The Basis Mixer: A Computational Romantic Pianist

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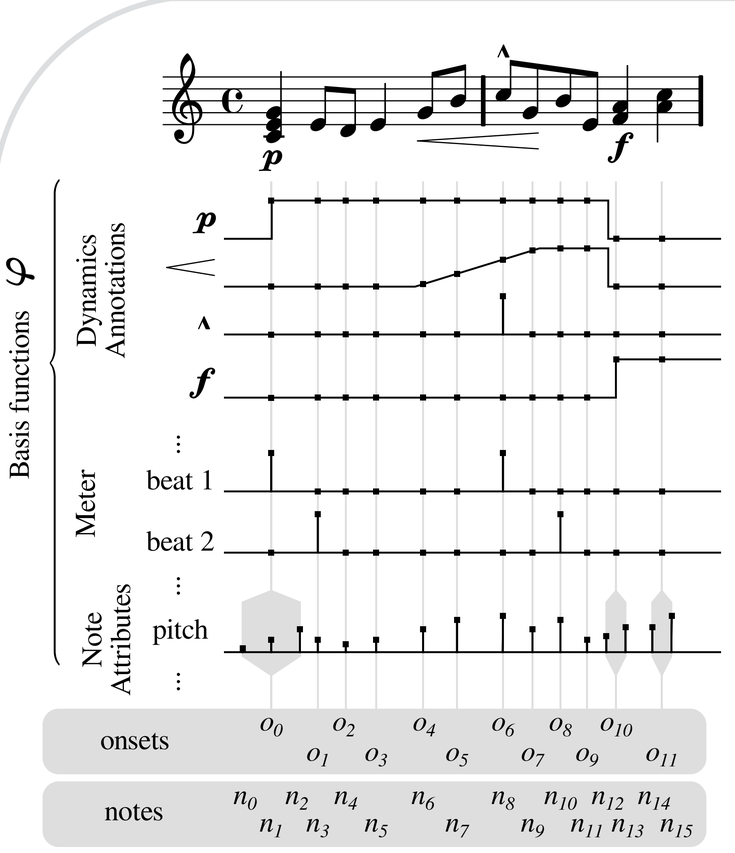
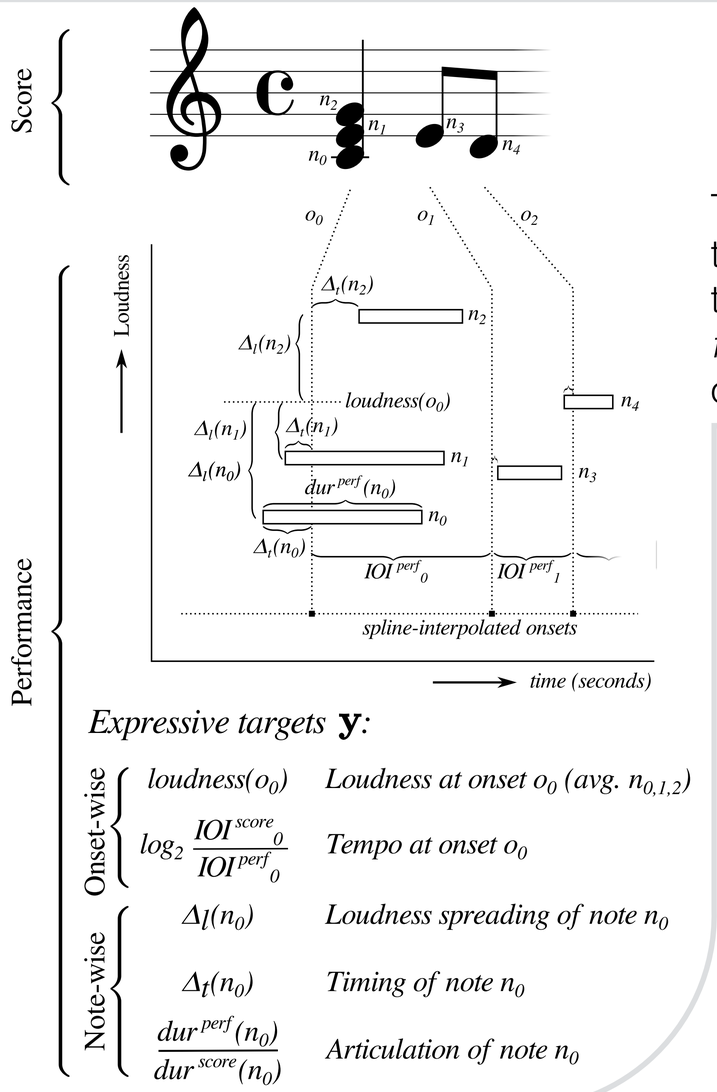
The Basis Mixer is a basis modeling framework for musical expression. This framework uses numerical encodings of musical scores (basis functions) to learn from human music performances how music is performed in an expressive manner. After it has been trained, it can be used to synthesize expressive performances of musical scores.





