Visualization by Demonstration:
An Interaction Paradigm for Visual Data Exploration

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IEEE Transactions on Visualization and Computer Graphics

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Data Exploration without Specification

Introduction

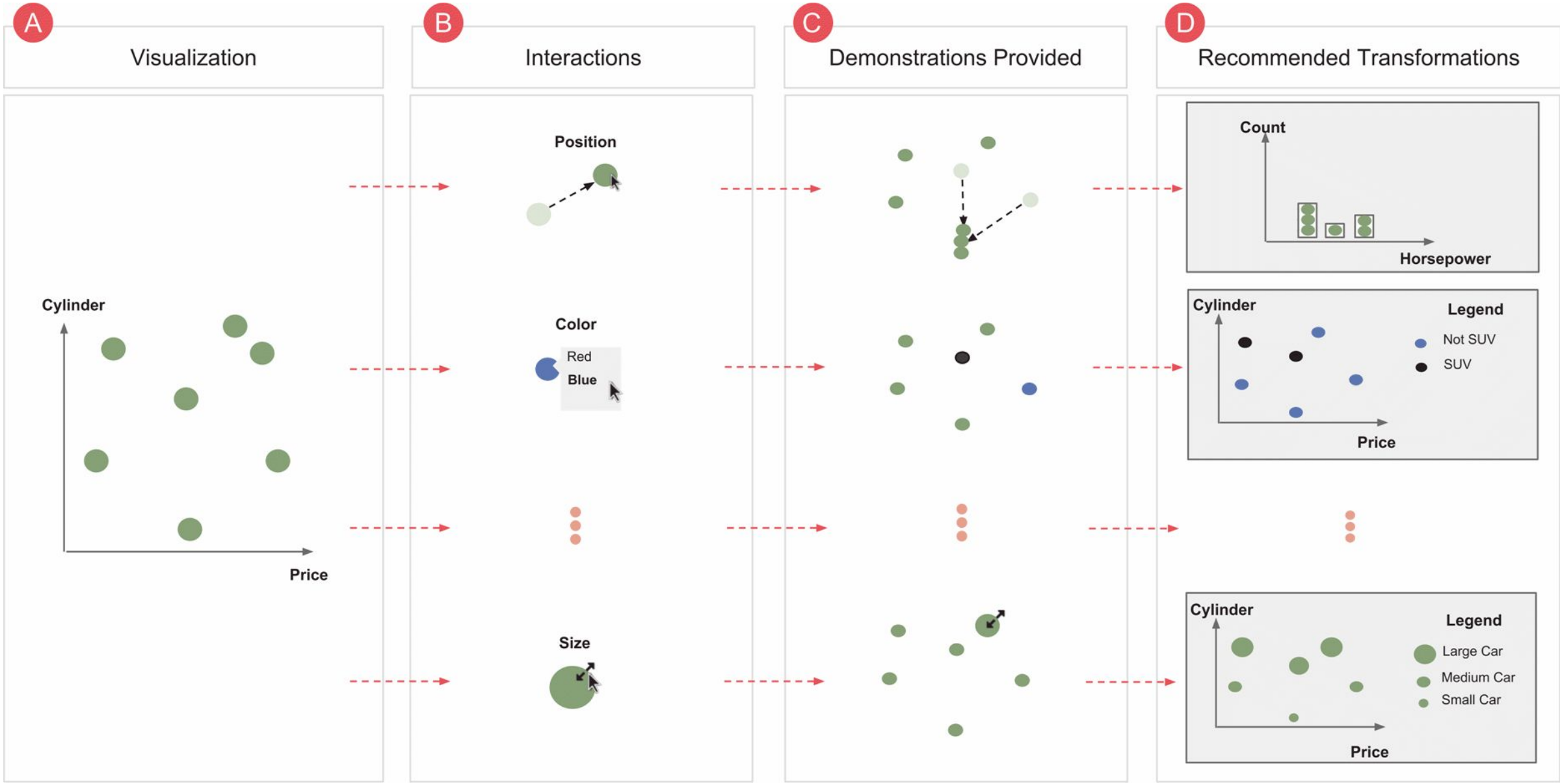
Use demonstrations to generate:

- visualizations techniques
- mappings
- parameters

Contributions

Visualization by Demonstration

1. Does not require users to specify vis techniques
2. Extracts vis mappings and parameters


A
Visualization
B
Interactions
C
Demonstrations Provided
D
Recommended Transformations
Cylinder
Price
Position
Color
Red
Blue
Size
Count
Horsepower
Cylinder
Legend
Not SUV
SUV
Price
Cylinder
Legend
Large Car
Medium Car
Small Car
Price

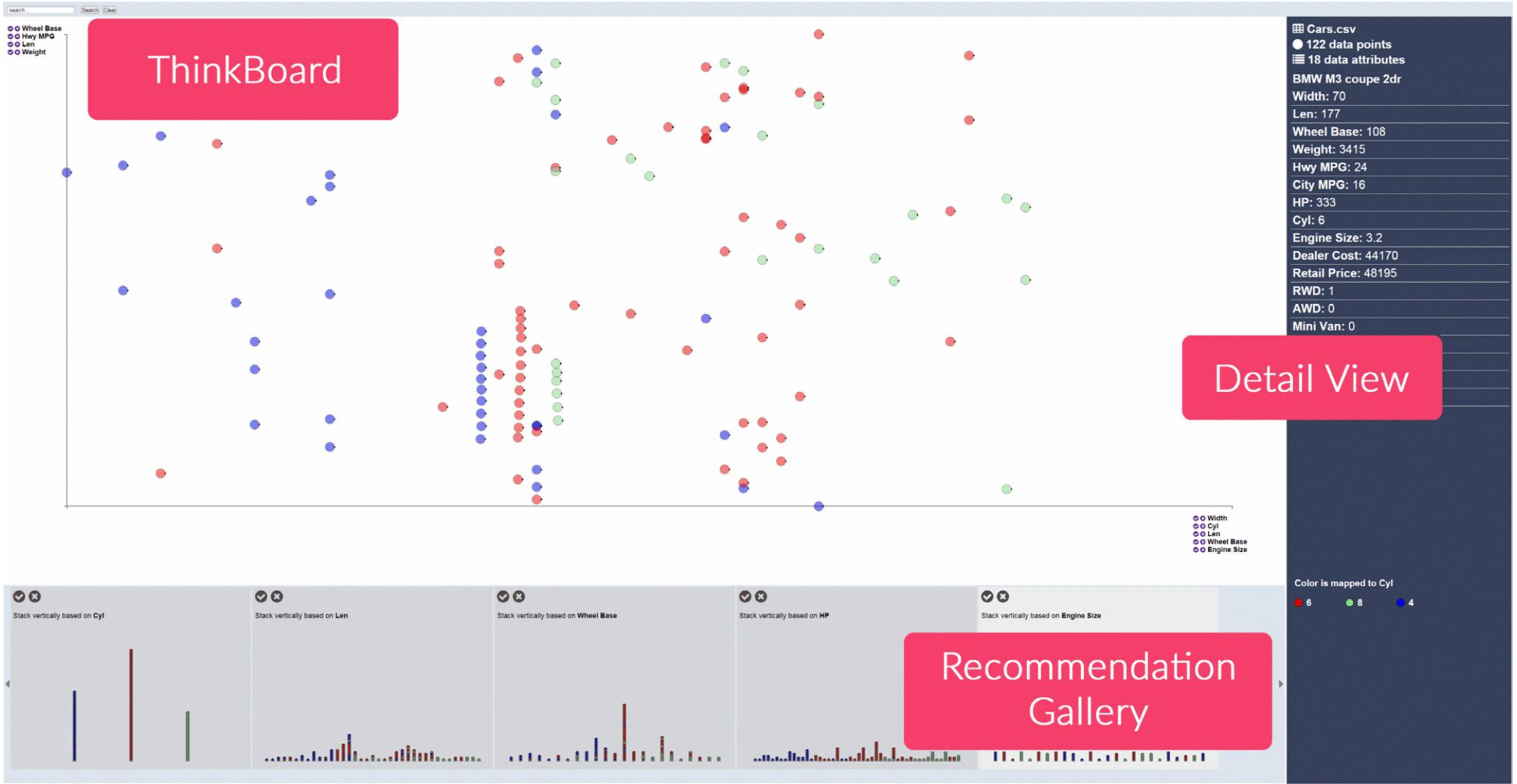
Video

https://www.youtube.com/watch?v=JFdStB0nYRs

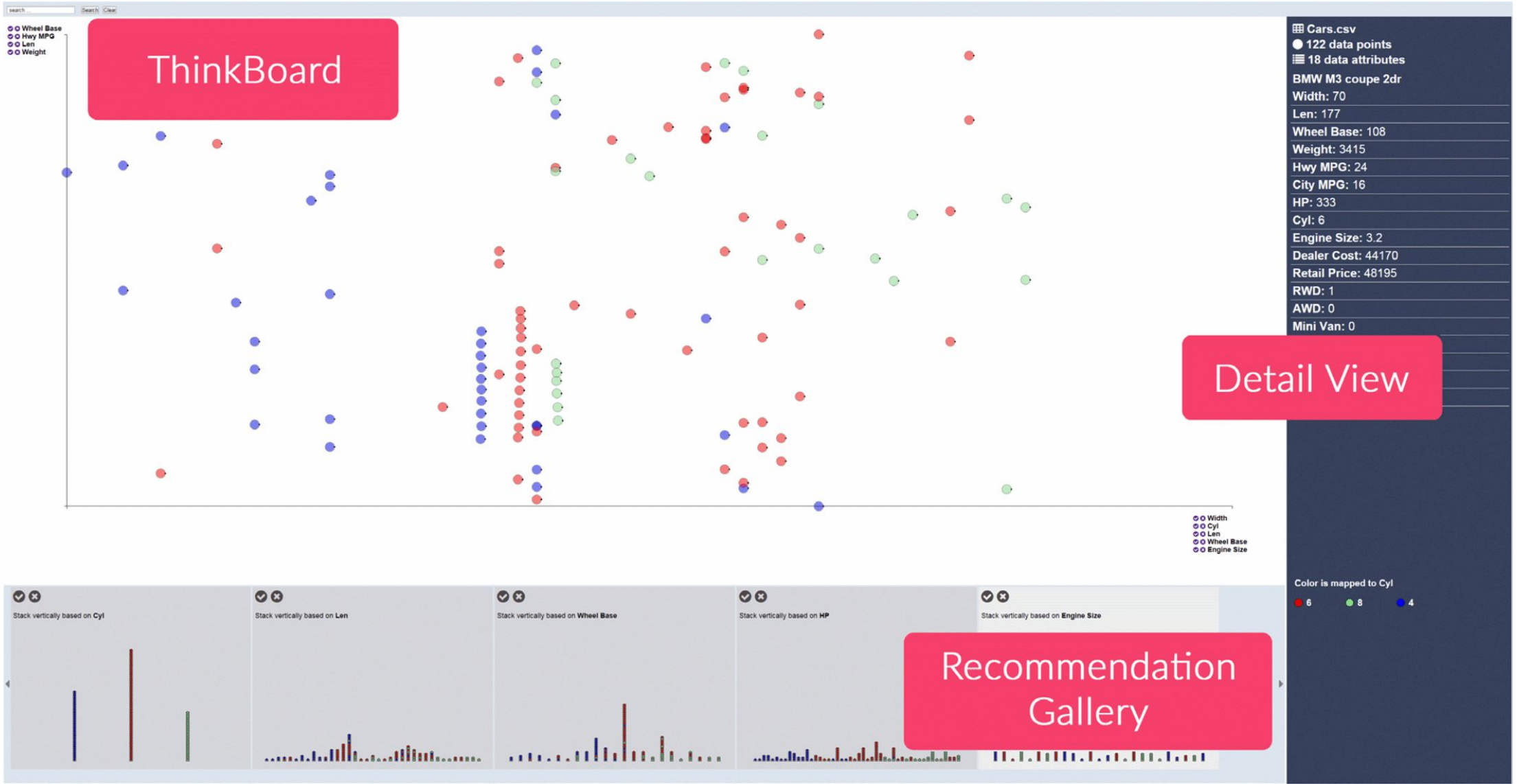
Design Guidelines

1. Support direct manipulation
2. Balance human/system workload
3. Enable user interactions to drive transformations
4. Enhance interpretability of recommendations

