

Spectrogram Factorization Using Phase Information



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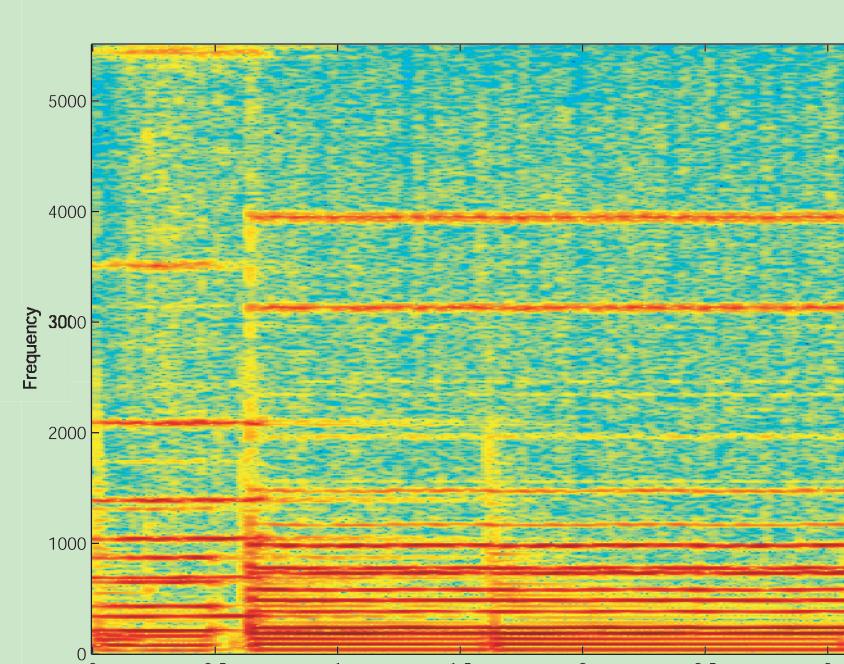
<http://www.cc.gatech.edu/cpl/projects/musicaudio/magspec.htm>

Summary

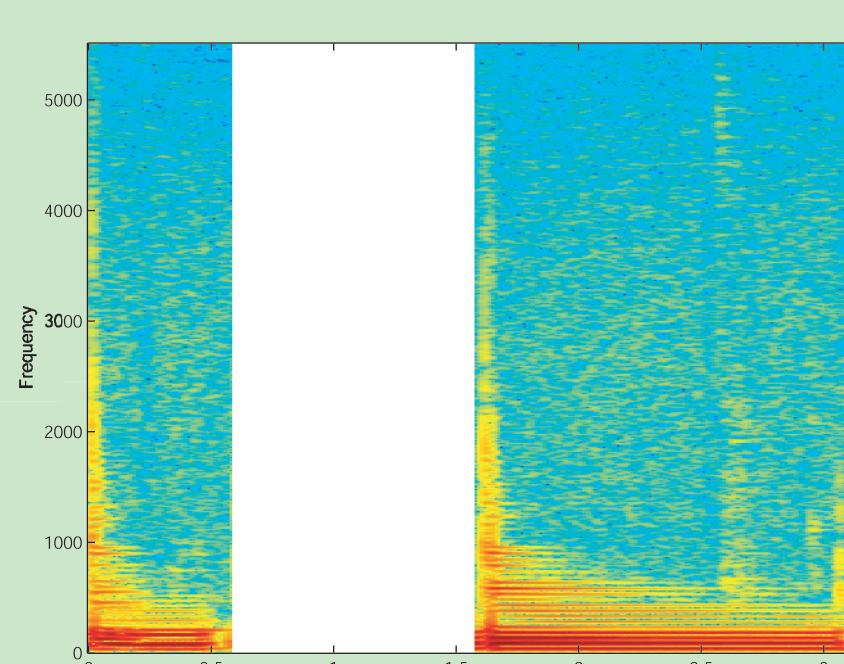
Spectrogram factorization methods have been proposed for single channel source separation. These methods assume that the mixture spectrogram is a linear combination of the source spectrograms. However, the mixture spectrogram additionally depends on the (unknown) phase of the sources. This paper investigates the role of phase in estimating the source spectrograms from the mixture spectrogram and incorporates a probabilistic representation of phase to improve separation.

