



Triggered Guitar Effects Platform

Bryan Guner, Ralph Quinto, Haley Scott
Department of Electrical and Computer Engineering
The College of New Jersey, Ewing, NJ

Abstract

In live performance, guitar effect pedals are a versatile yet limiting asset, requiring presence of mind on the part of the performer. This project proposes an automatic solution to the restrictions that guitar effect pedals present. This concept will be achieved through the use of Pure Data, a GUI for audio manipulation applications. Our team has created a system to read in a guitar signal, isolate subsections of a performance, and implement a modified dynamic time warping (DTW) algorithm.

Introduction

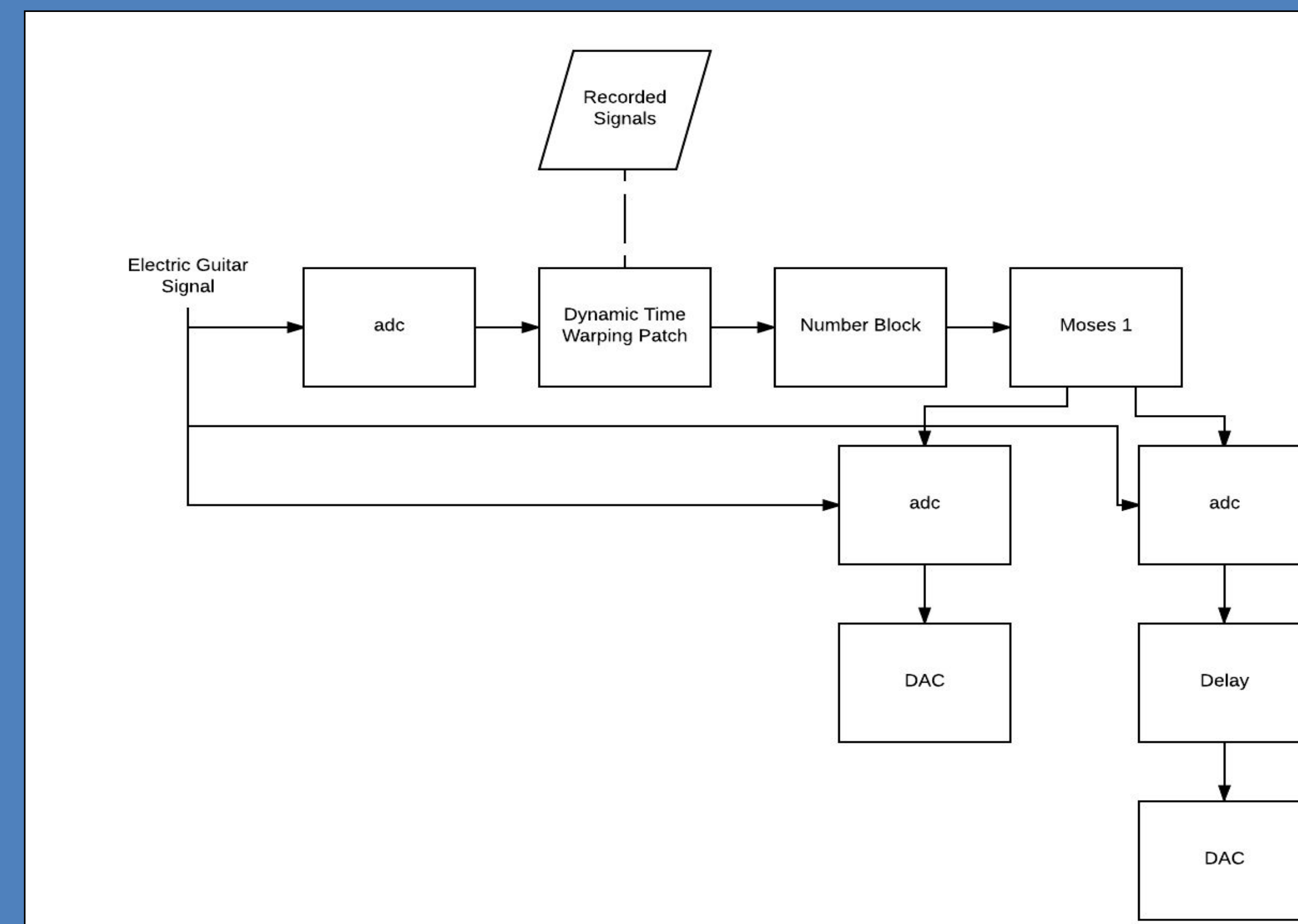
- What is the DTW algorithm?
 - An algorithm for the measurement of similarity between two temporal sequences which may vary in speed
 - Calculates an optimal match between two given sequences in the form of a distance that is the sum of localized cost functions
- DTW Conditions:
 - Continuity Condition: The optimal path through the DTW grid must be continuous and therefore indices of elements along it cannot increase by more than 1 per iteration
 - Monotonic Condition: the path will not turn back on itself because time only moves forward
 - Boundary Condition: requires that the path must begin at the intersection of each sequences respective first elements and end on the intersection of each sequence respective last elements (for the modified algorithm the end of a section of live performance is defined by the DTW threshold and the beginning of the subsequent section is defined by the end of the last)
 - Diagonal Cost Reduction: Often the best match is a nearly diagonal path through the grid and so by discounting the cost of diagonal movements through the grid as opposed to lateral moves we can increase computational efficiency by removing potential matches from consideration

