What Makes a Visualization Complex?

Kylie Lin Sean Sheng-Tse Ru David N. Rapp Hui Guan Cindy Xiong Bearfield

Georgia Institute of Technology University of Massachusetts Amherst Northwestern University

Modeling the **Visual Complexity** of Static Data Visualizations Based on **Design Features**

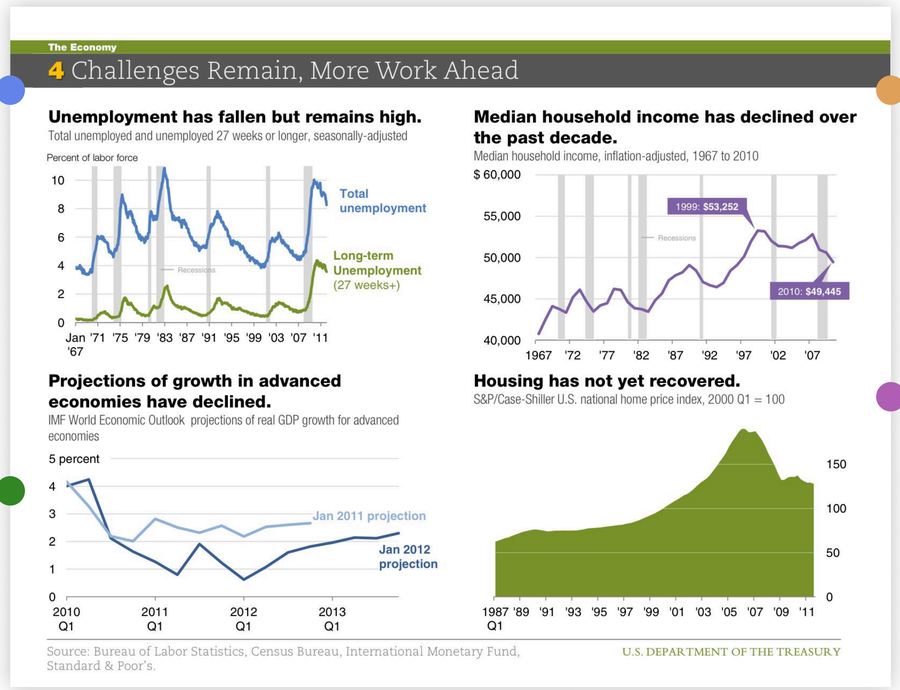
Read More!

Text

Title(s)
Axes label(s)
Axes text
Legend title
Legend text
Annotation(s)
Caption(s)
Text only
No text

Data

of quantitative variables (6)
# of categorical variables (2)



Color

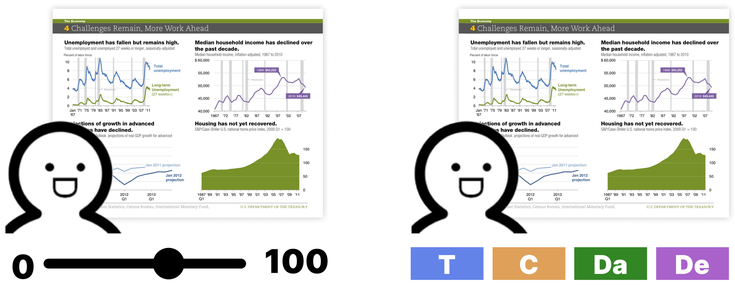
Black & white
Background color
# of colors (6)

Design

of charts (4)
# of chart types (2)
Chart types
Area Table Point ...
Line Map Bar ...