Spectrogram Factorization

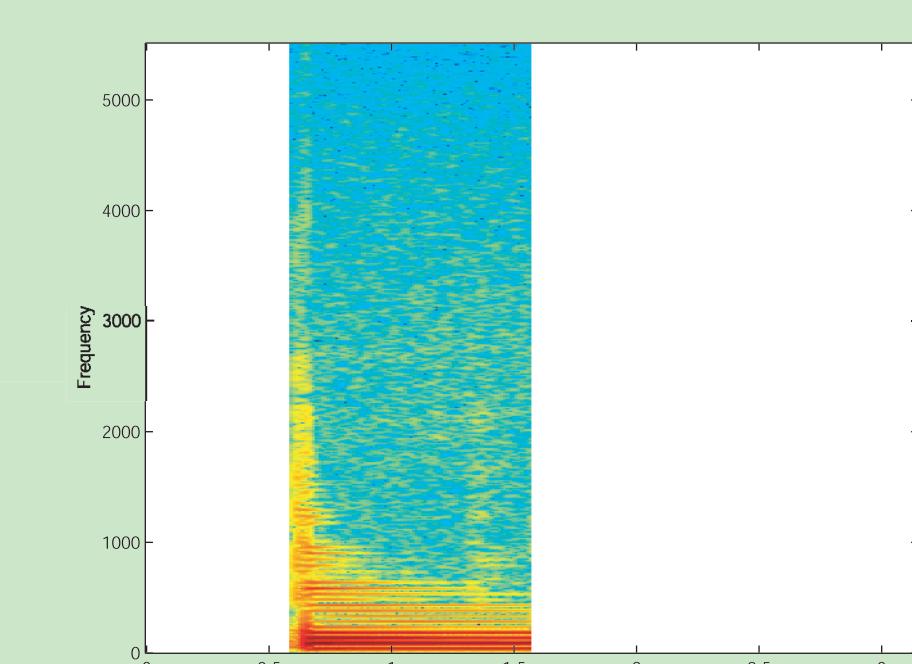
Mixture



Component 1

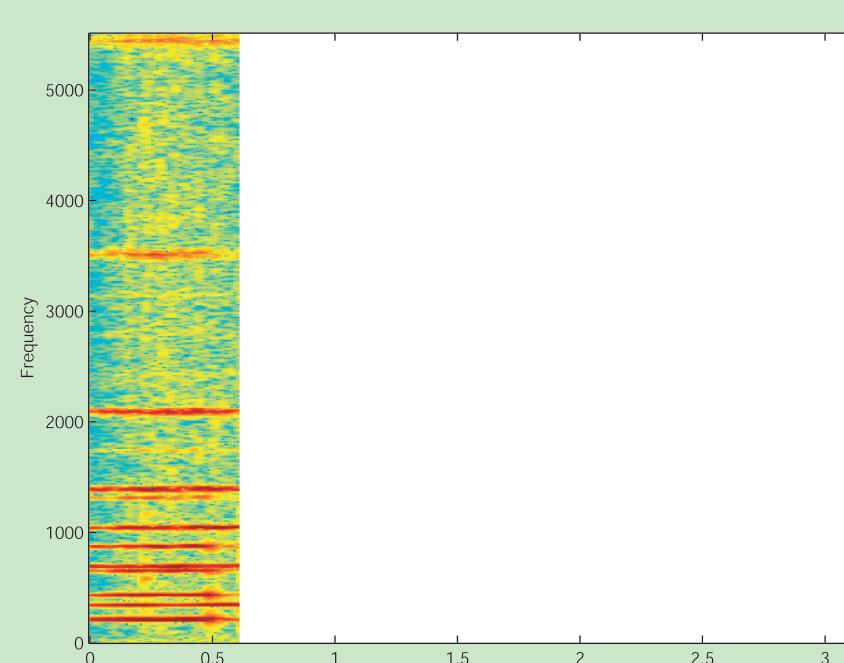


Component 2

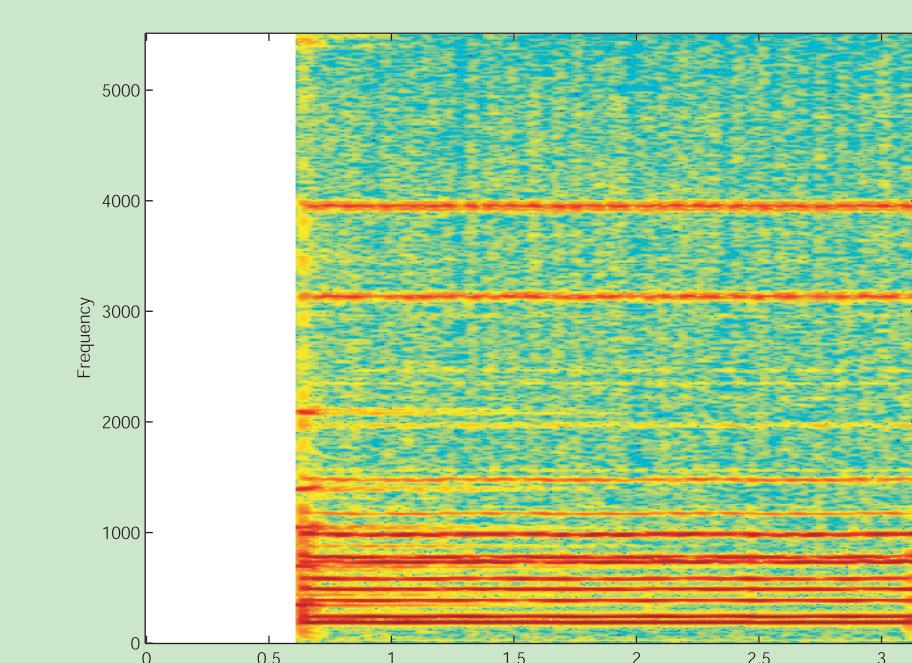


Assume mixture spectrogram is the sum of component spectrograms

Component 3



Component 4



Random Phase

$$\text{for } R \text{ components : } v = \sqrt{\sum_{ij}^R c_i c_j \cos(\theta_{ij})}$$

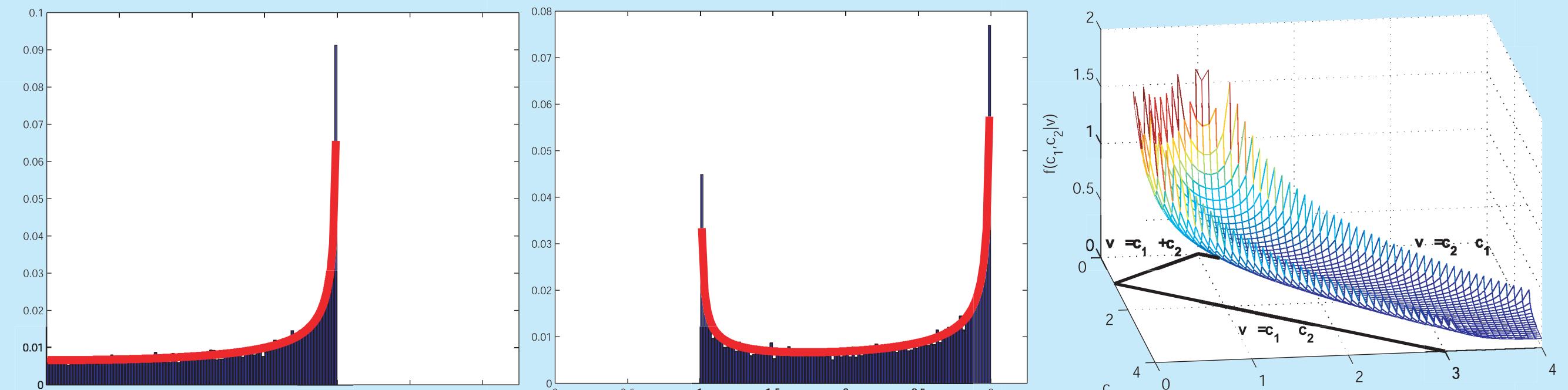
$$\text{for two components : } v = \sqrt{c_1^2 + c_2^2 + 2c_1 c_2 \cos(\theta)}$$

$$p(v|c_1, c_2) = \frac{2v}{\pi \sqrt{-(v+c_1+c_2)(v+c_1-c_2)(v-c_1+c_2)(v-c_1-c_2)}}$$

