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| **Classification of Music Lyrics by Genre** |
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| **Shiraz Chakraverty and Dan Price** |
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Abstract

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In the field of Natural Language Processing (NLP), the machine classification of text into human taxonomies is a formidable task. Machine understanding of language in general is complex. We cannot yet fully understand how the human brain does it but strides have been made. In the arts, the classification of music into genres inherits some of its nuance from the human cultural context the music originates. Yet, even casual listeners can often identify the assigned genre of a piece of music from written lyrics alone for popular genres. Engendering machines with a similar ability presents with its challenges. With that understanding, newer and emerging algorithms and word embeddings are able to offer classifications useful for organizations doing language tasks at a large scale.

We would like to explore the advantages and disadvantages of various methods in text classification papers we have selected and report our observations, learnings, and a recommendation. With the focus of deep learning, it is clear that neural networks tend to work better than previously used models. We would like to explore this path and provide some comparative analysis. We would also like to offer commentary on the larger issue of algorithmic bias in the setting of music genre classification.

Credits

Introduction

Rolling Stone magazine tells the story of a viral Internet hit song “Old Town Road” by a heretofore-unknown artist Lil Nas X. “Old Town Road” emerged on a social music video sharing site TikTok. It also sparked success on music sharing service SoundCloud. Partly motivated by promotion on social network Instagram from pop sensation Justin Bieber, the song simultaneously debuted on Billboard’s Hot 100 Chart, Hot Country Songs chart, and the Hot R&B/Hip-Hop Songs chart. However, after some time, Billboard elected to remove the song from its Hot Country Songs chart claiming the song “does not merit inclusion on Billboard’s country charts” because “it does not embrace enough elements of today’s country music to chart in its current version” [7]. Controversy over genre labeling ensued. The novelty and notoriety of the hit single ultimately led to famed country artist Billy Ray Cyrus appearing on an “Old Town Road” remix thereby cementing the songs relationship with the country music genre independent of the Billboard decision.

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In its editorial, Rolling Stone signaled that antiquated definitions of music genres highly correlated to race are to blame for Billboard’s classification controversy. In an age where codification of bias in artificial intelligence systems is under inspection, the conversation surrounding “Old Town Road” can be considered an important litmus test for the role of algorithmic classification in music. As artificial intelligence weaves its way into modern life, it is not unreasonable to consider the role machines could play in the classification of styles of music. Genre classification is likely to have an effect on music recommendation systems. Text classification is a broadly applied task in the field of natural language processing. Filtering of spam email and sentiment analysis are canonical, highly utilized examples of text classification in application. We seek to evaluate some of NLP’s gains on music lyrics. In this paper, we aim to determine the applicability of machine learning and deep learning algorithms on the task of classifying music lyrics by genre.

Song lyrics exhibit structure distinct from other text documents. Lyrics are often organized in discrete sections of choruses, verses, and bridges. Lyrics often align with a defined musical tempo with regularly occurring patterns. Various academic and industry teams have tried approaches to this space. Efforts to understand music, both sonically and semantically through sound, lyrics, and metadata have coalesced in a subfield known as Music Information Retrieval (MIR). No single effort has been very successful in finding a stable method that performs significantly well to tackle the lyrical genre classification problem. Algorithms such as Support Vector Machines, k-Nearest Neighbors, and Naive Bayes have all been used in lyrical classification but they all have very low accuracy in comparison to other NLP tasks on other datasets. We explore the application of new and emerging algorithms and models to the lyrics genre classification task. We can then, perhaps, get a machine’s take on how “Old Town Road” should be classified.

Dataset

Data for the lyrical classification problem is hard to come by due to copyright and other original content protection requirements. Artists and music labels do not usually publish lyrics with audio. With the rise of digital music and streaming, websites have emerged that build the infrastructure to crowd-source lyrics for ad revenue. Despite the public sourcing of the lyrics, public access to the entire dataset remains limited. Fortunately, a Kaggle user published a dataset of over 300,000 lyrics from a crawl of lyric website Metrolyrics.com

The initial dataset is downloadable as a comma delimited file. The columns in the file include an index, song title, release year, artist, genre, and lyrics. We are particularly interested in the text in the lyrics column. The lyrics are a string with carriage returns denoting an end of line. Statistics specific to the overall structure of the lyrics, such as line length, may add value to the classification task.

* 1. The Ruler

The ACL 2019 style defines a printed ruler that should be present in the version submitted for review. The ruler is provided in order that reviewers may comment on particular lines in the paper without circumlocution. If you are preparing a document without the provided style files, please arrange for an equivalent ruler to appear on the final output pages. The presence or absence of the ruler should not change the appearance of any other content on the page. The camera-ready copy should not contain a ruler.

