Carlos Eduardo Cancino-Chacón

PERSONAL DETAILS

Birth	June 6, 1986
Citizenship	Austrian, Mexican
Address	Institute of Computational Perception Johannes Kepler University Linz Wiesingerstrasse 4 A-1010, Vienna, Austria
E-Mail	carloscancinochacon@gmail.com
Website	http://www.carloscancinochacon.com
GitHub	https://github.com/neosatrapahereje
Orcid	0000-0001-5770-7005

MAIN AREAS OF RESEARCH

- Musical Informatics
- Computational models of expressive music performance and music expectation
- Human–Computer interaction in music performance (automatic accompaniment systems, interfaces for musical expression)
- Cognitively-plausible computational models of music analysis and music cognition
- Machine learning (deep learning, probabilistic models)

ACADEMIC QUALIFICATIONS

Doctoral degree in Computer Science 10/2014–12/2018
Johannes Kepler University of Linz, Austria
Supervisor: Gerhard Widmer
Co-supervisor: Maarten Grachten
Thesis: Computational Modeling of Expressive Music Performance Through Linear and Non-linear Basis Function Models

Master's degree in Electrical Engineering and Audio Engineering 10/2011–07/2014
Graz University of Technology/University of Music and Performing Arts Graz, Austria
Supervisor: Franz Pernkopf
Thesis: Tarkus Belief Propagation: On Message Passing Algorithms and Computational Commutative Algebra

Undergraduate degree in Physics 08/2005–03/2011
National Autonomous University of Mexico, Mexico City, Mexico
Supervisor: Marcos Ley Koo
Thesis: Análisis teórico experimental de transductores de ultrasonido tipo Langevin (*Theoretical–experimental analysis of ultrasonic Langevin transducers*)

Undergraduate degree in Piano Performance 09/1999–02/2011
National Conservatory of Music, Mexico City, Mexico
Supervisor: Héctor Alfonso Rojas Ramírez

RESEARCH EXPERIENCE

Assistant Professor 10/2020-present
Institute of Computational Perception
Johannes Kepler University Linz, Austria

Guest Researcher 01/2020-10/2021
RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion
University of Oslo, Norway
Project: MIRAGE

Postdoctoral Researcher 12/2018-09/2020
Austrian Research Institute for Artificial Intelligence, Vienna, Austria
Intelligent Music Processing and Machine Learning Group
Project: Con Espressione
Supervisor: Gerhard Widmer

Doctoral Researcher 01/2014-11/2018
Austrian Research Institute for Artificial Intelligence, Vienna, Austria
Intelligent Music Processing and Machine Learning Group
Projects:

- Lrn2Cre8 (01/2014 – 09/2016)
  Supervisors: Maarten Grachten and Gerhard Widmer
- Con Espressione (10/2016 – 11/2018)
  Supervisor: Gerhard Widmer

TEACHING AND SUPERVISION

External Lecturer 03/2023-present
University of Music and Performing Arts Vienna, Austria

- Musical Computing (PhD level)

Assistant Professor 10/2020-present
Johannes Kepler University Linz, Austria

- Musical Informatics (undergraduate/master's level)
- Reinforcement Learning (undergraduate level)
- Machine Learning and Pattern Classification (exercise track; undergraduate/master's level)
- Seminars in Data Science and Artificial Intelligence (undergraduate and master's level)
- Artificial Intelligence (exercise track; undergraduate level)

Guest Lecturer 2020-2021
National Autonomous University of Mexico, Mexico City, Mexico

- Guest Lecture on Artificial Intelligence for History of Psychology (first year undergraduate level). November 2020 and November 2021.

Course Lecturer 01/2011-07/2011
National Conservatory of Music, Mexico City, Mexico

- Elementary Music Theory I
- Harmony (Levels I-III)

