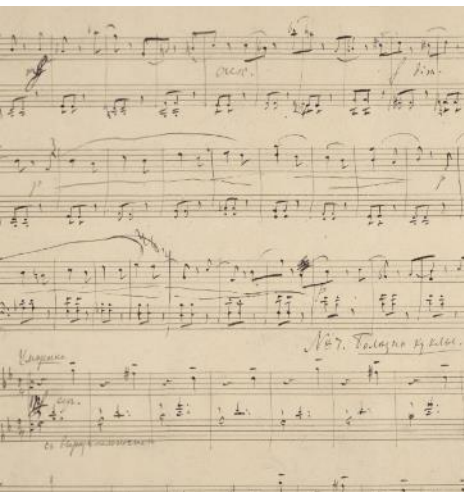




Towards Demystifying Transformations of Tchaikovsky's Children's Album with Support of Computational Models: Problem Conceptualization

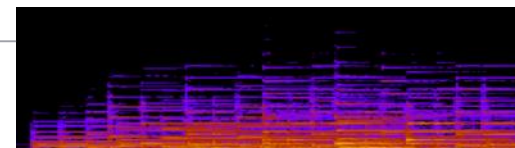


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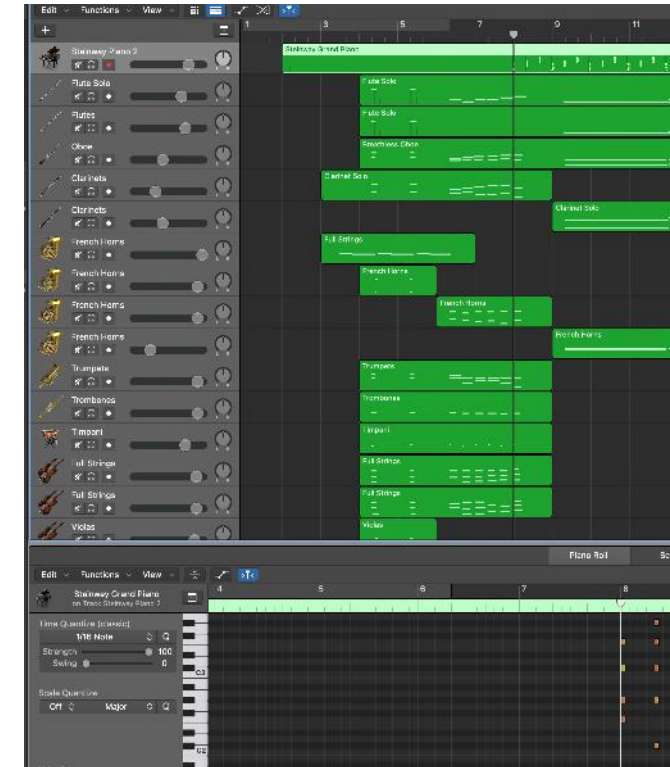


Introduction



Though the studies of rich metaphors hidden in the musical compositions* lay mostly in scope of art and musicology, there is still large space for formal methods based on mathematical models and computer technology that can be helpful in discovering complementary insights to how the composition is structured, what are its relationships to the precursors' works, and how it affects the later works of the same or other authors.

Our idea is to investigate how computational models can enhance musicology research on music style identification and comparative analysis using the case study of Tchaikovsky's Children's Album.



Screen from a demo project made in Logic Pro Piano Concerto No.1 (intro)

** Presentation contains the links to mp3 audio samples of the music compositions by Beethoven, Wagner, Tchaikovsky, Scriabin, and Schumann recorded by the author on Yamaha Arius YDP-144 and Yamaha Clavinova CLP-735 digital pianos and processed using Logic Pro 10.6.3 software*

University of Aizu 会津大学



- The first university in Japan solely dedicated to Computer Science and Engineering



- Aizu-Wakamatsu
 - North-East Japan (Tohoku)
 - Population around 120000
 - Rice, buckwheat, vegetables, persimmon, horse meat
 - Sake production
 - Samurai city
 - International university

日本
福島県
会津若松市

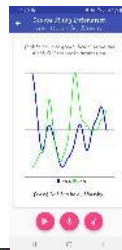


The Speaker: Academic Expertise



Areas of Interest

- Human-centric applications
 - Information systems for travelers
 - Speech processing applications
 - Educational software
- Software engineering and education
- Art and Humanities
 - Classical music and fine arts
 - Architecture and history
 - Opera and ballet

