Digital Soloer

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Objective

Create a system than takes an input song and separates its sources into different tracks while making the process as automatic and accurate as possible.

Background

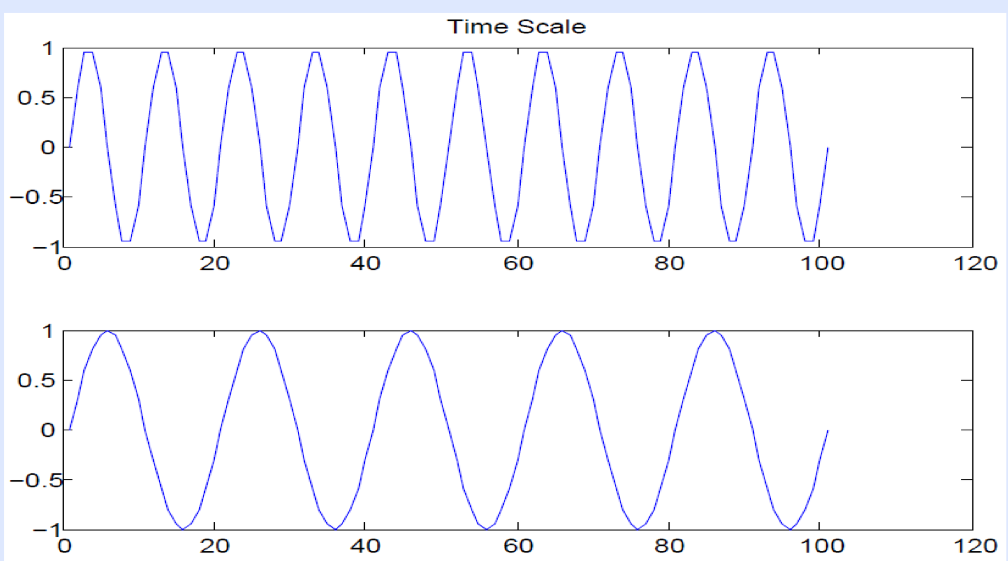
Remixing and re-mastering almost always require the original separated audio tracks in a recording, but many times these are unavailable. This project attempts to solve the classical and notorious source separation problem in audio. The problems in separation arise from different instruments having overlapping frequencies in their sounds, but by using linearity we can decompose an audio track into a superposition of its parts.

Techniques Used

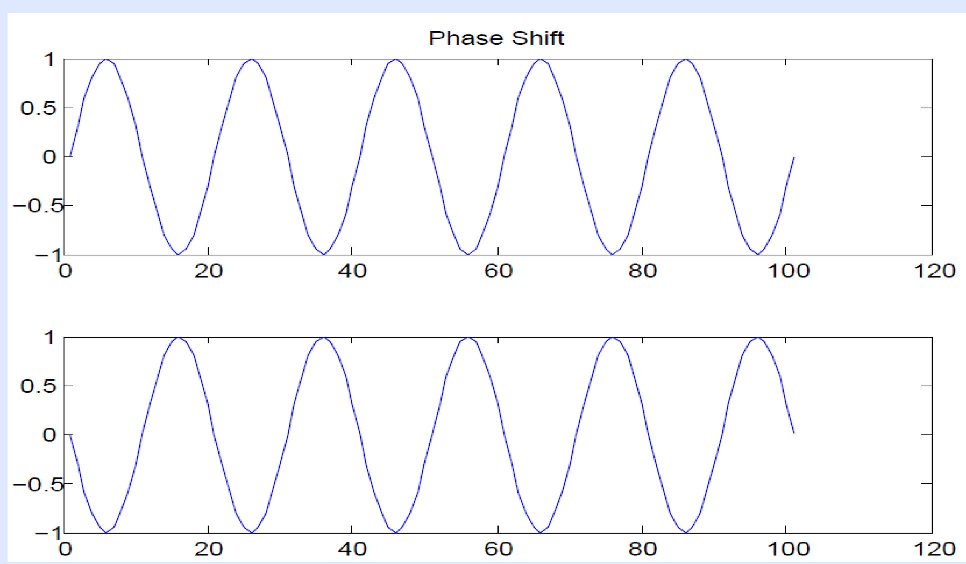
- ❖ Sample a note from the desired instrument to transform into the rest of the song
- ❖ Section the song into equal sections in order to extract the properties of an instrument from a section.
- ❖ Match transformations of samples of the desired instrument playing in the song