$$p(v|c_1 = 1, c_2 = 1)$$

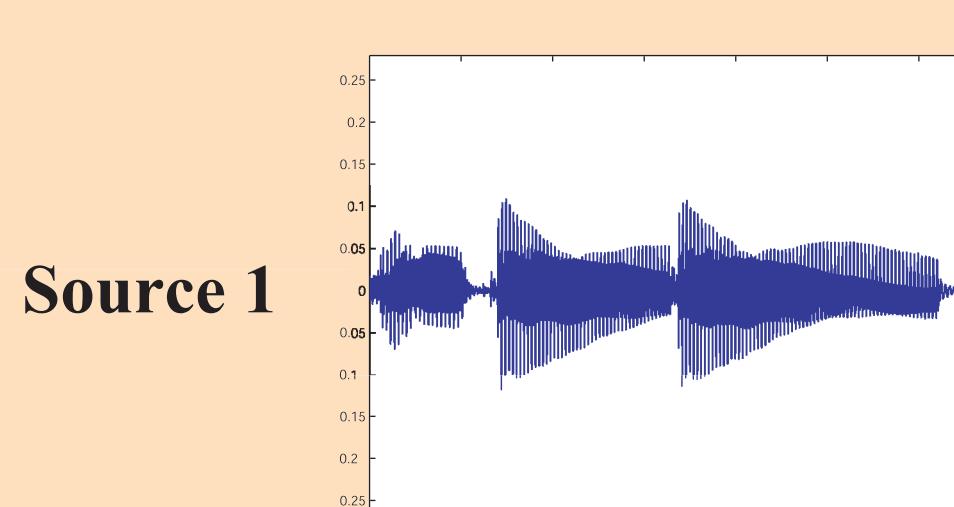
$$p(v|c_1 = 2, c_2 = 1)$$

$$p(c_1, c_2|v = 1)$$

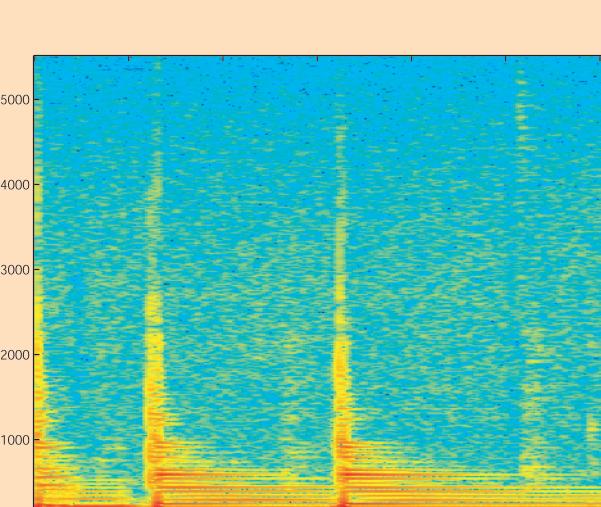


Short-time Fourier Transform

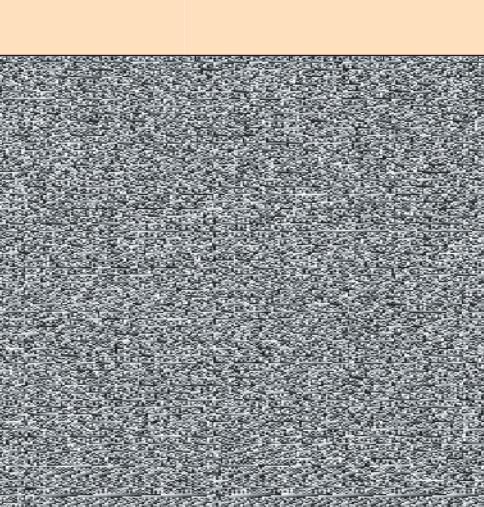
Waveform



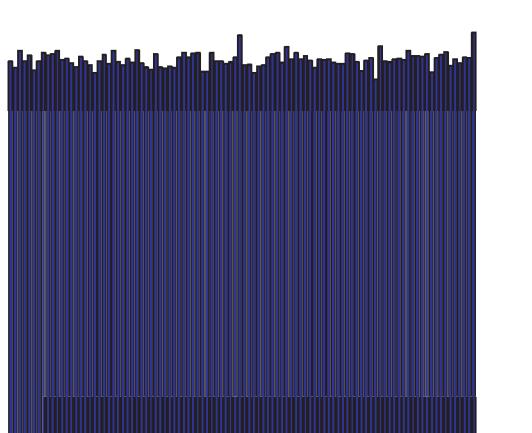
Spectrogram



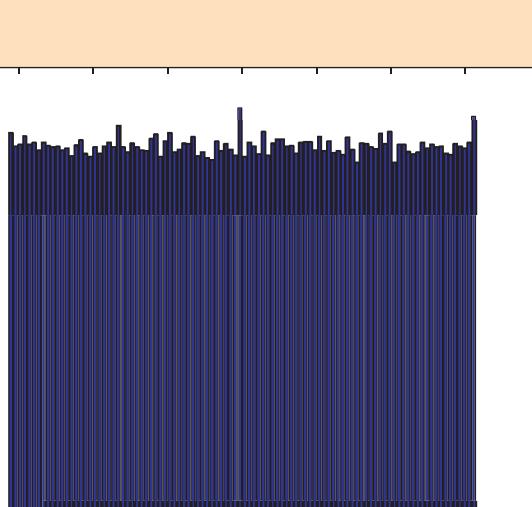