Process & Results

Complexity Ratings + Collect Features



Support Vector Regression (best R = 0.644)

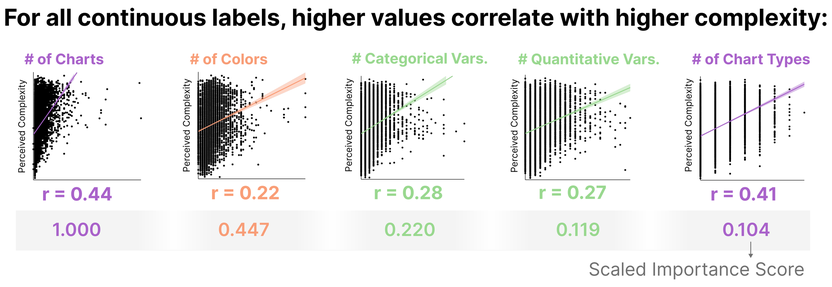
Linear Regression (best R^2= 0.591)

Decision Tree Regression (best R = 0.525)

Models	Hyperparameters	R2	MAE / MSE
Multiple Linear	–	0.591	10.73 / 179.70
Lasso	$\alpha = 0.0046$	0.589	10.75 / 180.30
Ridge	$\alpha = 1$	0.590	10.73 / 179.79
rbfSVR	$C = 10$, γ = scale, $\varepsilon = 1$	0.644	9.86 / 156.33
Decision Tree	depth=6, split=85, leaf=11	0.525	11.19 / 208.38

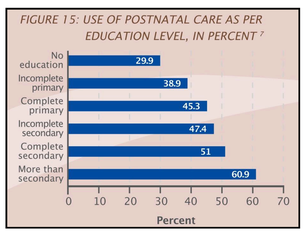
Models	Features	Importance
Linear	# of Chart Types	21.35
	Circle	-10.22
	Black and White	9.88
	Bar	-9.32
	# of Charts	8.33
Lasso	# of Chart Types	13.54
	Black and White	9.53
	# of Charts	8.34
	Circle	-7.95
	Bar	-7.04
Ridge	# of Chart Types	19.67
	Black and White	9.84
	Circle	-9.74
	Bar	-8.83
	# of Charts	8.33
rbfSVR	# of Charts	72.35
	# of Colors	32.32
	Diagram(s)	25.62
	Caption(s)	24.49
	# of Categorical Vars.	15.89
Decision Tree	# of Charts	0.54
	Caption(s)	0.20
	# of Colors	0.07
	Title(s)	0.07
	Background Color	0.02

For all continuous labels, higher values correlate with higher complexity:

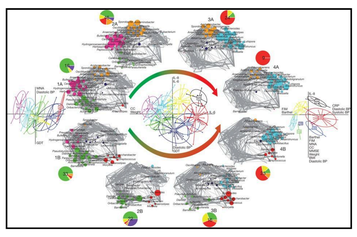


Mean perceived complexity was higher/lower when certain labels applied to a visualization:

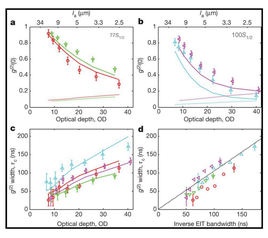
How 'visually complex' is each design?



mean rating: 1.9



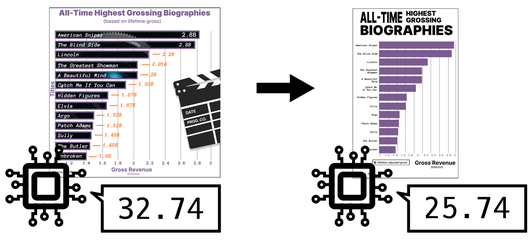
mean rating: 96.7



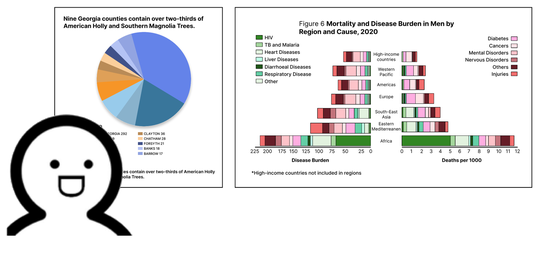
mean rating: 50

Applications of our work

Improving visualization design workflows



Studies on human cognition and visualization design



Kylie R. Lin

@kylierlin
kylierlin.github.io