Design and Methods

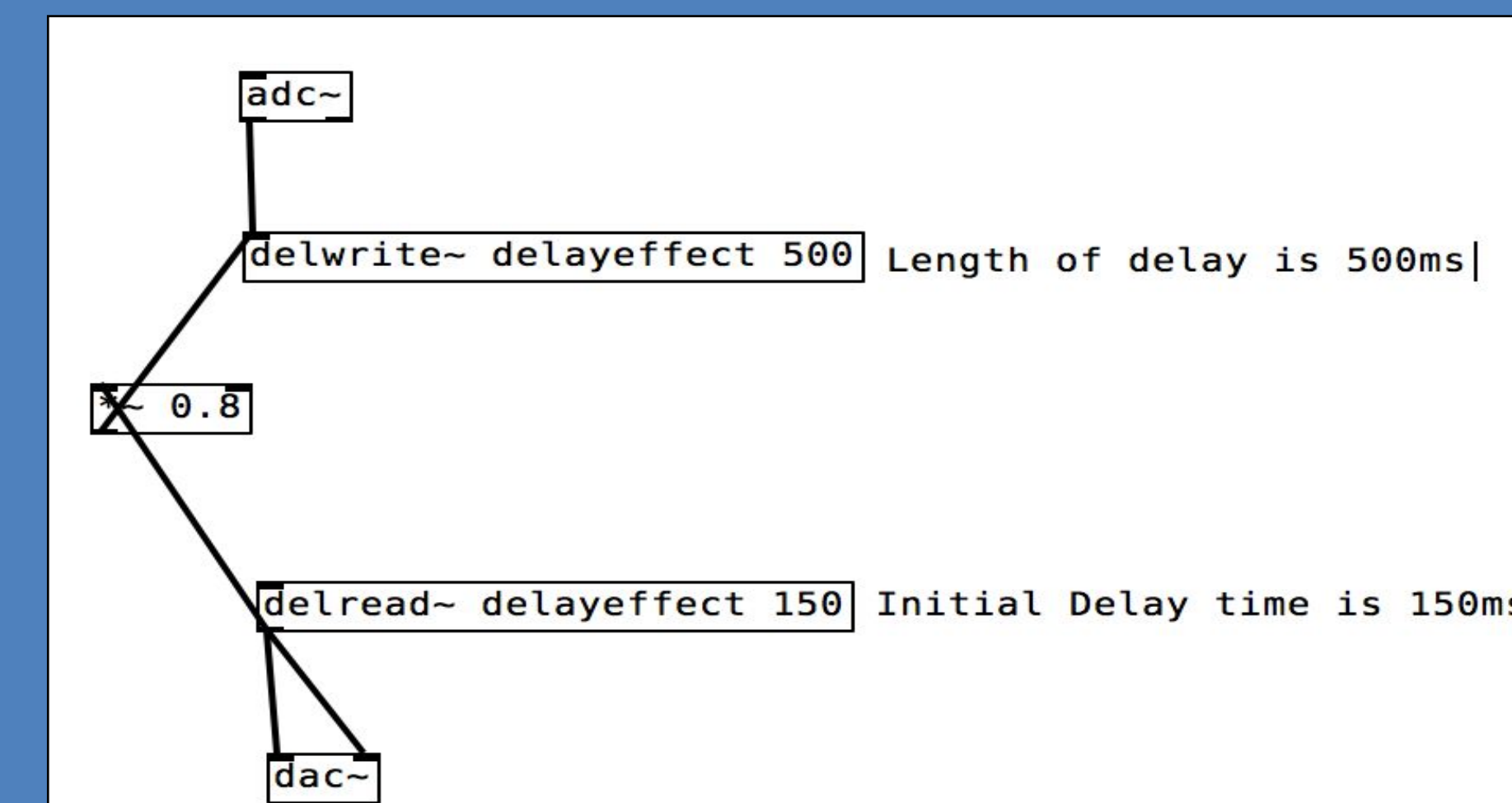
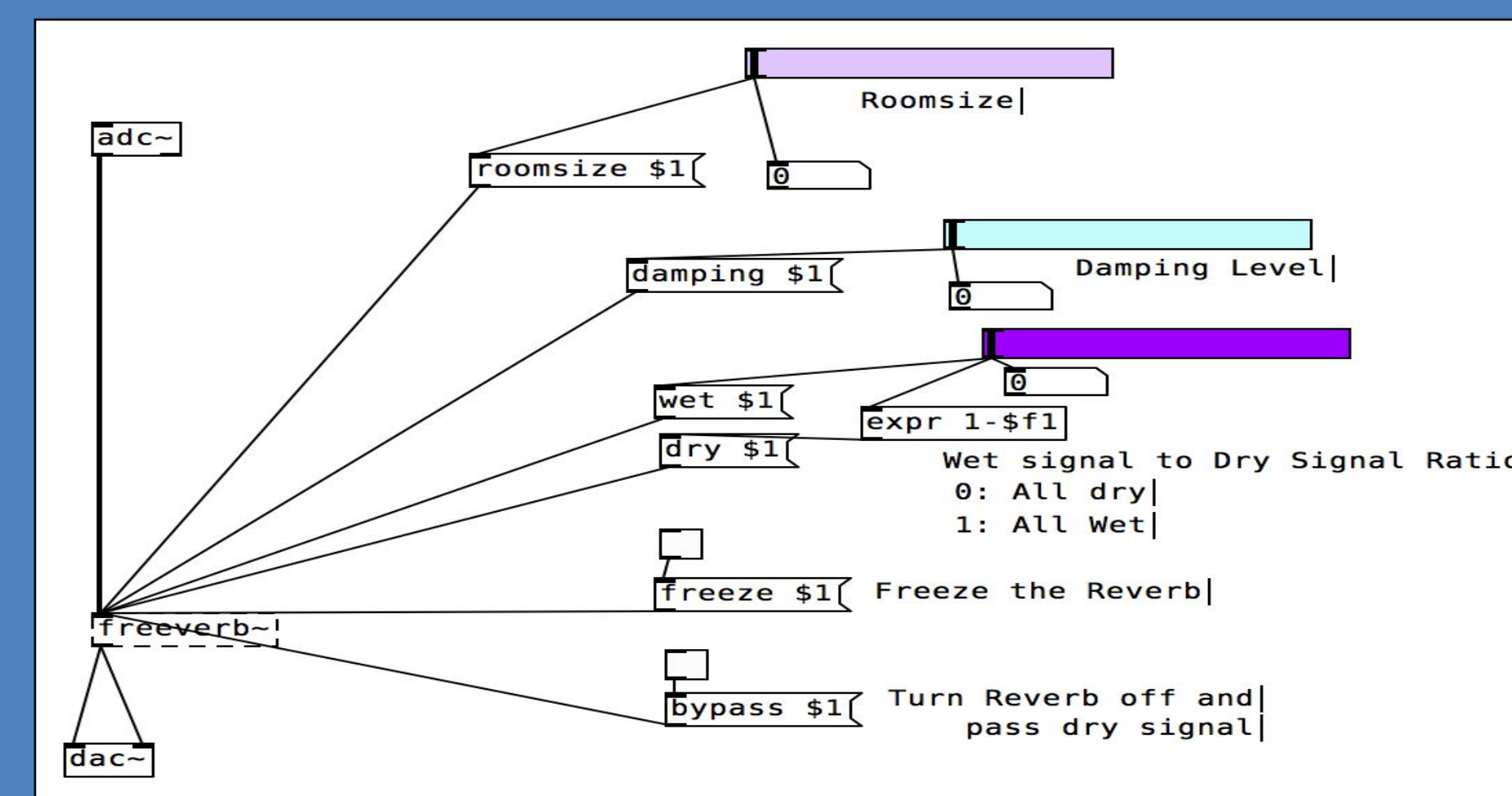
Dynamic Time Warping Triggering Scheme

Dynamic Time Warping External

- Feed in two song performances for learning phase and obtain Least Cost Path (LCP) for each subsignal
- Compare Incoming live signal with subsignal of one of the recorded performance
- When LCP value is less than or equal to the LCP obtained from learning phase, trigger guitar effect