Transformations

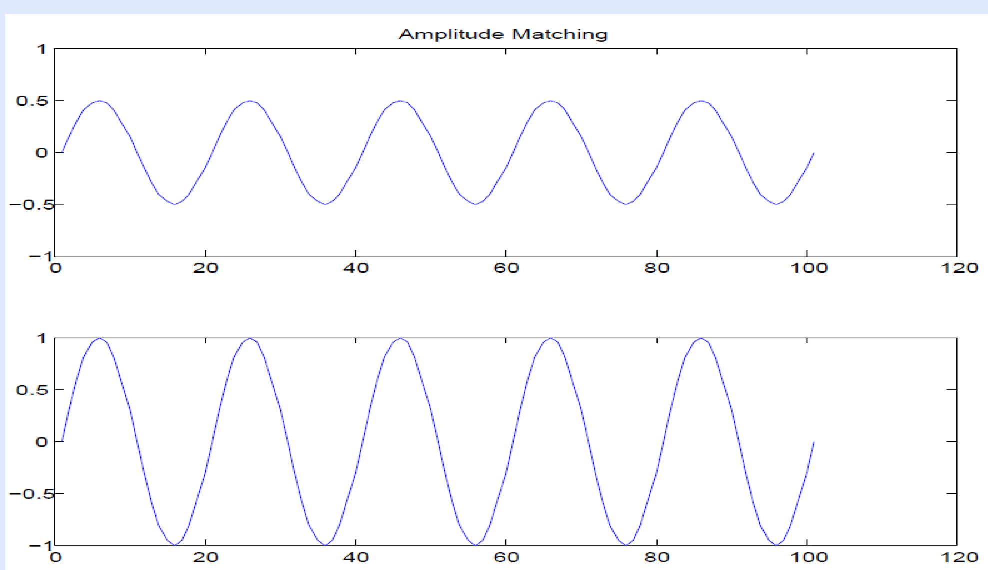
❖ Time Scale



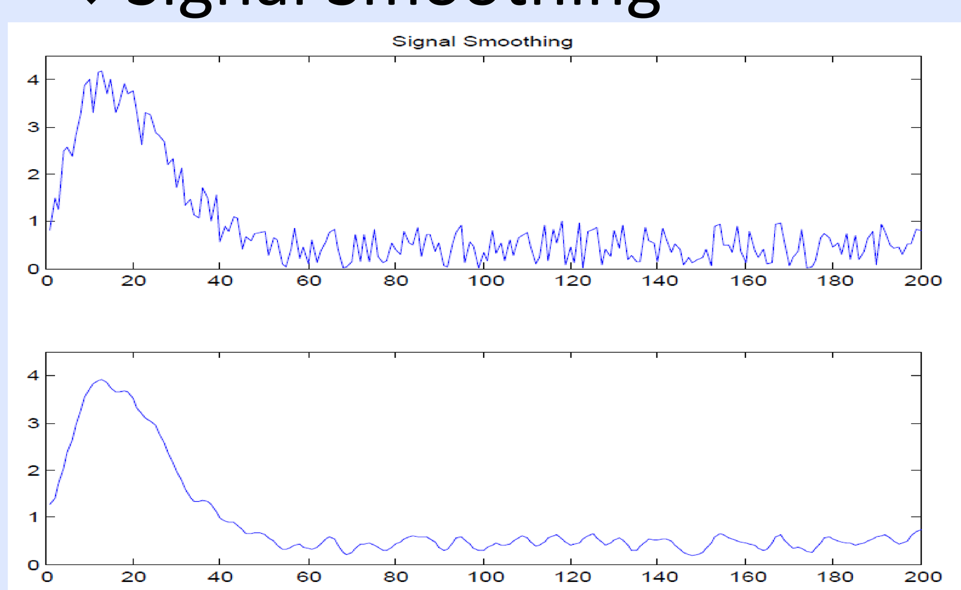
❖ Phase Shift



❖ Amplitude Matching

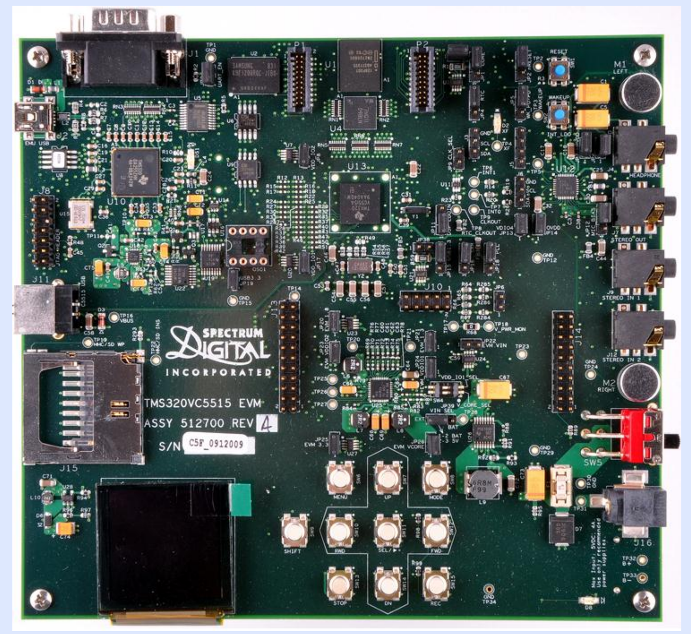


❖ Signal Smoothing



Hardware Used

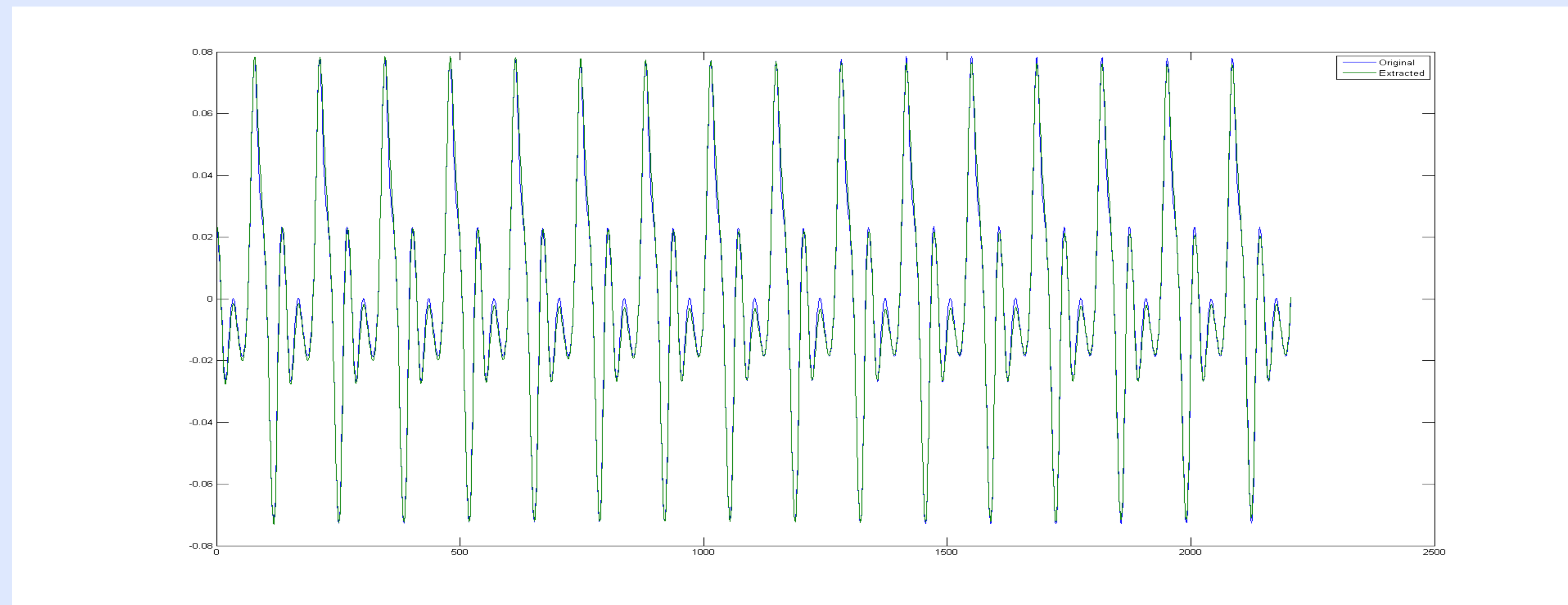
TMS320C5515 DSP Evaluation Module



Features:

- ❖ Low power 16-bit processors to conserve energy
- ❖ 240 MIPS performance
- ❖ 320KB on-chip memory
- ❖ Hardware accelerator for FFT computation

Results



In this case and for many with simple instruments (no effects) that play notes (single or chords) on beat, the extraction is almost identical to the original.

Future Work

- ❖ Adaptive note lengths versus sectioning
- ❖ Envelope detection versus constant amplitude matching
- ❖ Recursive iterations of extraction after some instruments have been removed to minimize residual error
- ❖ Analyzing and simulating different effects such as reverb, delay, filter cutoffs, etc.

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