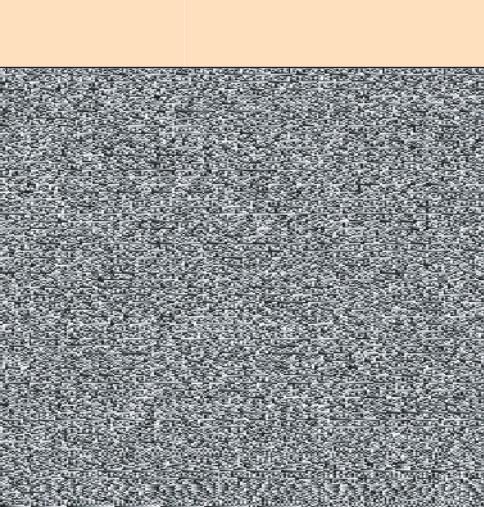
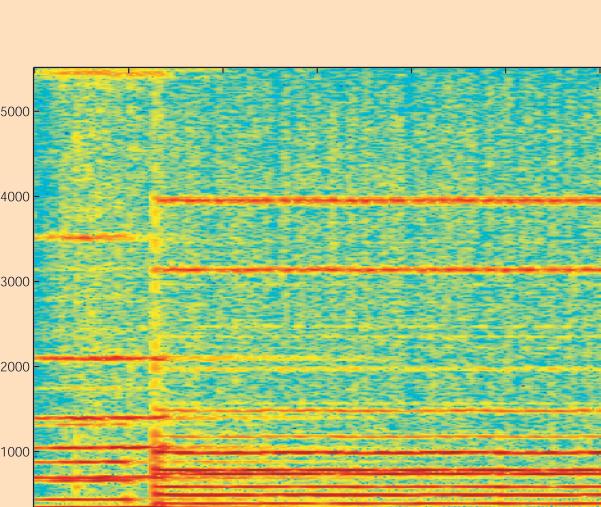
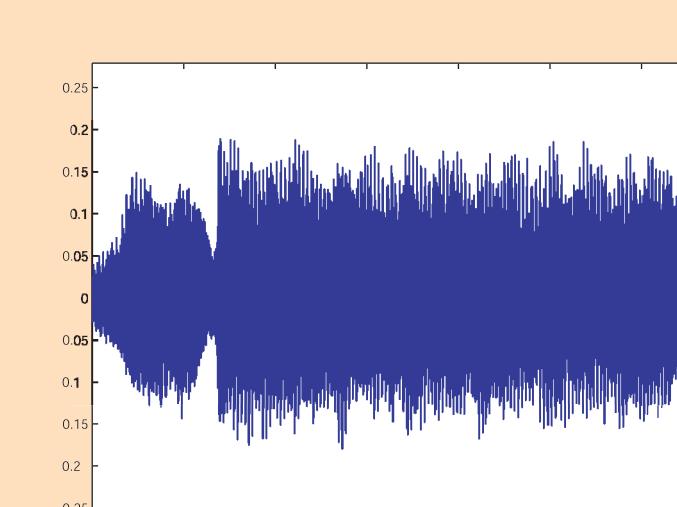
Phase



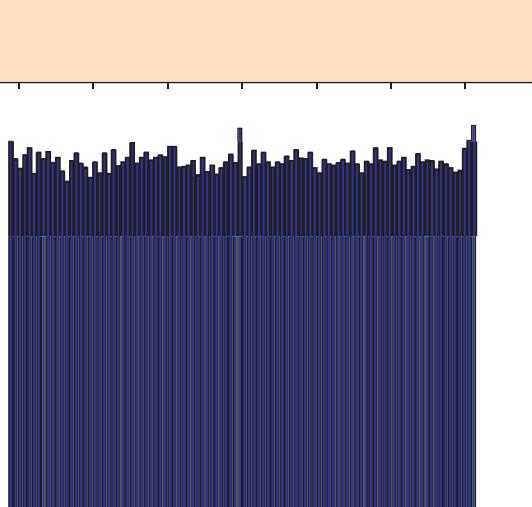
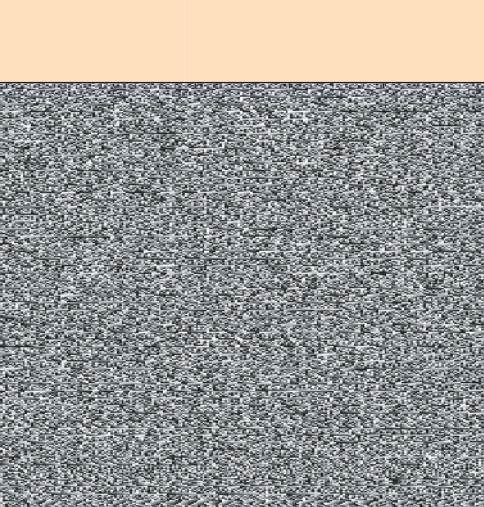
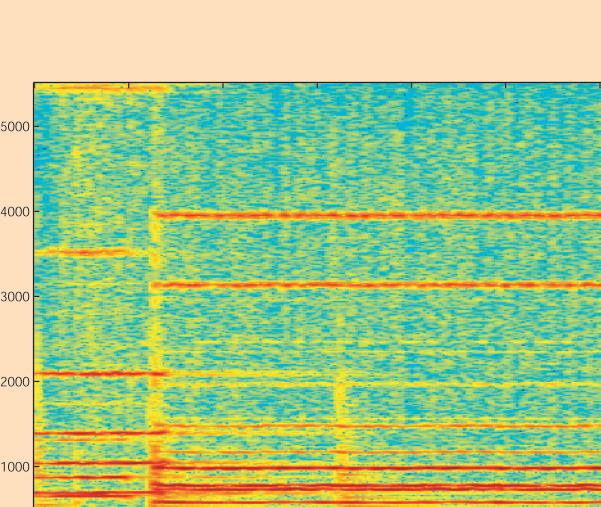
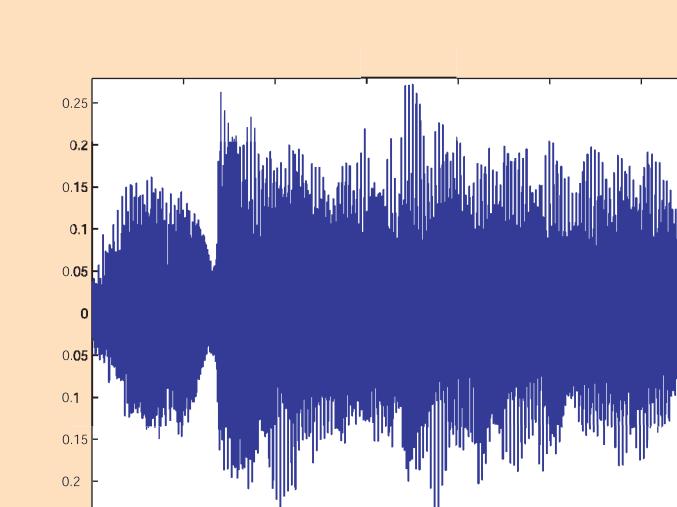
Phase Histogram



