A Novel Approach for Analyzing and Visualizing High-Dimensional, Multivariate Microarray Data

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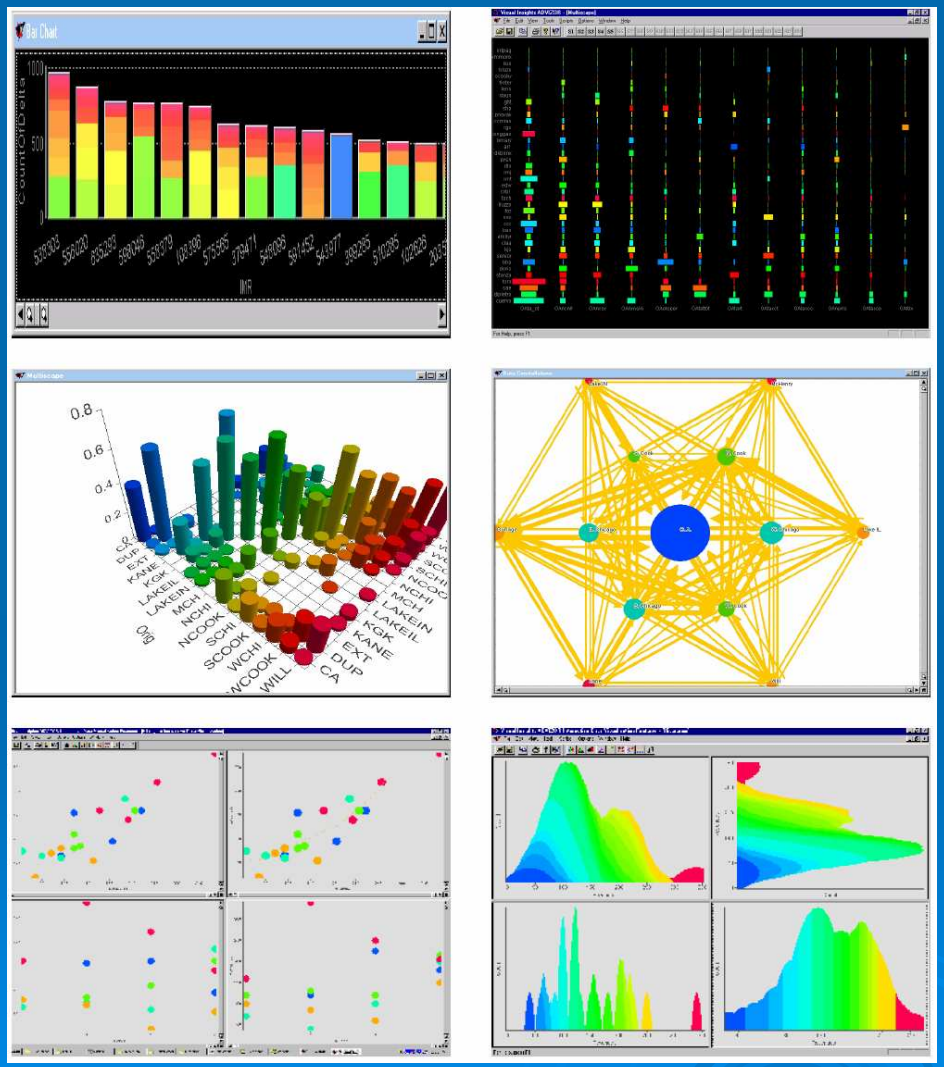
From the Desk of Vetria L. Byrd *

Graphical Representation of Data



- Charts
  - Bar, Line, Pie
- Matrix View
- Multiscape
- Network view
- Scatter Plots
- Histograms

Eick, S. G. and Karr, A. F. Visual Scalability. Technical Report Number 106. National Institute of Statistical Sciences, 2000.

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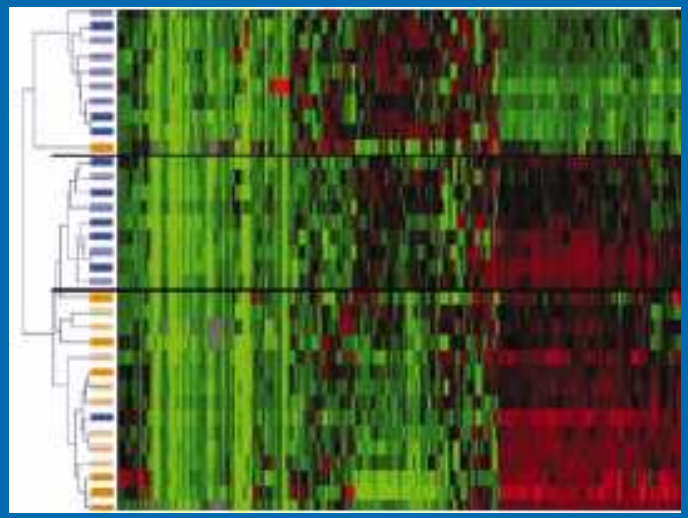
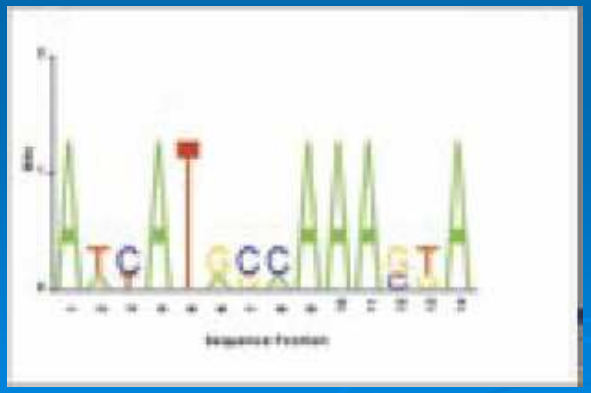
Common Visualization for Microarray Data