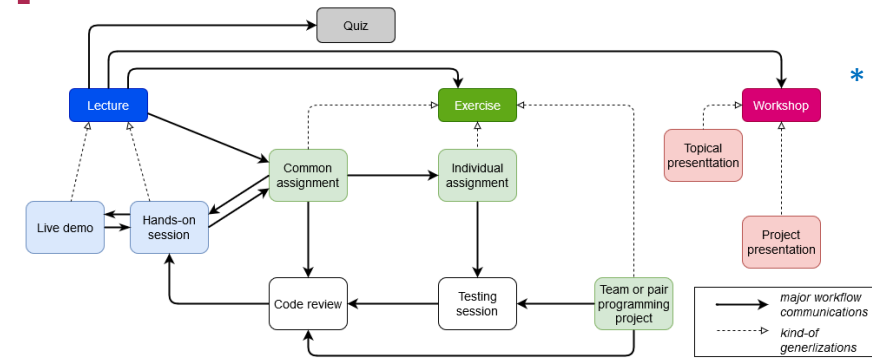
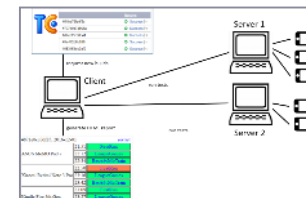


Undergraduate Courses

- Introduction to Programming
- Programming in C
- Introduction to Data Management

Graduate Courses

- Software Development Paradigms



* E. Pyshkin, "On programming classes under constraints of distant learning," 2020 The 4th International Conference on Software and e-Business (ICSEB-2020), Dec 18-20, 2020, Osaka, Japan. ACM, New York, NY, USA, pp. 14-19. DOI: <https://doi.org/10.1145/3446569.3446574>.



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** K. Pain, "The most popular coding languages of 2015", <https://www.linkedin.com/pulse/most-popular-coding-languages-2015-kerry-pain>

Computational Models and Music: Research Questions

- *How computer science and AI may enhance musicology research on music style identification, music generation, music composition, and music analysis?*

- Possible interesting areas

- Improving search algorithms and similarity evaluation
- Advancing tools for music creators
- Links between speech and music processing *
- AI approaches for music generation
- Understanding how humans perceive music

- *Why similarity and resemblance studies are so important?*

- Art and musicology research

- Genesis and development of style
- Citations and allusions

See example next slide...

- Simply “To know that tune...”

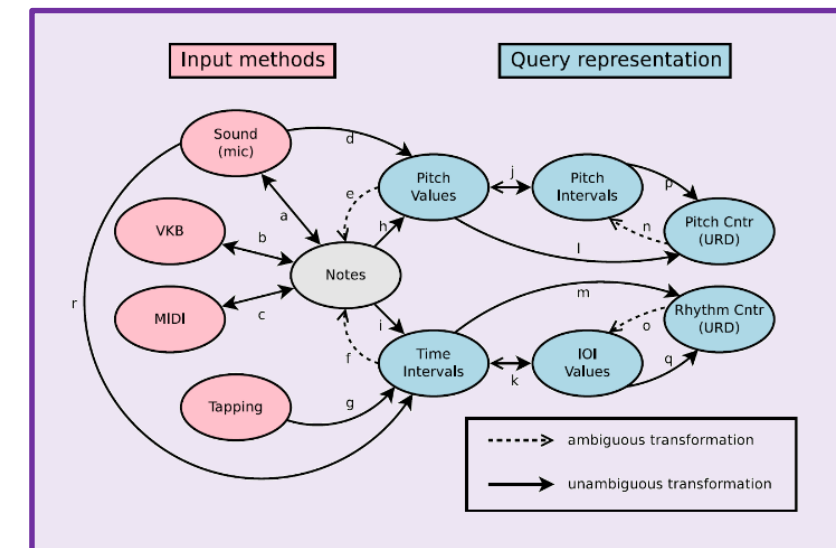
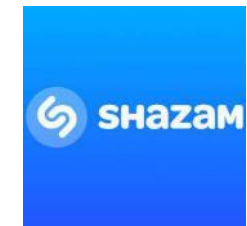
- Commercial applications