+ Source 2

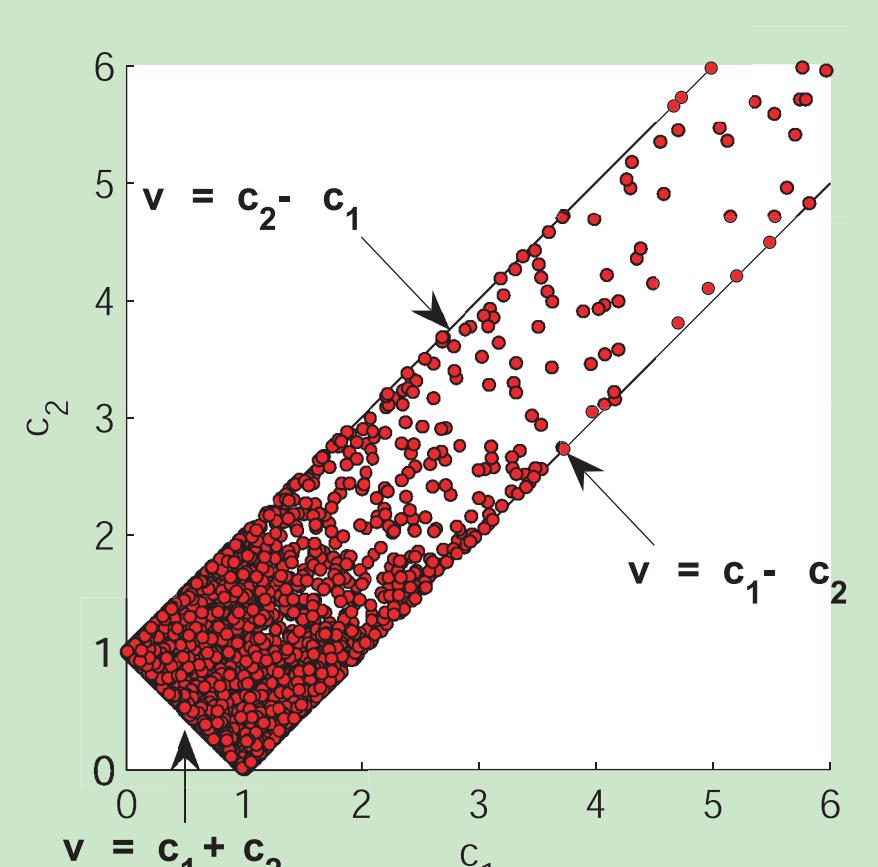


= Mixture

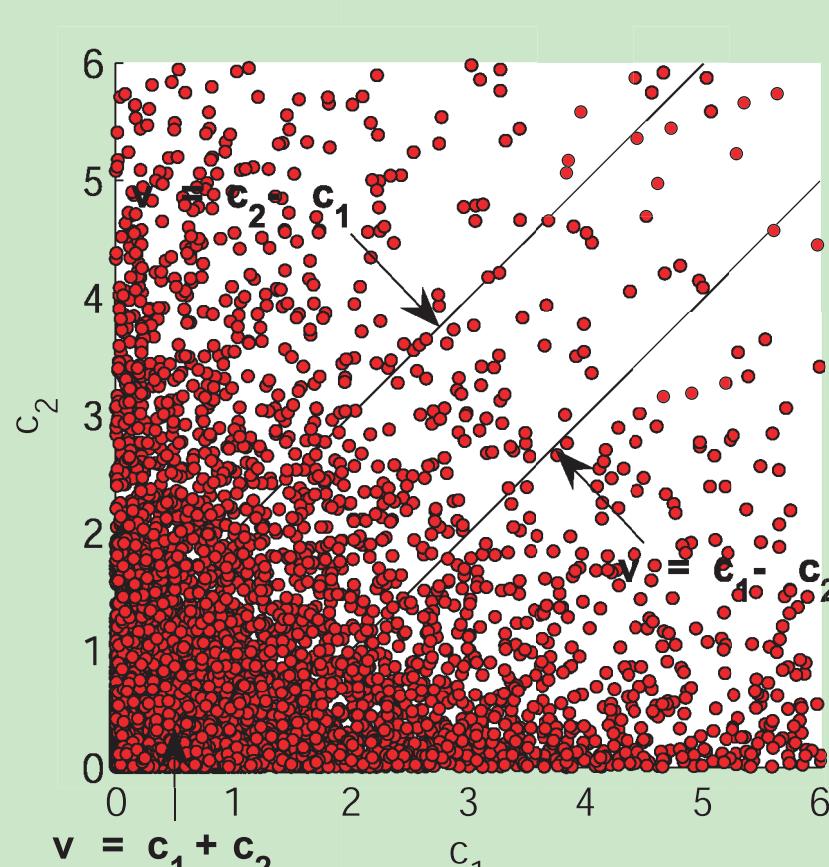


Results

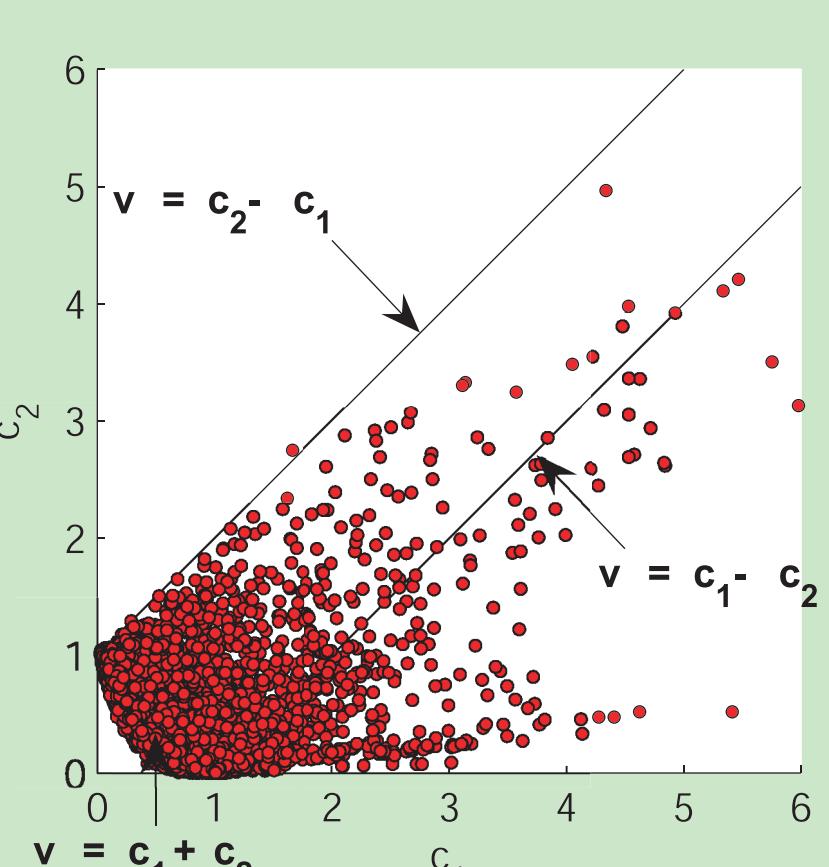