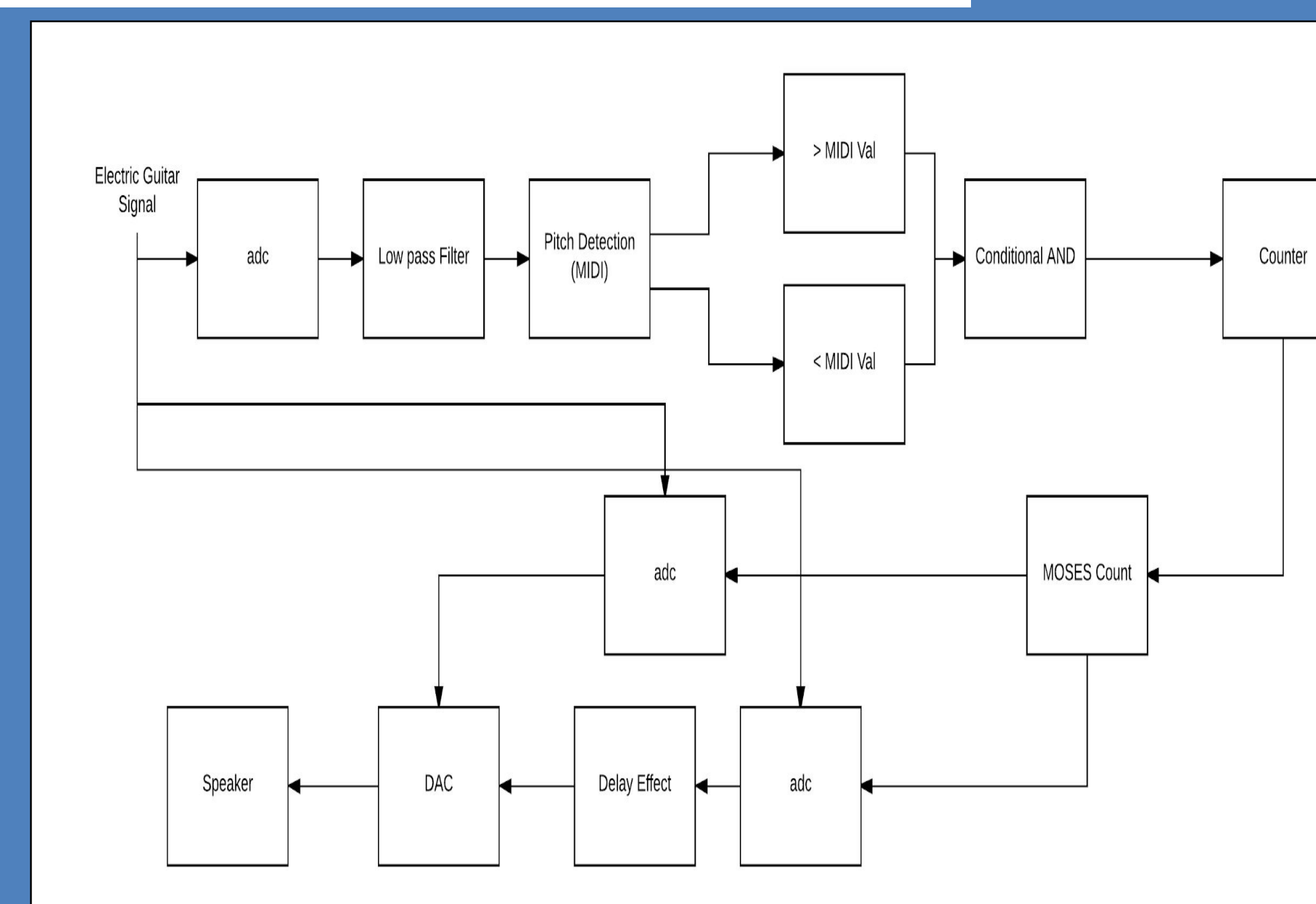
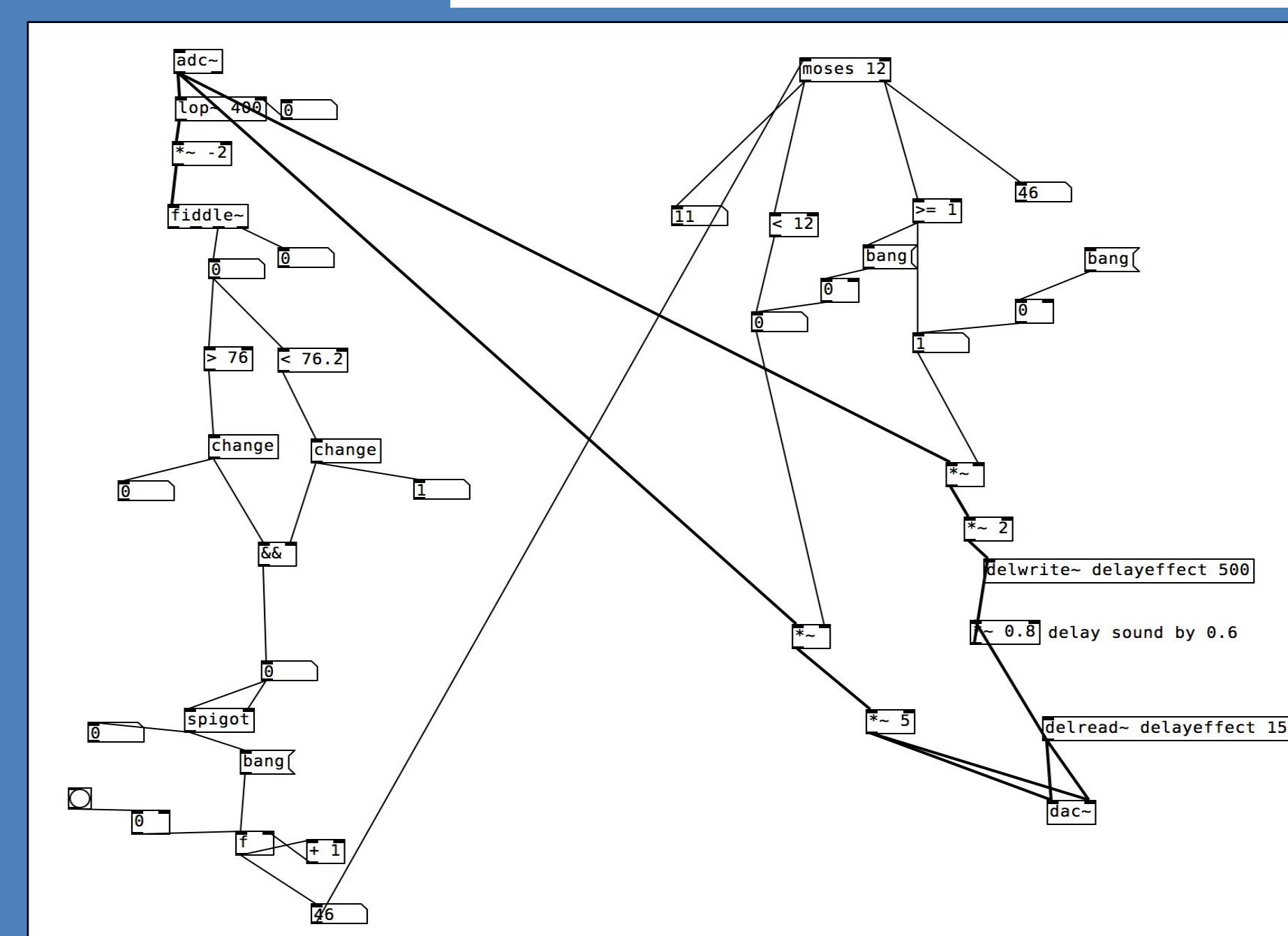