Supervision/Co-Supervision

Johannes Kepler University Linz, Austria

- **Huan Zhang** (06/2022-present) External PhD Mentor as part of the AIM Mentoring Programme at Queen Mary University of London (main supervisor: Simon Dixon).
- **Ivan Pilkov** (Master's Thesis, expected Spring 2024). Automatic Pose Estimation for Kinematic Analysis of the Arm-Hand-Fingers Chain of Pianists.
- **Li-An Lin** (Bachelor's thesis, expected Spring 2024). Automatic Anime Soundtrack Generation
- **Alexander Deutschbauer** (Bachelor's thesis, expected Fall 2023). TPDD: A Dataset for Automatic Difficulty Estimation of Solo Piano Pieces.
- **Julian Bakan** (Bachelor's thesis, expected Fall 2023) A Systematic Comparison of Dynamic Time Warping and Hidden Markov Models for Symbolic Score-to-Performance alignment.
- **Uros Zivanovic** (Bachelor's thesis, September 2023). Transformers for Piano Playing Detection and Note Detection from Video.
- **Jasmin Roll** (Bachelor's thesis, September 2023). Evaluating Real-Time Audio-to-Audio Alignment using OLTW and HMM on Piano and Violin Music.
- **Simon Bauer** (Master's Project, July 2023). Computer-Generated Music for Traditionally Non-Musical Story Experiences.
- **CoPeWithUs Team** (03/2022-06/2022) Co-supervised a team of 4 master's students (Anna Hausberger, Christoph Pichler, Ivan Pilkov and Jakob Wögerbauer) who participated in the AI Song Contest 2022.

Austrian Research Institute for Artificial Intelligence, Vienna, Austria

- **Simon Bahadoran** (Summer Internship/Master's Thesis/Summer 2020). Development of an encoder-decoder model for conditional prediction of expressive piano performance.
- **Martin Bonev** (2017-2019). Development of a polyphonic score follower for an expressive accompaniment system.
- **Federico Simonetta** (Summer Internship/Summer 2018). Main melody line identification from symbolic scores using convolutional neural networks.

ACADEMIC ACTIVITIES

REVIEWING

1. **International Scientific Journals**
   - Journal of New Music Research, Neural Computing and Applications, Applied Sciences, Transactions of the International Society of Music Information Retrieval, Frontiers in Psychology, Music Perception.
2. **International Conferences**
   - International Society for Music Information Retrieval Conference, International Joint Conference on Artificial Intelligence, Sound & Music Computing Conference, Biennial International Conference on Mathematics and Computation in Music, International Workshop on Deep Learning for Music.

INVITED SCIENTIFIC TALKS AND TUTORIALS

1. Cancino-Chacón, C. (June 2023) "Towards Understanding Emotion Communicated Through Performance of Orchestral Music: Preliminary Results", invited talk at the 2nd MIRAGE Symposium, RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, University of Oslo, Norway.

2. Cancino-Chacón, C., Peter, S., Karystinaios, E., Foscarin, F., (December 2022)"An Introduction to Symbolic Music Processing with Partitura", tutorial session at the 23rd International Society for Music Information Retrieval Conference, Bengaluru, India

3. Cancino-Chacón, C. (September 2022) "Play it Again, Hall 9000! Towards Expressive Computational Music Performers" invited talk at the Max Planck Institute for Intelligent Systems, Tübingen, Germany

4. Cancino-Chacón, C. (March 2022) "Decoding Communicated Emotion in Expressive Music Performance (of the Rach 3!)", invited talk at the MIRAGE Workshop, University of Oslo, Norway

5. O. Lartillot, E. Guldbransen, C. E. Cancino-Chacón (June 2021), "Dynamics analysis, and application to a comparative study of Bruckner performances" Invited Talk at the Mirage Symposium #1: Computational Musicology, RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, University of Oslo, Norway.

6. Cancino-Chacón C. (April 2020) "I'll be Bach! Modeling Expressive Performance with Machine Learning", invited talk at the Food & Paper Talk Series, RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, University of Oslo, Norway.

7. Cancino-Chacón C. (March 2020) "Machine Listening of Orchestral Music", invited talk at the Workshop on Musical Listening, University of Oslo, Norway.

8. Cancino-Chacón, C., Kosta, K. and Grachten, M. (November 2019) "Computational Models of Expressive Performance", tutorial session at the 20th International Society for Music Information Retrieval Conference, Delft, The Netherlands.

9. Cancino-Chacón, C. (March 2019) "Modeling Expressive Music Performance with Non-linear Basis Function Models", invited talk at the Deep Learning Seminar, University of Vienna, Austria.

10. Cancino-Chacón, C. (January 2019) "Computational Modeling of Expressive Music Performance with Linear and Non-linear Basis Function Models", invited talk at the Austrian Research Institute for Artificial Intelligence, Vienna, Austria.

11. Cancino-Chacón, C. (November 2016) "¿Escuchan los androides música electrónica?", invited talk at the Pláticas DeMentes talk series. Faculty of Psychology, National Autonomous University of Mexico.

12. Cancino-Chacón, C. (November 2016) "En busca del factor Mozart", invited talk at the National Conservatory of Music, Mexico City, Mexico.