Correct



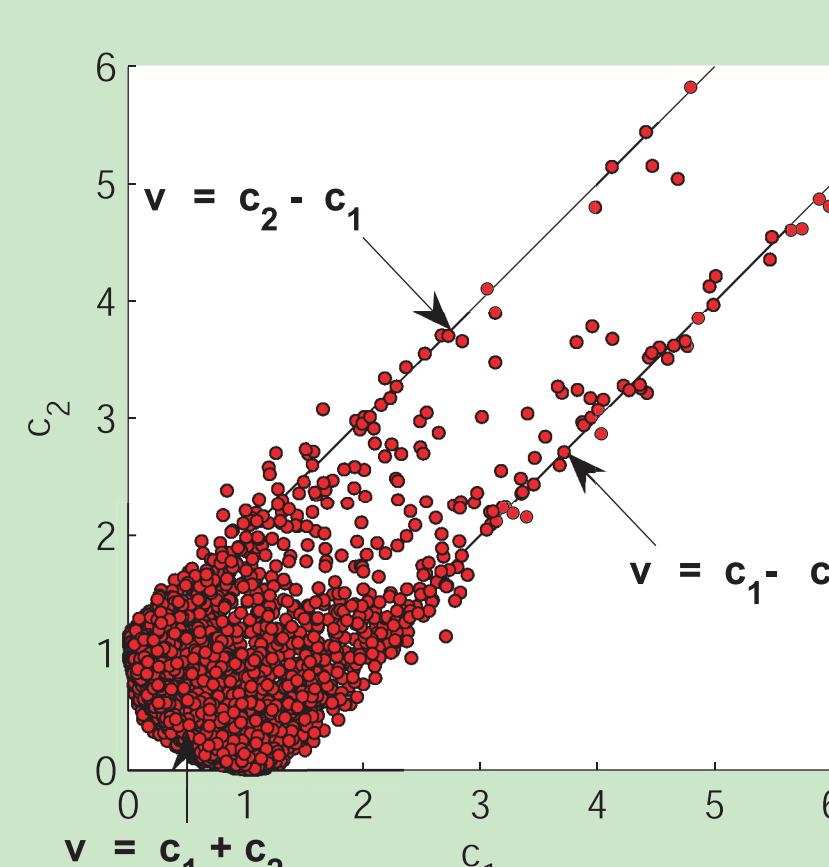
Initial



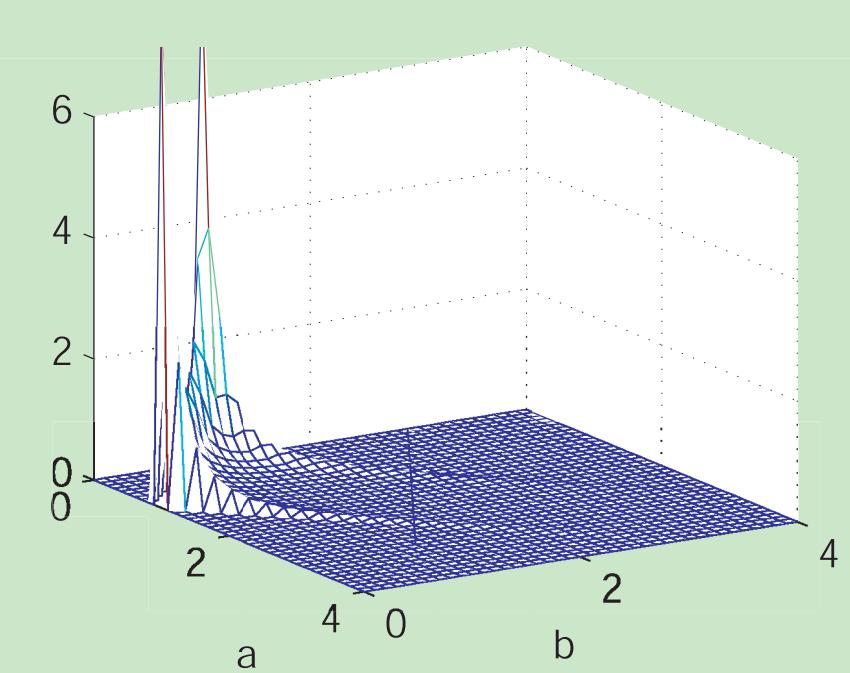
NMF



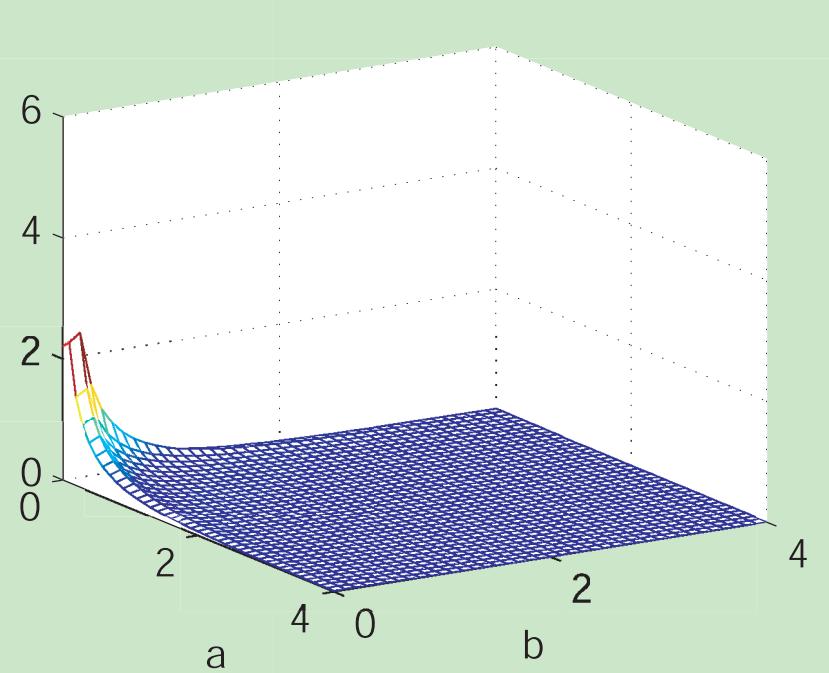
Our approach



