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THE AUTONOMOUS POST PRODUCTION OF A PIANO RECORDING

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This investigation aims to determine if the basic post production techniques typically applied to a piano recording can be done so entirely autonomously by software, in the form on a VST Plugin. Using spectral analysis the software will compare the incoming audio to a predetermined ideal and apply compression and equalisation accordingly, then alter the parameters of the effects in real time in order to maintain a relatively constant tone and volume. In the context of a popular music production this will be extremely useful during the mixing process, as it will automatically control the large dynamic and frequency range of the piano.

- The tonal qualities of a time domain digital signal are determined via frequency domain analysis.
- Conversion between the time and frequency domains is achieved with the Fourier Transformation.
- The Discrete Fourier Transform (DFT) calculates the Fourier Transform of a discrete signal.
- The Fast Fourier Transform (FFT) is an algorithm for efficient computation of the DFT.

Regression

- An overall shape can be observed in the traces of most pianos and recordings. This is in fact a common trace shape for a large variety of musical instruments.
- The slight differences in that shape determine the tonal qualities of a sound by showing the spread of amplitudes across the spectrum.
- The results also show that the trace is very jagged. A combination of its jagged shape and flickering movement make it very difficult to observe how the trace changes over time, and also to determine its shape.
- A smooth trace can be made with non-linear regression—a 5th order polynomial is derived with acts as a trend line of the data.
- This is achieved with software via the Gauss-Newton algorithm.

Spectral Analysis

- Observing the frequency content of a signal in this way is called Spectral Analysis, and shows the amplitude of component sine waves in the signal.

Processing

- Filter gain is determined by the difference in the Y-axis between input and ideal trace.
- Filter centre frequency and Q factor is determined by differences in the X-axis between traces.
- A high pass filter will also be implemented, who’s cut-off frequency is determined by the first point where the traces cross.
- These processes will result in a piano tone extremely difficult to create with existing products.

Comparison

- The ideal trace represents the decisions of the mixing engineer which can be used as a reference to which the input is then compared, leaving the software to determine what needs to be done to have the input and ideal traces be as similar as possible.
- The software does this by literally comparing the two traces to find areas which are more than a pre-set distance apart, and using compression and equalisation to correct them.