- Cluster grams
- Pairwise and multiple sequence alignments
- Parallel coordinates
- Heat maps





```
WYFGKITR---RESERLLLNPENPRGTFLVRESET-TKGAYCLSVSDFDNAK-----GLN
-YHGKISR---ETGEKLLLA-TGLDGSYLLRDSES-VPGVYCLCVLYHG----------Y
WNDGCIMGFISKERERALLK-DQQPGTFLLRFSESSREGAITFTWVERSQNGGE-PDFHA
YIMGFISK----ERERAILS-TKPPGTFLLRFSESSKEGGVTFTWVEKDISGK--TQIQS

VKHYKIRRLDSG-------GFYITSRTQ--FSSLQQLVAYY
IYTYRVSQTETG-----------------------------
VEPYTKKEL--------------------------------
VEPYTKQQLNNMSFAEIIMGYKIMD-AT--NILVSPLVYLY
```

From the Desk of Vetta L. Byrd

Problem Statement

- Microarray data contains answers to biological questions that haven't been asked or formulated yet
- No way to intuitively discern or extract biologically relevant data without visualization tools

Tilstone, C. (2003). Vital Statistics. Nature 424:610-612.

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Research Goal

- To enable researchers to assess and visualize high dimensional, multivariate data in a way that is equivalent to (or improved upon) current state of the art techniques for visualizing such data

Presentation Overview

- Goals/Tasks
- Approach to achieving goals/tasks
- Questions
- Suggestions & Comments

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Goals and Tasks

- Assess existing visualization tools
- Determine what, if any, unmet visualization needs exist
- Develop a tool/method to aid in the analysis and visualization of multivariate, high dimensional data

From the Desk of Velvia L. Byrd

Goal #1: Assess Existing Visualization Software

Commercial

GeneSpring
GeNet
Array-Pro Analyzer
CloneTracker
ImaGene
GeneSight
ArrayPack
GenePort
HDFR
Array-Pro Analyzer
arraySCOUT
arrayTAG
GenePix
Z3 2-D PAGE Image Analysis

Free

ANOVA Programs
CLUSFAVOR
SCAN-ALYZE
CLUSTER/TREEVIEW
D-CHIP
GENE-CLUSTER
PaGE
VERA and SAM
R-package in R and S-PLUS subroutines
SVDMAN
TREE-ARRANGE and TREEPS
BRB Array Tools
TIGR MultiExperiment Viewer
TIGR ArrayViewer
TIGR SpotFinder
F-SCAN
P-SCAN
GeneX
MAPS (Mircroarray Project System)

This is NOT an exhaustive list

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Goal #2: Determining Visualization Needs

- Survey Research Instrument
  - Survey Design & Implementation
  - VCU Institutional Review Board
  - Identify Survey Targets
- Survey Targets
  - Research Universities
  - National Laboratories
  - Research Institutions
  - Biotech Companies

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Survey Goal

- To ascertain, from researchers who do microarray analysis, what features and functions the next visualization tool should offer to allow them more biological insight into the analysis of multivariate, high-dimensional microarray data.

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Participation in the Study

- Voluntary
- No Identifiable data collected
- Will provide researchers with insight
  - What visualization tools are currently used in the analysis of microarray data,
  - How the tools are used and
  - If the current tools meet the needs of the analyst using these tools.

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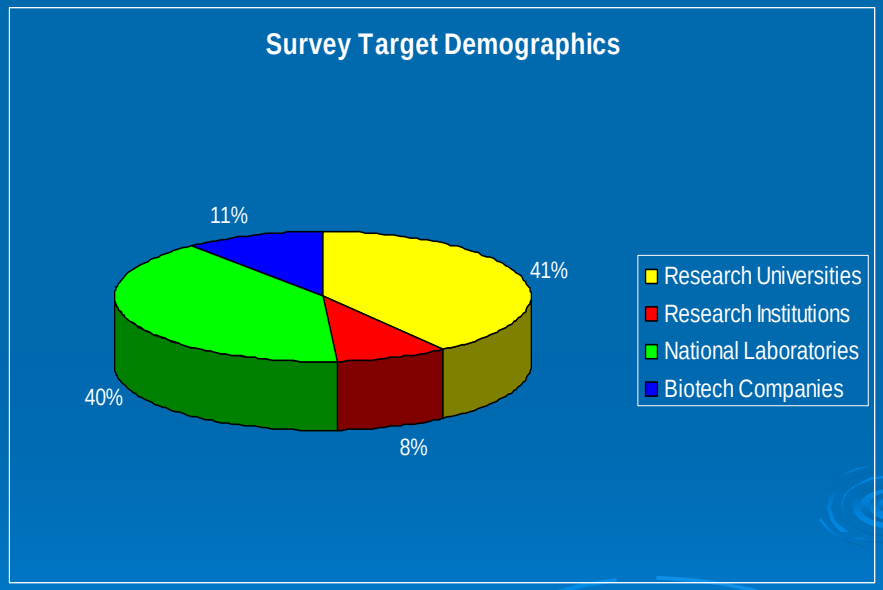
Survey Instrument

- Needs Assessment for Scientific Visualization of Microarray Data
- VCU IRB Approved: IRB# 5065
- 600+ Survey Targets
- 500 Survey Targets randomly selected
- Implemented and distributed this summer from VCU
- Results pending



Acknowledgements

Dr. Tarynn M. Witten

BCCL Colleagues

BBSI Colleagues

BBSI Faculty & Staff

VCU Postal Service

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Questions?

Comments?

Suggestions?

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