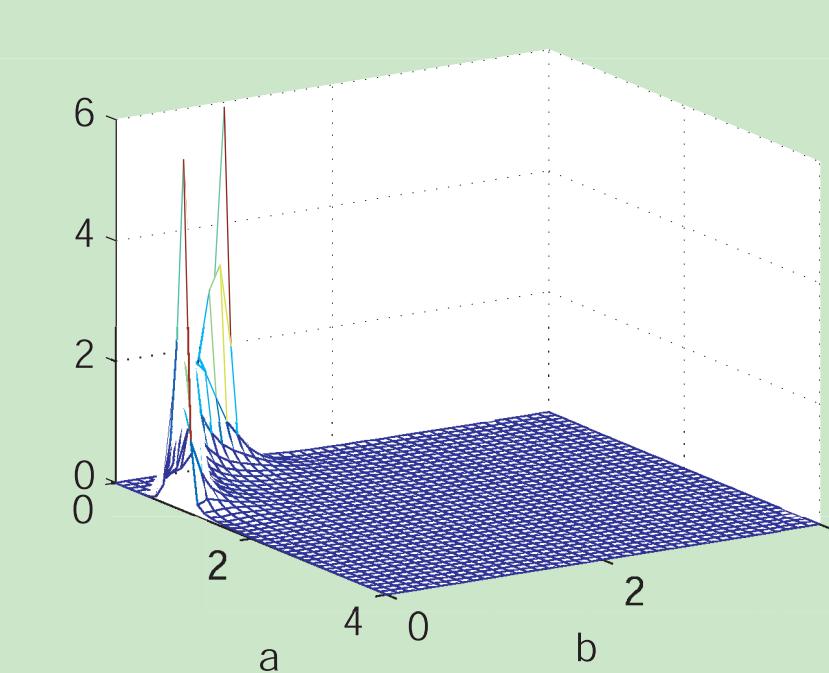
Correct



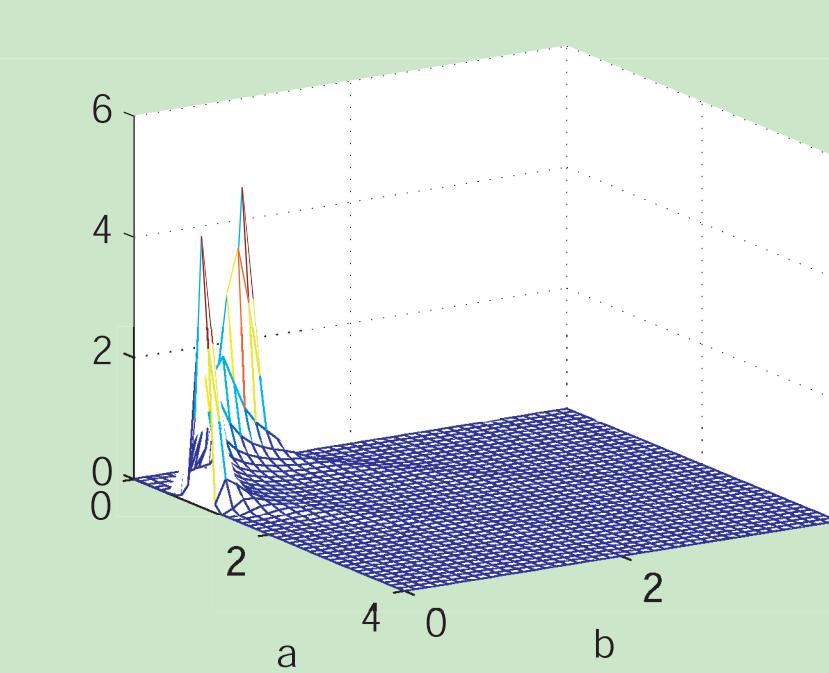
Initial



NMF

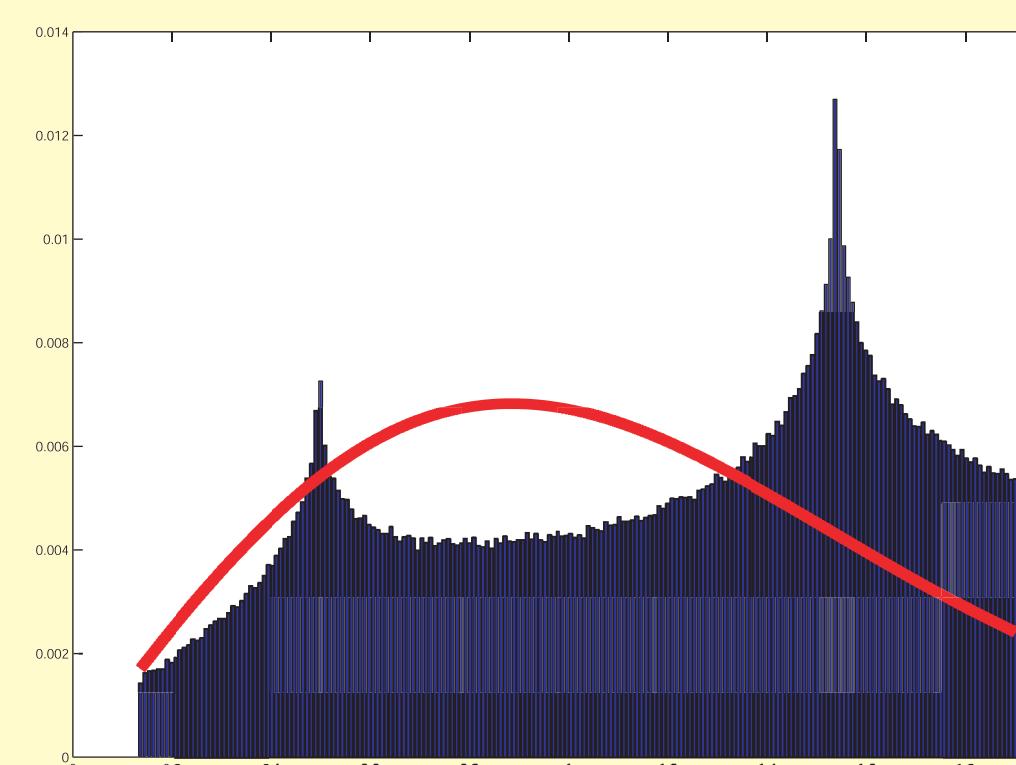


Our approach