Expressive targets $\mathbf{y}$*:*

Onset-wise	$loudness(o_0)$	*Loudness at onset o_0 (avg. $n_{0,1,2}$)*
Onset-wise	$\log_2 \frac{IOI^{score}{}_0}{IOI^{perf}{}_0}$	*Tempo at onset o_0*
Note-wise	$\Delta_l(n_0)$	*Loudness spreading of note n_0*
Note-wise	$\Delta_t(n_0)$	*Timing of note n_0*
Note-wise	$\frac{dur^{perf}(n_0)}{dur^{score}(n_0)}$	*Articulation of note n_0*

Score Representation and Expressive Targets

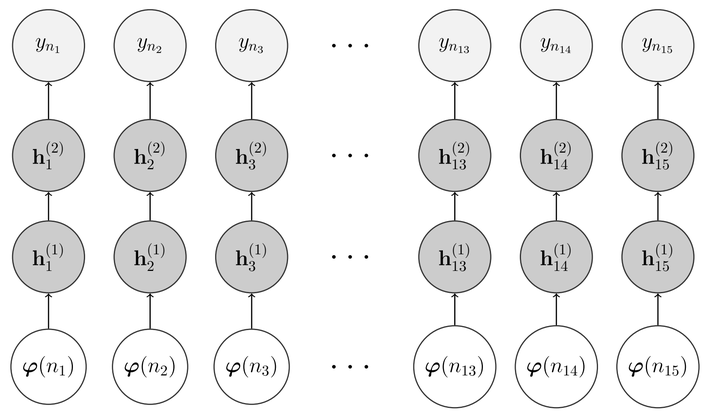
The BM framework models numerical descriptors that encode an expressive performance, referred to as *expressive targets* $\mathbf{y}$, as a function of *basis functions* φ, i.e. numerical encodings of a variety of descriptors of a musical score.

Regression

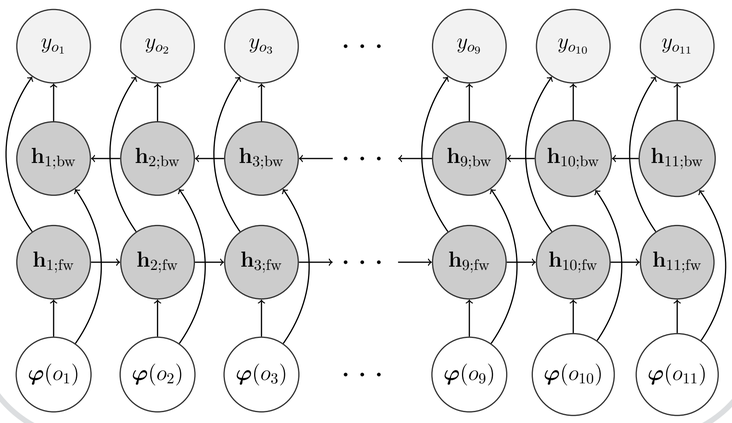
Note-wise targets (Loudness spreading, Timing, and Articulation) are predicted using (static) feed-forward neural networks.

Onset-wise targets (Loudness, Tempo) are predicted using (temporal) bi-directional recurrent neural networks.