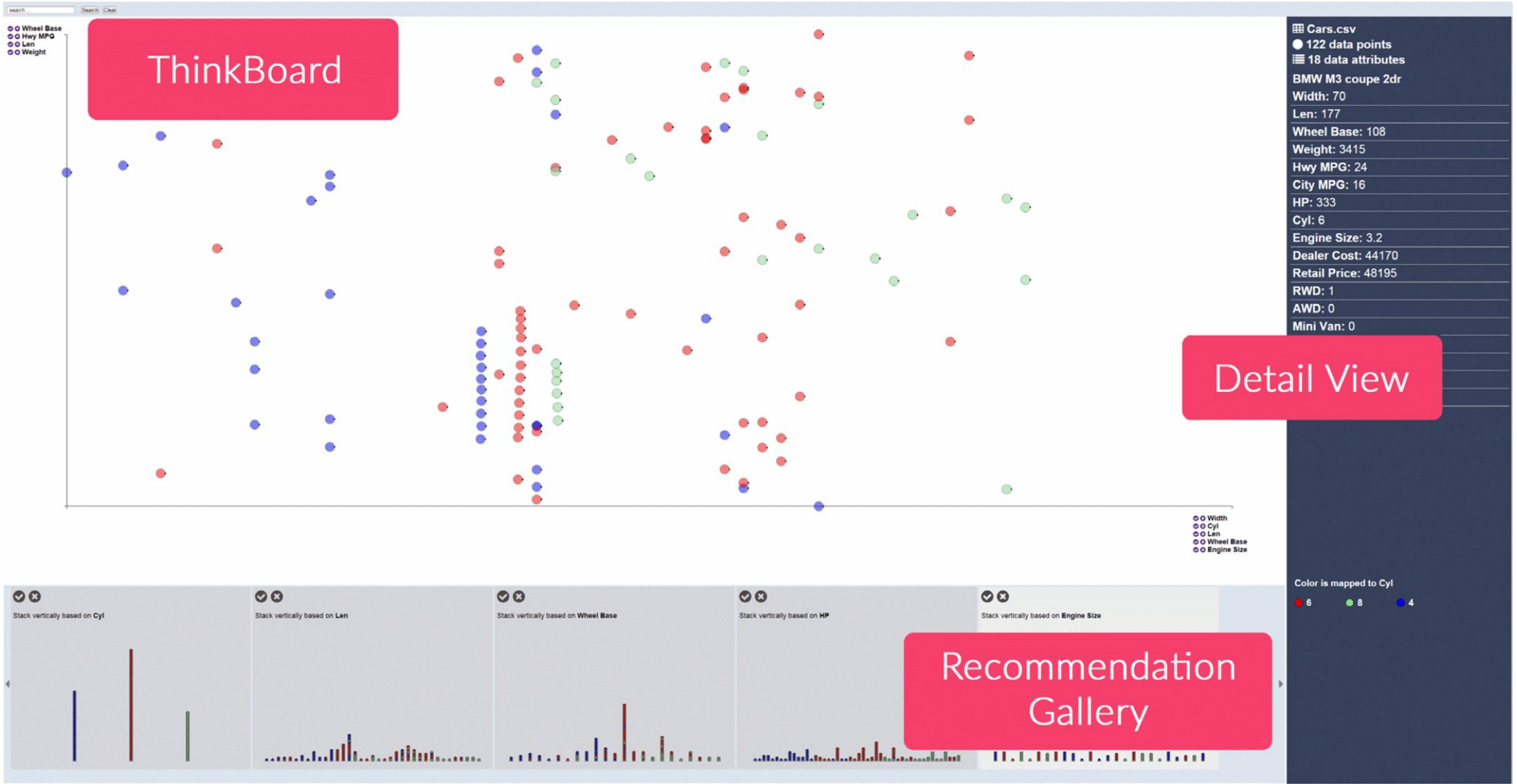
VisExemplar



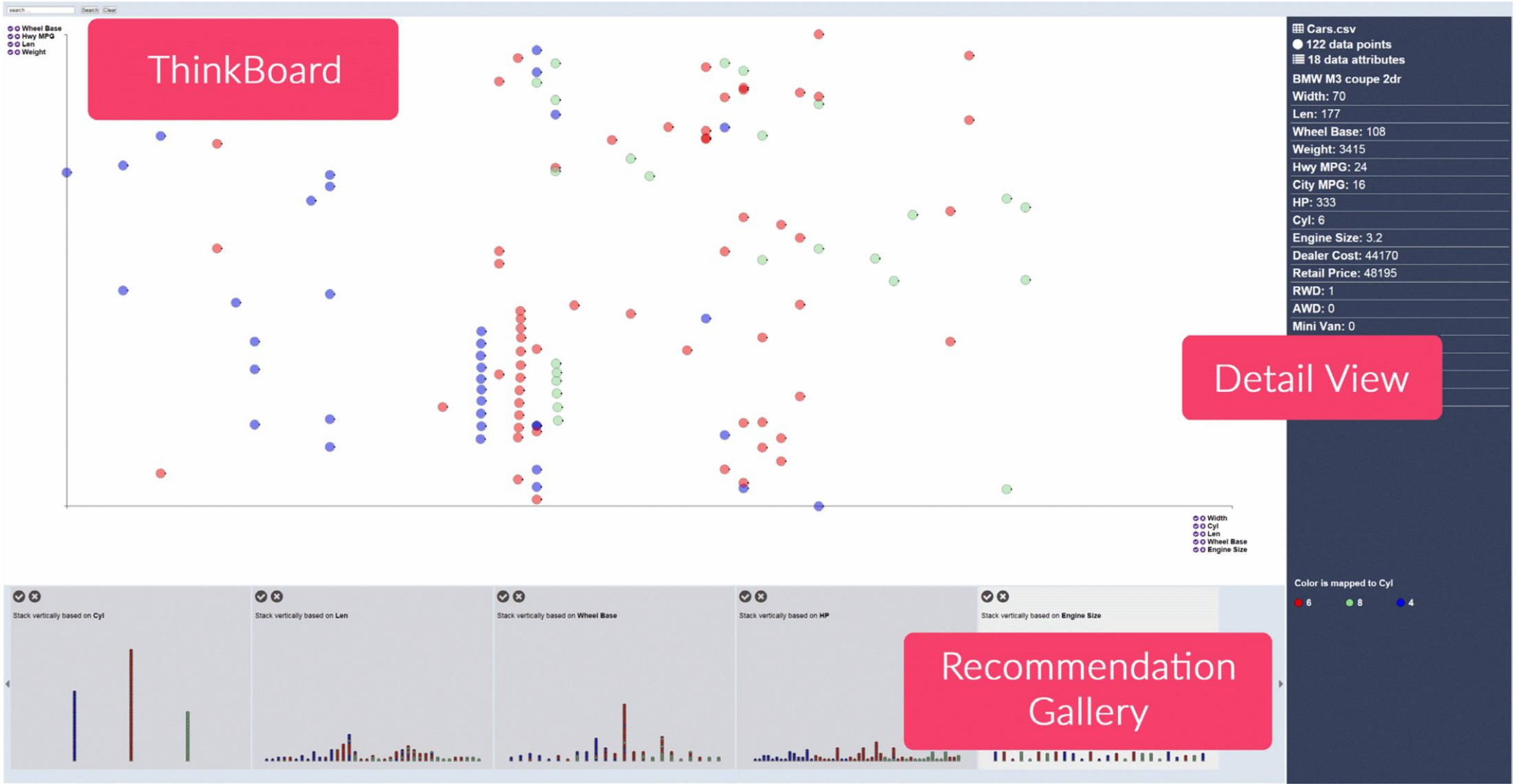
1. Support direct manipulation