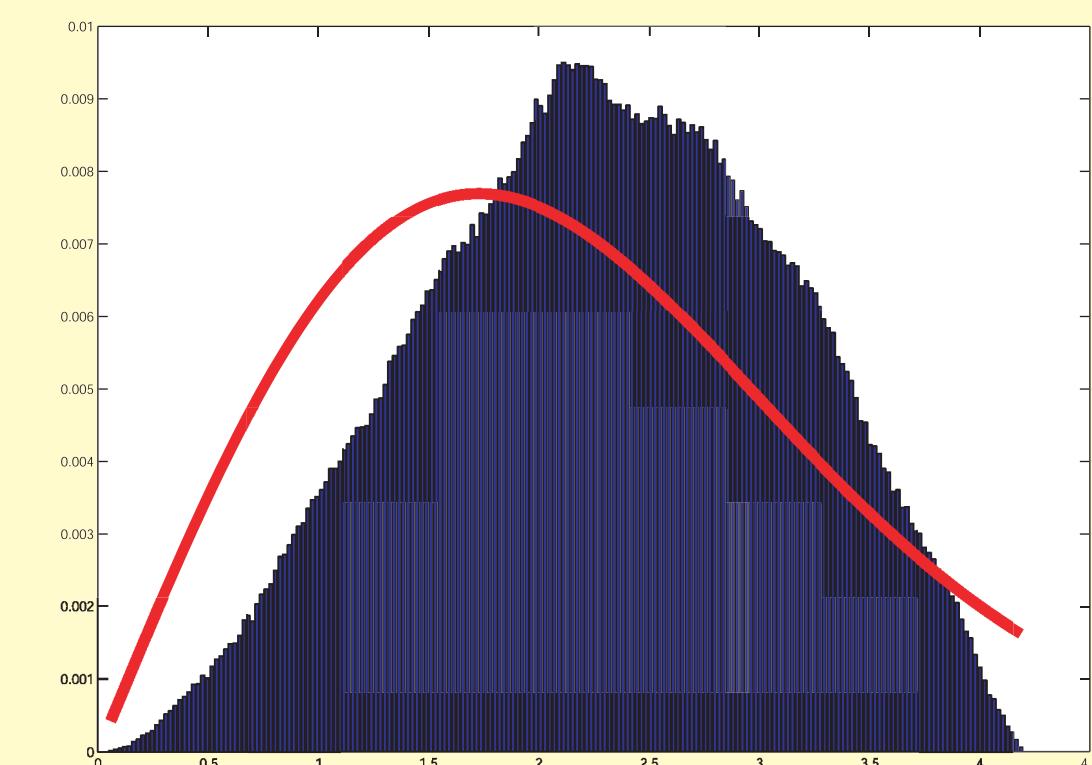


Future Work

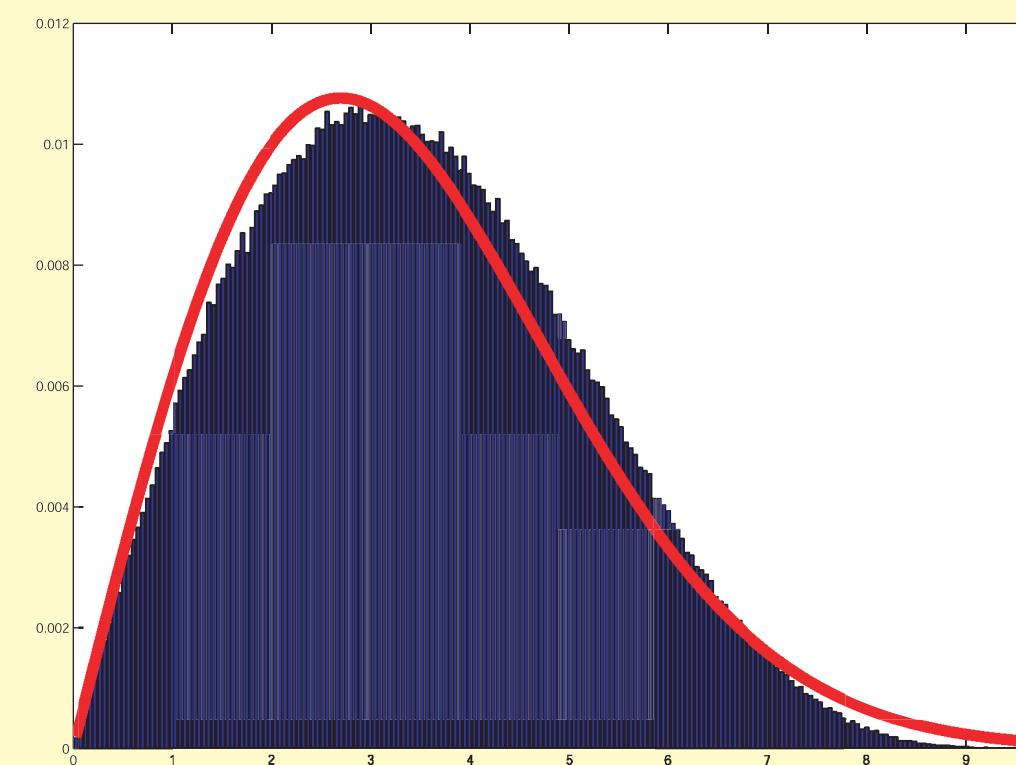
3 Components



5 Components



10 Components



20 Components