Guitar Effects



Simple Triggering Scheme

- Apply Low pass filter to incoming signal
- Convert signal to MIDI
- If incoming value is between desired MIDI range, increase counter
- When counter passes threshold, then trigger guitar effects



Results

- Dynamic Time Warping Results
 - In testing the Dynamic Time Warping scheme, the expected results of our test cases were observed
- Simple Counting Scheme
 - The simple counting scheme was able to trigger on the correct location of the signal
 - Sensitive to note articulation
 - Similar songs may trigger effects designed for other songs

Discussion & Conclusion

The project has demonstrated the capability of a low cost, functional and automated guitar effect triggering system. The platform successfully triggers a user-selected effect in live performance at a user-defined point within the pre recorded performance. The system showed limited song capacity, yet with single song tasks the system performance was satisfactory. Future improvements can be made toward the simplicity and clarity of the user interface, as well as the development of multiple song capabilities.

References

- [1] Muller, M. (1970, January 01). Dynamic Time Warping (DTW). Retrieved December 10, 2017,
- [2] K. (n.d.). [Pd~] graphical dsp programming. Retrieved December 10, 2017, from <http://www.katjaas.nl/puredata/puredata.html>
- [3] C. (n.d.). Retrieved December 10, 2017, from http://www.phon.ox.ac.uk/jcoleman/old_SLP/Lecture_5/DTW_explanation.html