Note-wise: FFNN

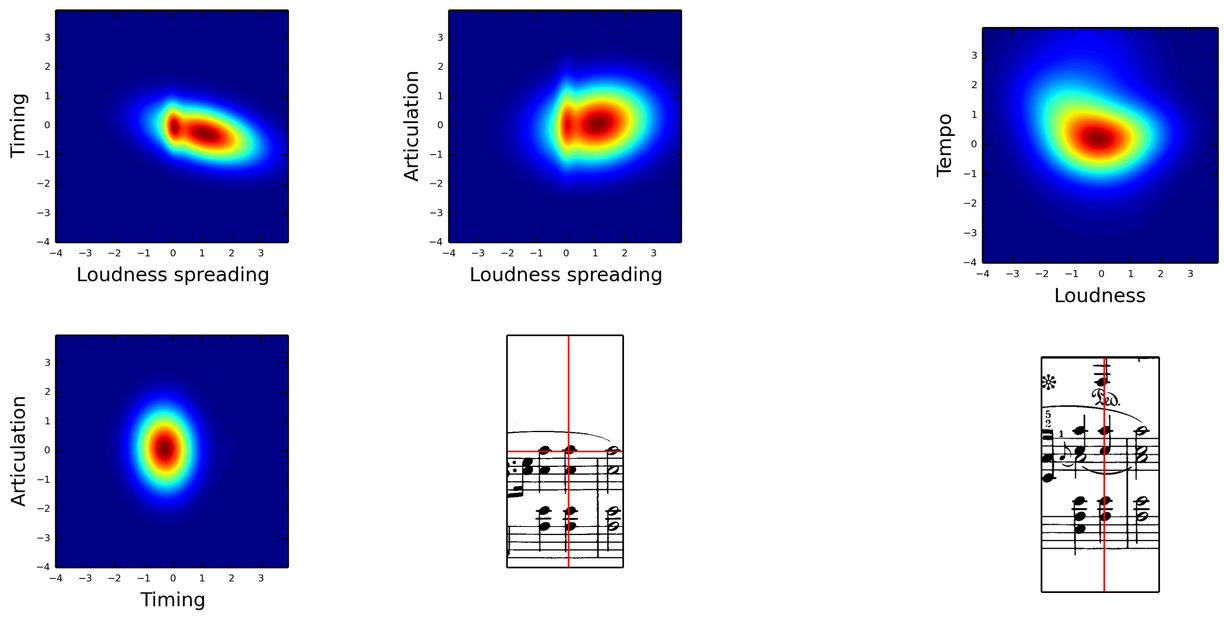


Onset-wise: bi-directional RNN



Joint Modeling of Expressive Targets

The networks can be used for point-wise modeling of targets, but can also be adapted to model the conditional distribution of targets given the basis functions as a mixture of Gaussians (Gaussian Mixture Density Networks).



Note-wise targets

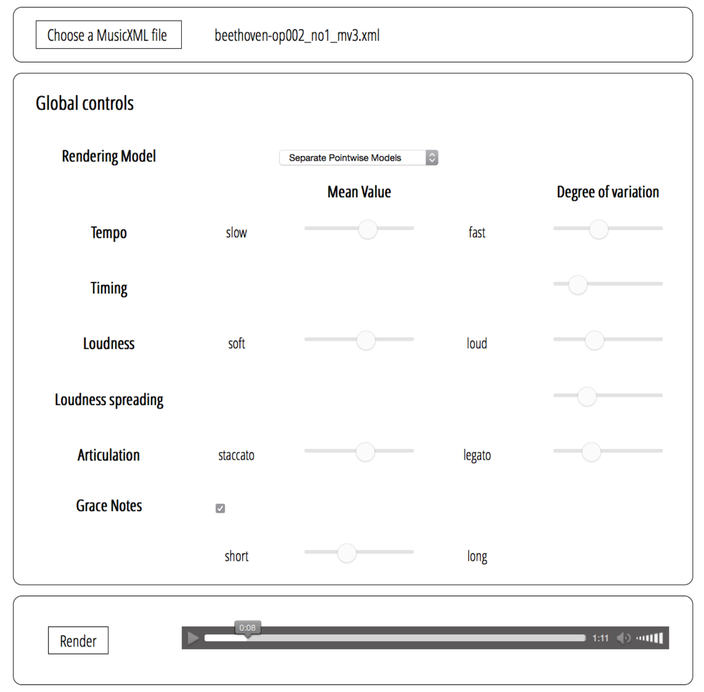
Onset-wise targets

Interactive Web Interface

The user can upload a score in MusicXML format and create an expressive interpretation of the score as an audio file.

The models are trained in a supervised fashion on romantic piano music from the late 18th and 19th centuries, including Chopin and Beethoven, performed by professional pianists, and recorded on a computer-monitored grand piano.

The user can control the overall expressive characteristics of the performance using the UI.



Acknowledgements

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