AWARDS AND GRANTS

Award for Creative Achievement 06/2017
AccompaniX Competition, 2017 Turing Tests in the Creative Arts.
$500 team award for development of an expressive computer accompaniment system.
Fundación INBA – CONACYT Scholarship
Mexican National Council for Science and Technology 10/2012-02/2014

PUBLICATIONS

PEER REVIEWED PUBLICATIONS

1. Zhang, H., Karystinaios, E., Dixon, S., Widmer, G., and Cancino-Chacón, C. (2023). Symbolic Music Representations for Classification Tasks: A Systematic Evaluation. In *Proceedings of the 24th International Society for Music Information Retrieval Conference (ISMIR 2023)*, Milan, Italy

2. Peter, S. D., Cancino-Chacón, C. E., Foscarin, F., McLeod, A. P., Henkel, F., Karystinaios, E., and Widmer, G. (2023). Automatic Note-Level Score-to-Performance Alignments in the ASAP Dataset. *Transactions of the International Society for Music Information Retrieval*

3. Cancino-Chacón, C., Peter, S., Hu, P., Karystinaios, E., Henkel, F., Foscarin, F., and Widmer, G. (2023). The ACCompanion: Combining Reactivity, Robustness, and Musical Expressivity in an Automatic Piano Accompanist. In *Proceedings of the Proceedings of the 32nd International Joint Conference on Artificial Intelligence (IJCAI-23)*, Macao, S. A. R

4. Cancino-Chacón, C. E. (2023). Commentary on A Computational Approach to the Detection and Prediction of (Ir)Regularity in Children's Folk Songs. *Empirical Musicology Review*, 6(2)

5. Cancino-Chacón, C., Peter, S. D., Karystinaios, E., Foscarin, F., Grachten, M., and Widmer, G. (2022b). Partitura: A Python Package for Symbolic Music Processing. In *In Proceedings of the Music Encoding Conference (MEC2022)*, Halifax, Canada

6. Foscarin, F., Karystinaios, E., Peter, S. D., Cancino-Chacón, C., Grachten, M., and Widmer, G. (2022). The match file format: Encoding Alignments between Scores and Performances. In *In Proceedings of the Music Encoding Conference (MEC2022)*, Halifax, Canada

7. Bishop, L., Cancino-Chacón, C., and Goebl, W. (2021). Beyond synchronization: How and why do ensemble performers communicate. In Timmers, R., Bailes, F., and Daffern, H., editors, *Together in Music: Participation, Co-Ordination, and Creativity in Ensembles*. Oxford University Press

8. Cancino-Chacón, C., Peter, S., Chowdhury, S., Aljanaki, A., and Widmer, G. (2020). On the Characterization of Expressive Performance in Classical Music: First Results of the *Con Espressione* Game. In *Proceedings of the 21th International Society for Music Information Retrieval Conference (ISMIR 2020)*, Montreal, Canada

9. Lartillot, O., Cancino-Chacón, C., and Brazier, C. (2020). Real-Time Visualization of Fugue Played by a String Quartet. In *Proceedings of the 17th Sound and Music Computing Conference (SMC2020)*, Torino, Italy

10. Bishop, L., Cancino-Chacón, C., and Goebl, W. (2019b). Moving to communicate, moving to interact: Patterns of body motion in musical duo performance. *Music Perception*, 37(1):1–25

11. Bishop, L., Cancino-Chacón, C., and Goebl, W. (2019a). Eye gaze as a means of giving and seeking information during musical interation. *Consciousness & Cognition*, 68:73–96

12. Simonetta, F., Cancino-Chacón, C., Ntalampiras, S., and Widmer, G. (2019). A Convolutional Approach to Melody Line Identification in Symbolic Scores. In *Proceedings of the 20th International Society for Music Information Retrieval Conference (ISMIR 2019)*, Delft, The Netherlands

13. Cancino-Chacón, C., Grachten, M., Goebl, W., and Widmer, G. (2018). Computational Models of Expressive Music Performance: A Comprehensive and Critical Review. *Frontiers in Digital Humanities*, 5:25

14. Velarde, G., Cancino-Chacón, C., Meredith, D., Weyde, T., and Grachten, M. (2018). Convolution-based classification of audio and symbolic representations of music. *Journal of New Music Research*, 47(3):191–205. doi: 10.1080/09298215.2018.1458885

