

Master Thesis

## Performance Analysis for Statistical Spectral Modeling

Statistical Spectral Modeling [6] offers a method for transferring a sample library of musical instrument sounds into a data set for the use in expressive sound synthesis. Based on sinusoidal modeling [4], the recorded sounds are decomposed into temporal trajectories, describing the tonal and the stochastic part of the signal. Subsequently the temporal axis is eliminated by calculating probability distributions for the obtained trajectories. Frequency domain aspects of the stochastic processes are captured by means of Markov chains.

The recent analysis system for the generation of statistical models works in Matlab with a previously annotated sample library of single instrument sounds [7, 5]. The production of new sets for synthesis thus needs preparations and properly formatted data. Using methods for the automatic analysis of musical performances [1, 2, 3], this process can be fully automated and fed with arbitrary recordings. The thesis includes the implementation of a C++ based unsupervised analysis algorithm, based on established methods for monophonic music.

### Requirements

- interest in spectral modeling synthesis
- knowledge in audio content analysis and machine learning
- profound knowledge in Python/Matlab and C++

### References

- [1] J.P Bello, G Monti, and M Sandler. Techniques for Automatic Music Transcription. In *First International Symposium on Music Information Retrieval (ISMIR-00)*, Plymouth, Massachusetts, USA, 2000.
- [2] C.G. Boogaart and R. Lienhart. Note Onset Detection for the Transcription of Polyphonic Piano Music. In *IEEE International Conference on Multimedia and Expo (ICME)*, page 446–449, 2009.
- [3] Yixing Guan, Jinyu Zhao, Yiqin Qiu, Zheng Zhang, and Gus Xia. Melodic phrase segmentation by deep neural networks. In *ICMC*, 2018.
- [4] Xavier Serra. *A SYSTEM FOR SOUND ANALYSIS/TRANSFORMATION/SYNTHESIS BASED ON A DETERMINISTIC PLUS STOCHASTIC DECOMPOSITION*. PhD thesis, Stanford University, 1989.
- [5] Henrik von Coler. TU-Note Violin Sample Library – A Database of Violin Sounds with Segmentation Ground Truth. In *Proceedings of the 21st International Conference on Digital Audio Effects (DAFx)*, Aveiro, Portugal, 2018.
- [6] Henrik von Coler. Statistical Sinusoidal Modeling for Expressive Sound Synthesis. In *Proceedings of the 22nd International Conference on Digital Audio Effects (DAFx)*, Birmingham, UK, 2019.
- [7] Henrik von Coler, Jonas Margraf, and Paul Schuladen. TU-Note Violin Sample Library. TU Berlin, <http://dx.doi.org/10.14279/depositonce-6747>, 2018. Data set.

### Supervisors

Henrik von Coler	E-N 323	<a href="mailto:voncoler@tu-berlin.de">voncoler@tu-berlin.de</a>
Prof. Dr. Stefan Weinzierl	E-N 322	<a href="mailto:stefan.weinzierl@tu-berlin.de">stefan.weinzierl@tu-berlin.de</a>