- Customers who want to find and purchase compositions they like

- Copyright issues

- Plagiarism in creative works

musipedia
The Open Music Encyclopedia

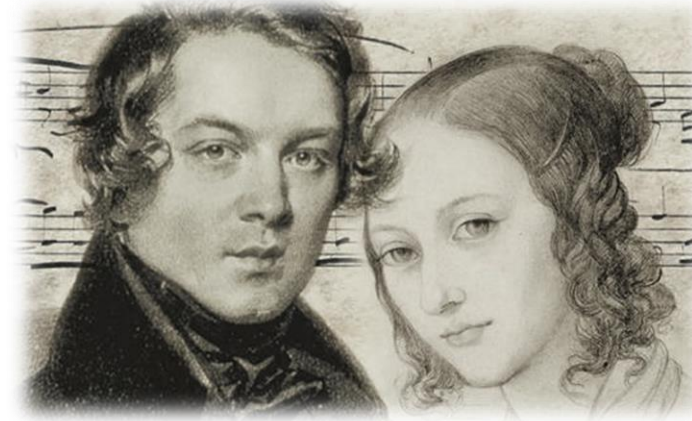


* N. Bogach et al., “Speech Processing for Language Learning (...),” Electronics, 10 (3), 2021.

** M. Purgina, A. Kuznetsov, and E. Pyshkin. “Leveraging user experience through input style transformation to improve access to music search services,” Informatica, 38(1), 2014

Phenomenon of Piotr Tchaikovsky's "Children's Album" *

- Rich metaphors hidden in the pieces thought to be for children naturally lies in the scope of art and musicology, but there is still a large research space for formal methods based on mathematical and computational models
 - Insights into our understanding of the structure and organization of the whole work
 - Relationships to precursors (such as "43 Clavierstücke für die Jugend" ** by Robert Schumann)
 - Argued reasons for significant differences between the original manuscript and the first published edition



ROBERT & KLARA SCHUMANN
1810 – 1856 1819 – 1896



* P. Tchaikovsky, Children's Album. Op 39. Yurgenson, 1878.

** R. Schumann, 43 Piano Pieces for the Youth. Op 68 (Orig. Title in German: 43 Clavierstücke für die Jugend). Schubert and Co., 1848.

Important Notes on the Related Work

- Music is a symbolic fact characterized by the complex configuration of interpretants *
- Great variety of models used for music representation (e.g., different notations and views) is one of reasons why music provides an interesting and complex use case for experimenting with information retrieval, object recognition and classification algorithms
- Music representation complexity can be explained by the presence of two arrays of elements and relationships, where the first one corresponds to the elements that can be treated mathematically (pitch, rhythm, or harmony), while the second one includes non-mathematical elements such as tension, expectancy, and emotion **
- Current approaches to music similarity evaluation mostly target the searching and retrieval systems including well-known apps, such as Shazam
- There is no perfect fit to the problems of stylistic similarity evaluation
- Among the models assumed to be more adequate to the problem of music style identification:
 - Functional representation of music along with harmony and harmonic similarity estimation ***
 - Automated extraction of music signatures ****
 - Modeling music structure using ontology and graph-based representations
 - Classification based on machine learning algorithms

* J.-J. Nattiez, *Music and discourse: Toward a semiology of music*. Princeton University Press, 1990.

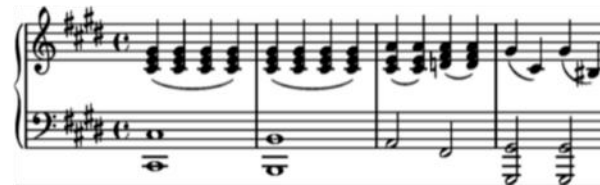
** R. B. Dannenberg, "Music representation issues, techniques, and systems," *Computer Music Journal*, vol. 17, no. 3, 1993, pp. 20–30.

*** J. P. Magalhaes and W. B. de Haas, "Functional modelling of musical harmony: an experience report," *ACM SIGPLAN Notices*, vol. 46, no. 9, 2011, pp. 156–162.