15. Cancino-Chacón, C. E., Gadermaier, T., Widmer, G., and Grachten, M. (2017d). An Evaluation of Linear and Non-linear Models of Expressive Dynamics in Classical Piano and Symphonic Music. *Machine Learning*, 106(6):887–909

16. Grachten, M., Cancino-Chacón, C. E., Gadermaier, T., and Widmer, G. (2017). Towards computer-assisted understanding of dynamics in symphonic music. *IEEE Multimedia*, 24(1):36–46

17. Cancino-Chacón, C., Grachten, M., Sears, D. R. W., and Widmer, G. (2017c). What Were You Expecting? Using Expectancy Features to Predict Expressive Performances of Classical Piano Music. In *Proceedings of the 10th International Workshop on Machine Learning and Music (MML 2017)*, Barcelona, Spain

18. Cancino-Chacón, C., Grachten, M., and Agres, K. (2017b). From Bach to The Beatles: The Simulation of Human Tonal Expectation Using Ecologically-Trained Predictive Models. In *Proceedings of the 18th International Society for Music Information Retrieval Conference (ISMIR 2017)*, Suzhou, China

19. Grachten, M. and Cancino-Chacón, C. E. (2017). Temporal dependencies in the expressive timing of classical piano performances. In Lessafre, M., Maes, P.-J., and Leman, M., editors, *The Routledge Companion to Embodied Music Interaction*, pages 360–369. Routledge

20. Velarde, Gissel and Weyde, Tillman and Cancino Chacón, Carlos and Meredith, David and Grachten, Maarten (2016). Composer Recognition Based On 2D-Filtered Piano Rolls. In *Proceedings of the 17th International Society for Music Information Retrieval Conference (ISMIR 2016)*, pages 116–121, New York, NY, USA

21. Gadermaier, T., Grachten, M., and Cancino-Chacón, C. E. (2016). Basis-Function Modeling of Loudness Variations in Ensemble Performance. In *Proceedings of the 2nd International Conference on New Music Concepts (ICNMC 2016)*, Treviso, Italy

22. Cancino Chacón, C. E. and Grachten, M. (2015). An Evaluation of Score Descriptors Combined with Non-linear Models of Expressive Dynamics in Music. In *Proceedings of the 18th International Conference on Discovery Science (DS 2015)*, pages 48–62, Banff, AB, Canada

23. Agres, K., Cancino, C., Grachten, M., and Lattner, S. (2015). Harmonics co-occurrences bootstrap pitch and tonality perception in music: Evidence from a statistical unsupervised learning model. In *Proceedings of the Annual Meeting of the Cognitive Science Society (CogSci 2015)*, Pasadena, CA, USA

24. Lattner, S., Grachten, M., Agres, K., and Cancino Chacón, C. E. (2015b). Probabilistic Segmentation of Musical Sequences using Restricted Boltzmann Machines. In *Fifth International Conference on Mathematics and Computation in Music (MCM 2015)*, London, UK

25. Lattner, S., Cancino Chacón, C. E., and Grachten, M. (2015a). Pseudo-Supervised Training Improves Unsupervised Melody Segmentation. In *In Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence (IJCAI 2015)*, pages 2459–2465, Buenos Aires, Argentina

26. Cancino Chacón, C. E. and Mowlaee, P. (2014). Least Squares Phase Estimation of Mixed Signals. In *15th Annual Conference of the International Speech Communication Association (INTERSPEECH 2014)*, Singapore

27. Cancino Chacón, C., Lattner, S., and Grachten, M. (2014a). Developing Tonal Perception Through Unsupervised Learning. In *Proceedings of the 15th International Society for Music Information Retrieval Conference (ISMIR 2014)*, pages 195–200, Taipei, Taiwan

28. Grachten, M., Cancino Chacón, C. E., and Widmer, G. (2014). Analysis and Prediction of Expressive Dynamics Using Bayesian Linear Models. In *Proceedings of the 1st International*

Workshop on Computer and Robotic Systems for Automatic Music Performance (SAMP 14), pages 545–552, Venice, Italy

29. Tschiatschek, S., Cancino Chacón, C. E., and Pernkopf, F. (2013). Bounds for Bayesian network classifiers with reduced precision parameters. In *Proceedings of the 2013 International Conference on Acoustics, Speech and Signal Processing (ICASSP 2013)*, pages 3357–3361, Vancouver, Canada. IEEE