In this Word template, you can add the ruler to each individual page by copying it from another page. The Ruler consists of separate left-hand rulers and right-hand rulers. Each ruler is a text box, sized 10 in x 0.45 in, flushed with the sides of the page, with a table containing numbers. The table has no borders, and the edges are pushed to the edges of the textbox. The left part of the ruler is justified left, left indent 0.1 in/right indent 0 in, and saved in the “ACL Ruler Left” style; and the right-hand ruler, justified right had left indent 0 in/right indent 0.1 in, saved in the “ACL Ruler Right” style. Number text is in Arial, and spacing between each line is Multiple, 1.05 in, with 4.5 pt below each line. After pasting a new ruler onto a page, highlight the ruler text and press **F9** to update the numbers. **Align** the text box **Middle**, and **Center**, and then **Arrange** Behind Text.

**Reviewers:** Note that the ruler measurements do not align well with lines in the paper — this turns out to be very difficult to do well when the paper contains many figures and equations, and, when done, looks ugly. Just use fractional references (*e.g.*, this paragraph ends at mark 141.5).

* 1. Electronically-available Resources

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ACL provides this description in LATEX2e (acl2019.tex) and PDF format (acl2019.pdf), along with the LATEX2e style file used to format it (acl2019.sty) and an ACL bibliography style (acl2019.bst) and example bibliography (acl2019.bib). These files are all available at [http://naacl2019.org/downloads/ acl2019-latex.zip](http://naacl2019.org/downloads/%20naaclhlt2019-latex.zip). A Microsoft Word template file (acl2019-word.docx) and example submission pdf (acl2019-word.pdf) is available online. We strongly recommend the use of these style files, which have been appropriately tailored for the ACL 2019 proceedings.

* 1. Format of Electronic Manuscript

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For the production of the electronic manuscript, you must use Adobe's Portable Document Format (PDF). This format can be generated from postscript files: on Unix systems, you can use ps2pdf for this purpose; on Windows, you can use Adobe's Distiller, an online service such as <http://go4convert.com/>, or if you have cygwin installed, you can use dvipdf or ps2pdf.

Please make sure that your PDF file includes all the necessary formatting, hyperlinks, and fonts (especially tree diagrams, symbols, and fonts with Asian characters). When you print or create the PDF file, there is usually an option in your printer setup to include none, all, or just non-standard fonts. Please make sure that you select the option of including ALL the fonts. **Before sending it, test your PDF by printing it from a computer different from the one where it was created.** Moreover, some word processors may generate very large PDF files, where each page is rendered as an image. Such images may reproduce poorly. In this case, try alternative ways to obtain the PDF. One way on some systems is to install a driver for a postscript printer, send your document to the printer specifying “Output to a file”, then convert the file to PDF.

It is of utmost importance to specify the **A4 format** (21 cm x 29.7 cm) when formatting the paper. Print-outs of the PDF file on A4 paper should be identical to the hardcopy version. If you cannot meet the above requirements about the production of your electronic submission, please contact the publication chairs above as soon as possible.

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Format manuscripts two columns to a page, in the manner these instructions are formatted. The exact dimensions for a page on A4 paper are:

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* 1. The First Page

Center the title, author name(s) and affiliation(s) across both columns (or, in the case of initial sub- mission, space for the names). Do not use footnotes for affiliations. Use the two-column format only when you begin the abstract.

**Title:** Place the title centered at the top of the first page, in a 15-point bold font. (For a complete guide to font sizes and styles, see Table 1.) Long titles should be typed on two lines without a blank line intervening. Approximately, put the title at 2.5 cm from the top of the page, followed by a blank line, then the author name(s), and the affiliation(s) on the following line. Do not use only initials for given names (middle initials are allowed). Do not format surnames in all capitals (*e.g.*, use “Mitchell,” not “MITCHELL”). Do not use format title and section headings in all capitals as well, except for proper names (such as “BLEU”) that are conventionally in all capitals. The affiliation should contain the author's complete address, and if possible, an electronic mail address. Start the body of the first page 7.5 cm from the top of the page.

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**Abstract:** Type the abstract at the beginning of the first column. The width of the abstract text should be smaller than the width of the columns for the text in the body of the paper by about 0.6cm on each side. Center the word **Abstract** in a 12 point bold font above the body of the abstract. The abstract should be a concise summary of the general thesis and conclusions of the paper. It should be no longer than 200 words. The abstract text should be in 10 point font.

**Text:** Begin typing the main body of the text immediately after the abstract, observing the two-column format as shown in the present document. Use 11 points for text. Indent when starting a new paragraph, about 0.16 in. This is accomplished with Right click, Styles, “ACL First Line”.

