musical genre stands still. Their salient sonic and other features, interrelationships, connections to social formations are all in constant, unpredictable motion. Crucially this means that the association of particular musical texts and tastes with genres is also subject to change [329, 471].

[4] Both the catalogue of GTZAN and the fault-filtered partition are available here: https://github.com/boblsturm/GTZAN.

[5] http://marsyas.info/downloads/datasets.html.

4. DISCUSSION

Based on a survey of 560 MGR publications from 2013–2022, we find some continuity with the previous survey by Sturm [474]. GTZAN, *Classify* and *Accuracy* remain respectively the most widely used dataset, experiment and figure of merit. Despite an increase in the number of public datasets available to MGR researchers, we also see that the proportion of publications dealing with non-Western musical formations has not changed appreciably. Although the use of alternative modalities of data (e.g., lyrics, WWW, playlists) has roughly doubled, such work remains a minority and treating MGR as an audio-similarity problem still prevails. However, our survey goes further to find that MGR work has by and large not engaged with any critique of its accepted methodologies, critique of the research task itself, or of work in the social sciences and humanities related to genre.

We note that the engagement that there is has introduced to MGR key facets of the challenges of studying musical genre, which warrant greater consideration—we commend the introductory chapter of [577] as a comprehensive overview. Crucially, each of the factors outlined in Sec. 3.8 not only provide key pointers towards threats to validity for MGR [638] but also indicate that for MIR to contend with genre as a *musical* topic, a greater diversity of approaches is called for [639]. However, given the quantity of the surveyed publications that appear outside ISMIR or core MIR venues, it is not certain whether MGR remains a "flagship problem" of music information retrieval [604].

Has it, rather, become autonomous of MIR, as a convenient downstream task for computer scientists that has the appearances of addressing a domain-specific useful problem? Our reading of the given motivations for MGR research found in this corpus supports the plausibility of this interpretation, given the frequency of appeals to vaguely described industrial and user applications. One way to investigate this further would be through a bibliometric analysis of this corpus, geared towards identifying possible clusters of work through co-citation or collaboration. [6]. A possibility is that MIR specialists have shifted their attention to auto-tagging and away from MGR, which as a 'superset' problem of MGR, we do not cover here. However, an interesting area for follow-up research could be to perform a similar survey of auto-tagging research along with a bibliometric comparison, which may shed some light on the movement of research within MIR.

Nevertheless, we put forward the normative position that *music* informatics researchers should be oriented to *musical* questions open to investigating their complexities in collaboration with music scholars. Doing so likely involves shifts in how this research is pursued. Currently, what dominates is exploratory analysis where progress is assessed through benchmarks. [641] provides a framework for assessing the suitability of such 'outcome reasoning' along dimensions of measurement, adaptability, resilience and compatibility with stakeholder beliefs. These are telling questions, as it's not clear that for much MGR research who the stakeholders are. If one group of potential stakeholders is other music researchers, rather than the imagined needs of music platforms or their users, then this points to more *explanatory* work in MGR. However, benchmark-driven predictive modelling need not be abandoned. In [642] the authors point to ways in which benchmark-driven work can be incorporated and redirected towards richer ends and [643] shows how predictive models can be integrated into contemporary approaches to causal inference, suited to theory-driven, explanatory registers of research.

[6] Open scholarly databases such as OpenAlex [640] could automate at least some of this, although we note that its coverage of references for the papers in this corpus doesn't extend to around half of its ISMIR papers.

5. CONCLUSION

We close with some recommendations. Broadly, MGR suffers from threats to validity [638] that warrant more attention. Some progress could be made through a greater role for theory in MGR, both through authors being more explicit about the theoretical perspective on genre at work in a given study, as well as deeper engagement with theories of musical genre.

In particular, a close and critical reading of the introductory discussion of [577] in terms of its implications for MIR genre research could be generative for the field. Specifically, it is the sociality, temporality and heterogeneity of genres that are least addressed in the work we have surveyed, and these bring interesting challenges. One fruitful direction to engaging with the social can be found in [644]: by acknowledging that culture is present in every part of the MIR 'value-chain' [645], the authors propose a technical intervention on recommender system design in pursuit of a normative social outcome ('commonality') often considered to be outside the scope of engineering concerns. Some of the surveyed work already moves towards dealing with genre as temporal [301], and social-temporal [329]. This suggests a possible intersection with work in music and cultural evolution [646], which could serve as a constructive 'interface' between MIR and music studies.

Finally, to contend with the heterogeneity of genres means dealing not only with their sonic variability, but also variability across the many other dimensions that may define a particular genre for a particular aesthetic coalition. On the first point, we would recommend more genre-specific computational-musicological work like [647–649] to cast light on the relationships between computed features and aesthetic saliences for groups of listeners. More fine-grained, genre-specific datasets as in [276] might help here. On the second point, engaging with 'live' genres in motion implies the need for work in nonexperimental settings [650] that can cope with diverse, noisy and incomplete data.

6. ACKNOWLEDGMENTS

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