**** D. Cope, *Experiments in Musical Intelligence*. Madison, WI: A-R Edition, 1996.

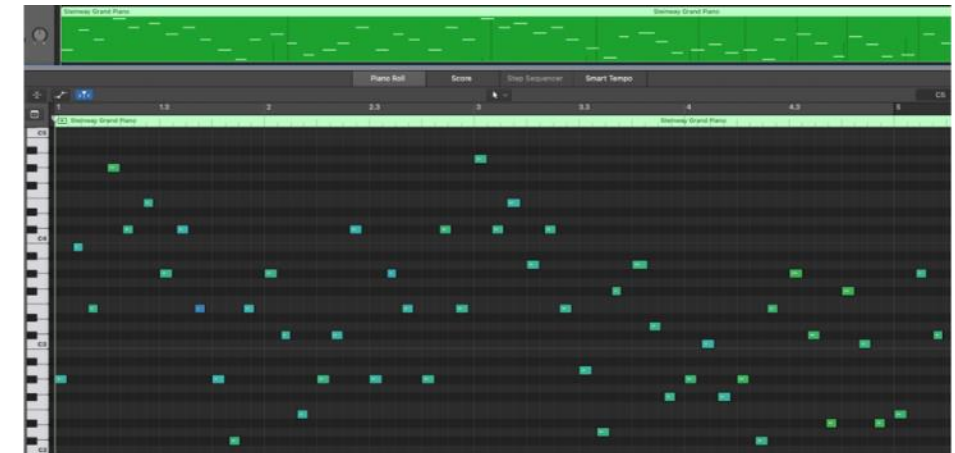
Experiments with Harmonic Similarity

- Listeners can recognize similarity of compositions because of their harmonic similarity



Harmonic similarity contributes to style similarity, but only in part

- However, harmonic equivalence may not be enough to recognize the melody as demonstrated in the experiments with melodies distorted by substituting the note octave by randomly selected ones within three octaves *
- In our example (Beethoven's Moonlight Sonata): every note in the sequence keeps its position on the scale, but the tune varies over a three-octave range



* D. Deutsch, "Octave generalization and tune recognition," *Perception & Psychophysics*, vol. 11, no. 6, 1972, pp. 411–412; W. R. Thurlow and W. P. Erchul, "Judged similarity in pitch of octave multiples," *Perception & Psychophysics*, vol. 22, no. 2, 1977, pp. 177–182.

Study on Relationships to Schumann's Works

- Admitting Schumann's influence to Tchaikovsky does not lead us to automatically judge the "Children's Album" as an imitation of Schumann's pieces for the young (also with long history of editions but rather few scholarly studies *)

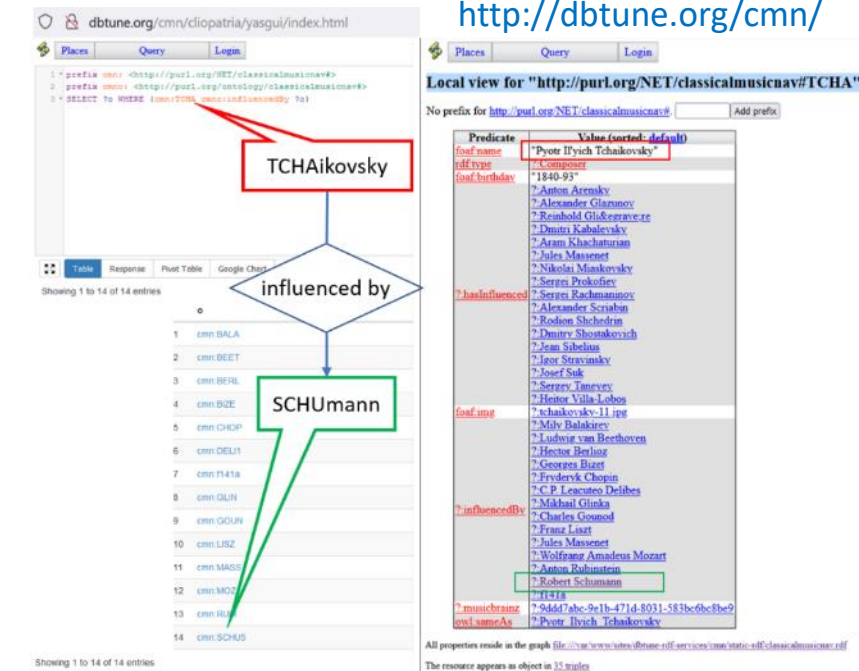
CASE STUDY: SOME OBVIOUS (?) PARALLELS in TWO "ALBUMS for the YOUNG"