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**Citations:** Citations within the text appear in parentheses as ([Gusfield, 1997](#Gusfield1997)) or, if the author's name appears in the text itself, as Gusfield ([1997](#Gusfield1997)). Collapse multiple citations as in ([Gusfield, 1997](#Gusfield1997); [Aho and Ullman, 1972](#AhoUllman72)). Append lowercase letters to the year in cases of ambiguities. Treat double authors as in ([Aho and Ullman, 1972](#AhoUllman72)), but write as in ([Chandra et al., 1981](#ChandraEtAl1981)) when more than two authors are involved. Also refrain from using full citations as sentence constituents.

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“Gusfield ([1997](#Gusfield1997)) previously showed ... ”

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**References:** Gather the full set of references together under the heading **References**; place the section before any Appendices. Arrange the references alphabetically by first author, rather than by order of occurrence in the text. Provide as complete a reference as possible, using a consistent format, such as the one for *Computational Linguistics* or the one in the *Publication Manual of the American Psychological Association* ([American Psychological Association, 1983](#APA83)). Use of full names for authors rather than initials is preferred. A list of abbreviations for common computer science journals can be found in the Association for Computing Machinery ([1983](#ACM83)) *Computing Reviews*.

The bibliography style described here roughly fits the American Psychological Association format, allowing regular citations, short citations and multiple citations as described above.

Submissions should accurately reference prior and related work, including code and data. If a piece of prior work appeared in multiple venues, the version that appeared in a refereed, archival venue should be referenced. If multiple versions of a piece of prior work exist, the one used by the authors should be referenced.

**Appendices:** Appendices, if any, directly follow the text and the references. Letter them in sequence and provide an informative title: **Appendix A. Title of Appendix**.

* 1. Footnotes

**Footnotes:** Put footnotes at the bottom of the page and use 9 point font. They may be numbered or referred to by asterisks or other symbols.[[1]](#footnote-1) Footnotes should be separated from the text by a line.[[2]](#footnote-2)

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**Creating:** To create a new Figure or Table, insert a Text Box where you want it to appear (generally, centered at the top of a column close to where it is referred to) and then fill it in with the Figure (or Table). Highlight and right click to add Caption, with the ACL Caption style, which places 10 pt below and above the caption.

**Placement:** Place figures and tables in the paper near where they are first discussed, as close as possible to the top of their respective column. Wide figures and tables may run across both columns and should be placed at the top of a page.

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| Figure 1: Figure caption**.** |

In MSWord, authors can place a Figure (*e.g.*, a graphic and its caption) inside the rows of a 2 x 1 table (2 rows and 1 column) with invisible borders. Specify table positioning by right-clicking its handle in the upper left corner. Place the image in the center of the first row, and the caption in the center of the second row.

**Captions:** Provide a caption for every table and figure; number each one sequentially in the form: “Figure 1: Figure caption.”, “Table 1: Table caption.” Type the captions of the figures and tables below the body, using 10 point text. Captions should be placed below illustrations. Captions that are one line are centered. Captions longer than one line are left-aligned.

**Numbering:** To update numbering, highlight all the relevant text (*e.g.*, **Ctrl-A + F9**). This will update all the numbering applicable to tables, figures, equations, and headings.

**Cross-referencing:** To add a cross reference to a figure or table:

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* This is an example reference to Figure 1.

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* 1. Equations

An example equation is shown below:

(1)

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**Cross-referencing:** To create a cross-reference for an equation:

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* Select the number to the right of the equation. Go to **Insert**, **Bookmark** (in the **Links** panel),andthen create a name for your equation. Press **Add** to create the bookmark.
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* This will make it such that whenever a new equation is added, the references to the equation will be updated when **Ctrl-A + F9** is pressed.
* This an example cross-reference to Equation (1).
  1. Accessibility

In an effort to accommodate people who are color-blind (as well as those printing to paper), grayscale readability for all accepted papers is encouraged. Color is not forbidden, but authors should ensure that tables and figures do not rely solely on color to convey critical distinctions. A simple criterion: All curves and points in your figures should be clearly distinguishable without color.

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To remove submission formatting for the camera-ready document, delete the header and footer on the first page (double clicking in the area, then delete the text). This will remove them from the rest of the document. To remove the ruler, highlight the lists of numbers and delete.

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1. Translation of non-English Terms

It is also advised to supplement non-English characters and terms with appropriate transliterations and/or translations since not all readers understand all such characters and terms. Inline transliteration or translation can be represented in the order of:

original-form

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The ACL 2019 main conference accepts submissions of long papers and short papers. Long papers may consist of up to eight (8) pages of content, plus unlimited pages for references. Upon acceptance, final versions of long papers will be given one additional page – up to nine (9) pages with unlimited pages for references – so that reviewers’ comments can be taken into account. Short papers may consist of up to four (4) pages of content, plus unlimited pages for references. Upon acceptance, short papers will be given five (5) pages in the proceedings and unlimited pages for references. For both long and short papers, all figures and tables that are part of the main text must be accommodated within these page limits, observing the formatting instructions given in the present document. Papers that do not conform to the specified length and formatting requirements are subject to be rejected without review.