EXTENDED ABSTRACTS

1. Cancino-Chacón, C., Peter, S., and Widmer, G. (2022a). Can We Achieve Togetherness with an Artificial Partner? Insights and Challenges from Developing an Automatic Accompaniment System. In *Abstracts of the Musical Togetherness Symposium (MTS)*, Vienna, Austria

2. Cancino-Chacón, C., Peter, S., Karystinaios, E., and Widmer, G. (2021b). Towards Quantifying Differences in Expressive Piano Performances: Are Euclidean-like Distance Measures Enough? In *In Proceedings of the Rhythm and Perception Workshop (RPPW2021)*, Oslo, Norway

3. Cancino-Chacón, C., Peter, S., Chowdhury, S., Aljanaki, A., and Widmer, G. (2021a). Sorting Musical Expression: Characterization of Descriptions of Expressive Piano Performances. In *In Proceedings of the 16th International Conference on Music Perception and Cognition (ICMPC16-ESCOM11)*, Sheffield, UK

4. Cancino-Chacón, C. E., Balke, S., Henkel, F., Stussak, C., and Widmer, G. (2019). The *Con Espressione!* Exhibit: Exploring Human–Machine Collaboration in Expressive Performance. In *Late Breaking/ Demo, 20th International Society for Music Information Retrieval Conference (ISMIR 2019)*, Delft, The Netherlands

5. Grachten, M., Cancino-Chacón, C., and Gadermaier, T. (2019). partitura: A Python Package for Handling Symbolic Musical Data. In *Late Breaking/ Demo, 20th International Society for Music Information Retrieval Conference (ISMIR 2019)*, Delft, The Netherlands

6. Weigl, D., Cancino-Chacón, C., Bonev, M., and Goebl, W. (2019). Linking and Visualising Performance Data and Semantic Music Encodings in Real-Time. In *Late Breaking/ Demo, 20th International Society for Music Information Retrieval Conference (ISMIR 2019)*, Delft, The Netherlands

7. Shi, Z., Cancino-Chacón, C., and Widmer, G. (2019). User Curated Shaping of Expressive Performances. In *Proceedings of the Workshop on Machine Learning for Music Discovery, 36th International Conference on Machine Learning (ICML 2019) (Invited Paper)*, Long Beach, CA, USA

8. Cancino-Chacón, C. and Grachten, M. (2018). A Computational Study of the Role of Tonal Tension in Expressive Piano Performance. In *Proceedings of the 15th International Conference on Music Perception and Cognition (ICMPC15 ESCOM10)*, Graz, Austria

9. Bishop, L., Cancino-Chacón, C. E., and Goebl, W. (2018). Visual Signals between Improvisers Indicate Attention rather than Intentions. In *Proceedings of the 15th International Conference on Music Perception and Cognition (ICMPC15 ESCOM10)*, Graz, Austria

10. Cancino-Chacón, C., Bonev, M., Durand, A., Grachten, M., Arzt, A., Bishop, L., Goebl, W., and Widmer, G. (2017a). The ACCompanion v0.1: An Expressive Accompaniment System. In *Late Breaking/ Demo, 18th International Society for Music Information Retrieval Conference (ISMIR 2017)*, Suzhou, China

11. Bishop, L., Cancino-Chacón, C., and Goebl, W. (2017). Mapping Visual Attention of Duo Musicians During Rehearsal of Temporally-Ambiguous Music. In *Proceedings of the International Symposium on Performance Science (ISPS 2017)*, Reykjavik, Iceland

12. Cancino Chacón, C. E. and Grachten, M. (2016). The Basis Mixer: A Computational Romantic Pianist. In *Late Breaking/ Demo, 17th International Society for Music Information Retrieval Conference (ISMIR 2016)*, New York, NY, USA

TECHNICAL REPORTS

1. Cancino-Chacón, C. E. and Grachten, M. (2016). Rendering Expressive Performances of Musical Pieces Through Sampling From Generative Probabilistic Models. Technical Report OFAI-TR-2014-01, Austrian Research Institute for Artificial Intelligence, Vienna, Austria

2. Grachten, M. and Cancino Chacón, C. E. (2015). Strategies for Conceptual Change in Convolutional Neural Networks. Technical Report OFAI-TR-2015-04, Austrian Research Institute for Artificial Intelligence, Vienna, Austria

3. Cancino Chacón, C. E., Grachten, M., and Widmer, G. (2014b). Bayesian Linear Basis Models with Gaussian Priors for Musical Expression. Technical Report OFAI-TR-2014-12, Austrian Research Institute for Artificial Intelligence, Vienna, Austria