Schumann Op 68	Tchaikovsky Op 39
<u>Humming Song</u>	<u>Mama</u> (3)
<u>Soldier</u>	<u>March of Wooden Soldiers</u> (5)
<u>Chorale</u>	<u>In Church</u> (23)
<u>Sicilienne</u>	<u>Old French Song</u> (16)
<u>First Loss</u>	<u>The Doll is Sick</u> (7)
<u>Sheherazade</u>	<u>Sweet Dream</u> (21)
<u>Echoes from the Theatre</u>	<u>Waltz</u> (9)

Challenges

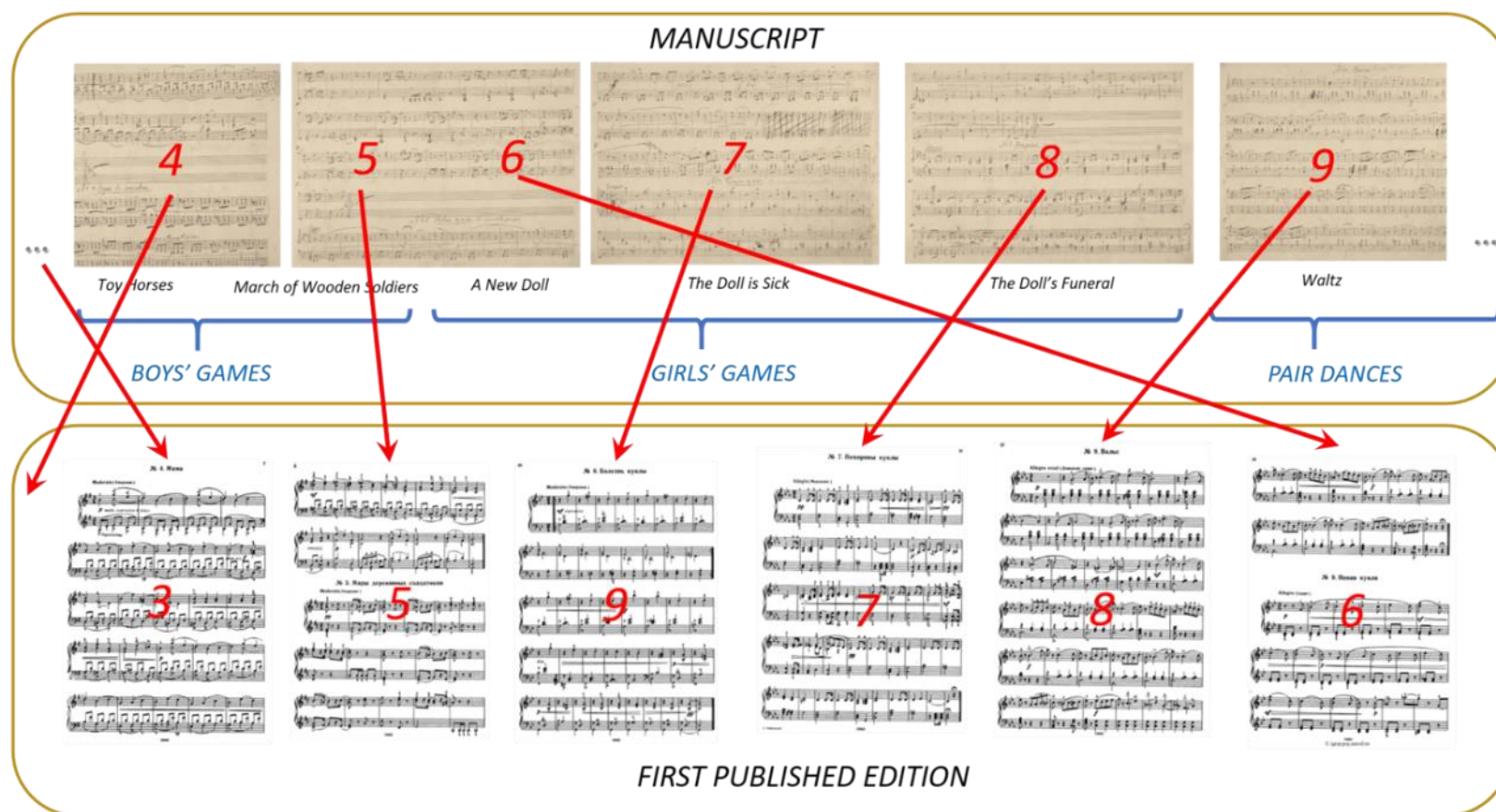
- In the process of study, we need to investigate, what are the suitable computational approaches that may contribute to style identification.
- Because of the subjectivity of style attribution and style dependency analysis, a possibility to construct and assess different computational models should be considered.
- It may be that particular models can contribute to particular characteristics of music style recognition.

