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    Your Dissertation Proposal Title:
VIZSTRUCT: VISUAL EXPLORATION FOR
GENE EXPRESSION PROFILING
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    Your Dissertation Proposal Abstract:

In many applications, understanding data is of primary importance.
Visualization may provide more insightful information than traditional
numerical methods. Nevertheless, this is often quite difficult due to
the complexity of the data and the limitation of human perspective.
DNA microarray technology provides a broad snapshot of the state of the
cell by measuring the expression levels of thousands of genes
simultaneously. It has already had a significant impact on the field of
bioinformatics and has proposed an unique challenge: information in
gene expression matrices is special in that the sample space and gene
space are of very different dimensionality and it can be studied in
either sample space or gene space.
To meet this challenge, this proposal presents a theoretically solid
visualization framework to explore gene expression datasets. Motivated
by radial coordinate visualizations such as RadViz, we consider the two
dimensional visualization problem as a problem of approximation of
discrete-time signals. In this proposal, we propose a new paradigm of
information visualization through frequency domain representation of
signals. We introduce Fourier harmonic projections (FHPs) to map the
high dimensional gene expression data onto a two dimensional space to
create an intuitive scatterplot. FHPs have desired properties
preserving crucial characteristics during the mapping. In this
proposal, we present a detailed discussion and rigorous mathematical
proofs of these properties. Furthermore, we design some possible
enhancements and user interactions. Based on the unique nature of gene
expression data, two novel and related processes are proposed,
explorative visualization and confirmative visualization.