Power of Visualization for Precision Medicine in Oncology

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Proprietary
About me (us)

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#Biostatistics #Oncology #Biomarker
#GWAS #NGS #GWAS #Bioinformatics
#R/Shiny #Vim #Linux #JS #Visualization
Outline

• Rethink about visualization, as an important tool for communication either between Statistician and its customers or within statistical team

• Why visualization is important for precision medicine in oncology

• Demo our visualization works for different levels of communication

• Equip statisticians with powerful visualization tools
Our Values: Communication-centered and Objective-driven Visualization

- BSSI values
  - Communication-centered visualization
  - Objective-driven visualization
    - key to transform data to actionable conclusion for our clients

- BSSI was founded on the mission of communication:
  - academic vs industry
  - scientific vs statistics
  - exploratory vs regulatory
Communication Circles

• Interactions between different functions:
  – Statistician, Scientist, Senior Management, and etc.
    • Actionable Points
    • Statistical Insights

Scientists
Physicians
Medical Writer
Senior Management

Statistician
Analytical Team
Vendor
CRO

• Objectives
A Typical Workflow for Statistical Team

Import → Tidy → Transform → Visualise → Model → Communicate → Program

- **Import**: Consistent way of storing data
- **Tidy**: Create new variables & new summaries
- **Transform**: Scales, but doesn’t (fundamentally) surprise
- **Visualise**: Surprises, but doesn’t scale
- **Model**: Scales, but doesn’t (fundamentally) surprise
- **Communicate**: Program

Motivations for Precision Medicine in Oncology

• Finding a valid tailoring biomarker is really hard (not many approved ones). Big opportunity, and more work to do.

• We need to rapidly and systematically transform high volume of biological and statistical hypotheses, into conclusive and actionable points for the next level of hypotheses filtering and generation.

• Visualization facilitates rapid exploration with concise specifications, and infer sensible defaults and allow customization.
The purpose of visualization is **insight**, not pictures.

Ben Shneiderman
Visualization Examples for Different Levels of Communication

- Visualization demos in the next slide

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<th>Visualization Demo</th>
<th>Communication Scenarios</th>
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<tr>
<td>Forest Plot</td>
<td>High-level overview, e.g. publication, executive summary</td>
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<tr>
<td>LSmean Plot</td>
<td>Breakdown one signal, and compare endpoints</td>
</tr>
<tr>
<td>Interactive Volcano Plot</td>
<td>Overview the biomarker effects and directions</td>
</tr>
<tr>
<td>Interactive 3D PCA Plot</td>
<td>Infer population structure or check batch effect</td>
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<tr>
<td>Interactive Schedule Plot</td>
<td>Check data availability and plan statistical analysis</td>
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- High-level visualization tend to be concise and static.
- Exploration is in favor of interactivity.
Live Demo

Disclaimer: All examples are either mock or public data
Equip Statisticians with Powerful Visualization Tools
Equip Statisticians with Powerful Visualization Tools

• ggplot2 reshaped the visualization landscape and vocabulary
• Htmlwidgets (e.g. plotly, and many open source packages) make modern visualization never be so easy!
  – linking/crosstalk
  – selection/brushing
  – multi-view/dashboard
  – animation
• Interactive and web-based visualization can be a main stream in the near future
The Grammar of (Interactive) Graphics

• Wilkinson (1999, 2005)
  – Chart typologies versus general graphics in graphical software
  – Wilkinson's monograph aimed to replace chart typographies with an overarching language

• Each layer represents different view of the same data
  – E.g. a scatterplot with overlaid smoother

• Multiple layers will composite an insight, via scale comparison, network, grouping, and etc.

• Interactivity provides even more layers
  – selection, hovering, animation, and etc.

• Expressive logics
  – Align graphics, programing, and statistical logics
Key Points Summary

• We promote communication-centered and objective-focused visualization.
• Visualization make decision faster and easier.
• Statistician should equip with powerful visualization tools.
• More data comes in with faster pace, especially in the Oncology area and after data sharing. Effective and efficient visualization is a key. It buys more time for Statistician to thinking and modeling.
Thank You!

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