ACL 2019 does encourage the submission of additional material that is relevant to the reviewers but not an integral part of the paper. There are two such types of material: appendices, which can be read, and non-readable supplementary materials, often data or code. Do not include this additional material in the same document as your main paper. Additional material must be submitted as one or more separate files, and must adhere to the same anonymity guidelines as the main paper. The paper must be self-contained: it is optional for reviewers to look at the supplementary material. Papers should not refer, for further detail, to documents, code or data resources that are not available to the reviewers. Refer to Appendix A and Appendix B and for further information.

Workshop chairs may have different rules for allowed length and whether supplemental material is welcome. As always, the corresponding call for papers is the authoritative source.

1. Multiple Submission Policy

Papers that have been or will be submitted to other meetings or publications must indicate this at submission time. Authors of papers accepted for presentation at ACL 2019 must notify the program chairs by the camera-ready deadline as to whether the paper will be presented. All accepted papers must be presented at the conference to appear in the proceedings. We will not accept for publication or presentation papers that overlap significantly in content or results with papers that will be (or have been) published elsewhere.

Preprint servers such as arXiv.org and ACL-related workshops that do not have published proceedings in the ACL Anthology are not considered archival for purposes of submission. Authors must state in the online submission form the name of the workshop or preprint server and title of the non-archival version. The submitted version should be suitably anonymized and not contain references to the prior non-archival version. Reviewers will be told: “The author(s) have notified us that there exists a non-archival previous version of this paper with significantly overlapping text. We have approved submission under these circumstances, but to preserve the spirit of blind review, the current submission does not reference the non-archival version.” Reviewers are free to do what they like with this information.

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Authors submitting more than one paper to NAACL must ensure that submissions do not overlap significantly (> 25%) with each other in content or results. Authors should not submit short and long versions of papers with substantial overlap in their original contributions.

1. STREAM Tools

This Microsoft Word file was updated in 2016 with STREAM Tools, designed for creating well-formatted reports and papers with Microsoft Word (Mamishev, 2010; Mamishev, 2013).

Acknowledgments

The acknowledgements should go immediately before the references. Do not number the acknowledgments section. Do not include this section when submitting your paper for review.

References

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Dan Gusfield. 1997. *Algorithms on Strings, Trees and Sequences*. Cambridge University Press, Cambridge, UK.

Mary Harper. 2014. [Learning from 26 languages: Pro- gram management and science in the babel program](http://aclweb.org/anthology/C14-1001). In *Proceedings of COLING 2014, the 25th International Conference on Computational Linguistics: Technical Papers*. Dublin City University and Association for Computational Linguistics, page 1. <http://aclweb.org/anthology/C14-1001>.

Alexander V. Mamishev and Murray Sargent. 2013. *Creating Research and Scientific Documents Using Microsoft Word*. Microsoft Press, Redmond, WA.

Alexander V. Mamishev and Sean D. Williams. 2010. *Technical Writing for Teams: The STREAM Tools Handbook*. Wiley-IEEE Press, Hoboken, NJ.

1. Appendices

Appendices are material that can be read, and include lemmas, formulas, proofs and tables that are not critical to the reading and understanding of the paper. Appendices should be **uploaded as supplementary material** when submitting the paper for review. Upon acceptance, the appendices come after the references, as shown here.

1. Supplementary Material

Submissions may include non-readable supplementary material used in the work and described in the paper. Any accompanying software and/or data should include licenses and documentation of research review as appropriate. Supplementary material may report preprocessing decisions, model parameters, and other details necessary for the replication of the experiments reported in the paper. Seemingly small preprocessing decisions can sometimes make a large difference in performance, so it is crucial to record such decisions to precisely characterize state-of-the-art methods.

Nonetheless, supplementary material should be supplementary (rather than central) to the paper. **Submissions that misuse the supplementary material may be rejected without review.** Supplementary material may include explanations or details of proofs or derivations that do not fit into the paper, lists of features or feature templates, sample inputs and outputs for a system, pseudo-code or source code, and data. (Source code and data should be separate uploads, rather than part of the paper).

The paper should not rely on the supplementary material: while the paper may refer to and cite the supplementary material and the supplementary material will be available to the reviewers, they will not be asked to review the supplementary material.

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1. This is how a footnote should appear.

   Note the line separating the footnotes from the text. [↑](#footnote-ref-1)
2. [↑](#footnote-ref-2)