* B. R. Appel, Actually, taken directly from family life: Robert Schumann's Album fur die Jugend. Princeton University Press, 2014, pp. 171–202. [Online]. Available: <https://doi.org/10.1515/9781400863860.171>



Structural Transformations of “Children’s Album”: Case Study and Research Question

- Changes in order destroyed the structure of the album as an indissociable whole, and deformed the micro-cycles existing in the manuscripts.
- Can computations models be helpful in better understanding why that changes took place?



- Micro-cycles in “Children’s Album”
(original order – examples)

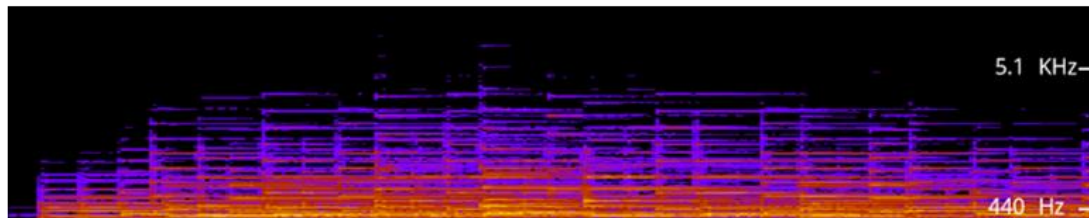
- Morning/Birth
 - 1. Morning Prayer
 - 2. Winter Morning
 - 3. Mama
- Boy’s Games
 - 4. Toy Horse Play
 - 5. March of Wooden Soldiers
- Girl’s Games
 - 6. A New Doll
 - 7-8. The Doll is Sick and The Doll’s Funeral
- Pair Dances
 - 9. Waltz
 - ...

Perhaps
O.k. ☺...

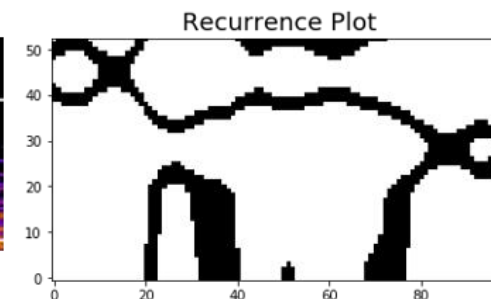
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Other Promising Approaches to be Studied

- Detection similarity using signal processing algorithms
- Grouping compositions based on weaker traits of similarity in their themes and sub-themes
- Acoustic spectral fingerprints for unique identification of the music fragments
- Combining the problem of music style identification with the approaches to music generation
- Detecting recurrences and irregular cyclicities if considering music as a semi-chaotic natural process (as in automated speech analysis)



Spectrogram of "A New Doll"
(first 30 measures, Recorded at
Yamaha YDP-144 by Evgeny Pyshkin)



Recurrence plot of the
spoken pitch

There are still
many questions,
challenges, and
open areas...

Conclusion



In this study, the problem of music style identification is sketched via a brief analysis of computational models and technical solutions that may be helpful to musicologists in their research on genesis and implications of musical compositions with an example of exploring the links between Tchaikovsky's "Children Album" and Schumann's "Album for the Youth". With the help of computer technology we can discover more findings to support meaningful hypotheses about the possible reasons explaining significant discrepancies between Tchaikovsky's manuscript and the following editions of "Children's Album".

Naturally, the outcomes from such compact joint musicology and computer science studies can address the broader scope of research on music style understanding, modeling, and recognition for the benefit of both computer technology and humanities so as to provide interesting use cases for AI applications as well as *"a further strand of evidence for systematic musicology to exploit"* as nicely formulated by Collins*.

* N. Collins, "Computational analysis of musical influence: A musicological case study using MIR tools." in ISMIR, 2010, pp. 177–182.

Acknowledgment

Many thanks to Natalia Bogach, John Blake, and Andrey Kuznetsov for their helpful suggestions during our discussions of this study. The work is supported by the University of Aizu Research Funding.