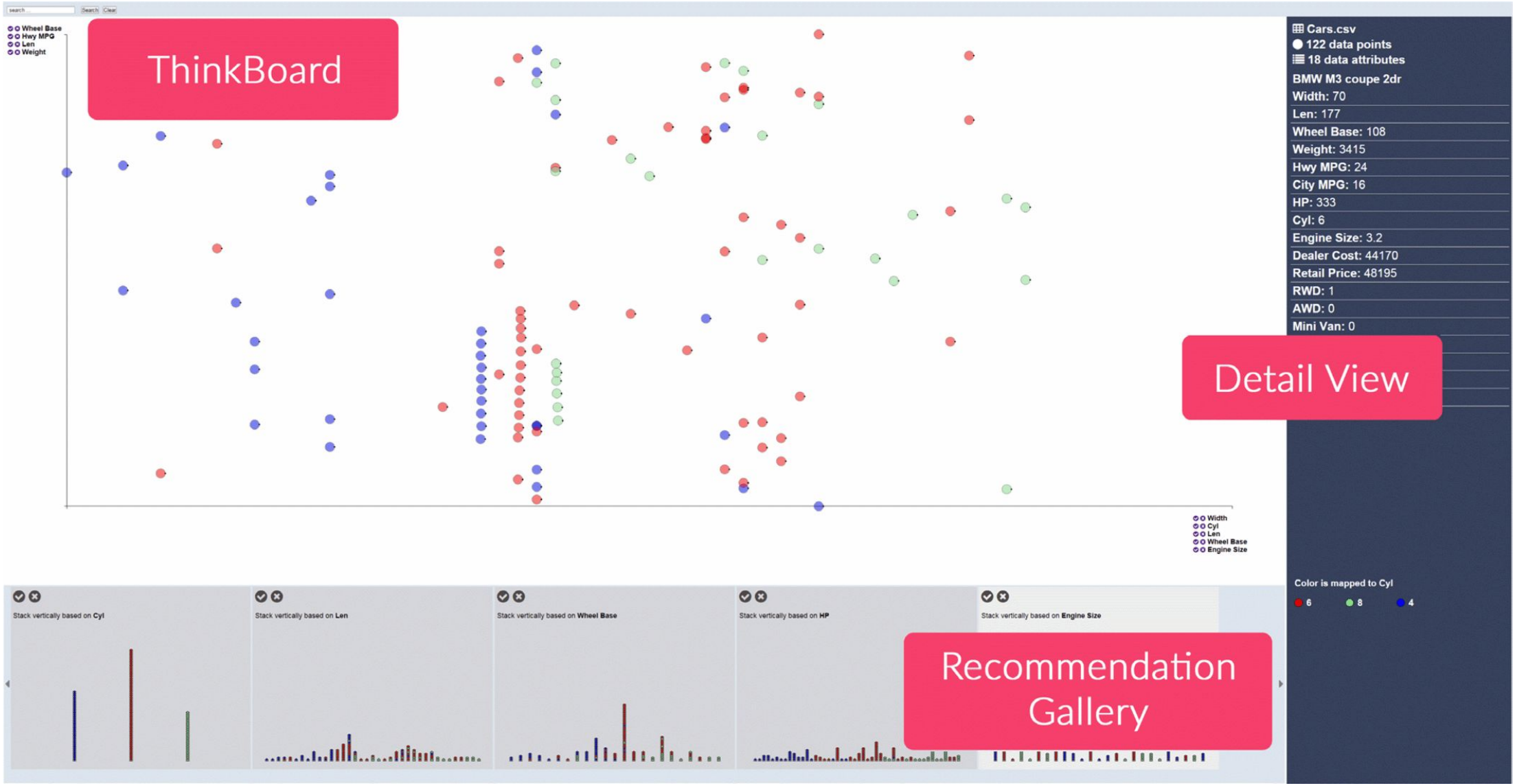
2. Balance **human/system** workload



3. Enable user **interactions** to drive **transformations**



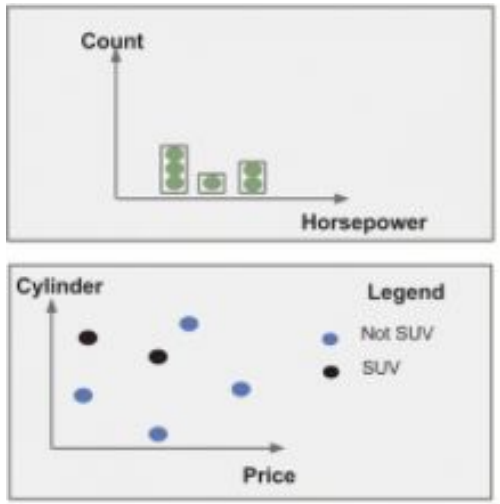
4. Enhance **interpretability** of recommendations



WHAT → Table

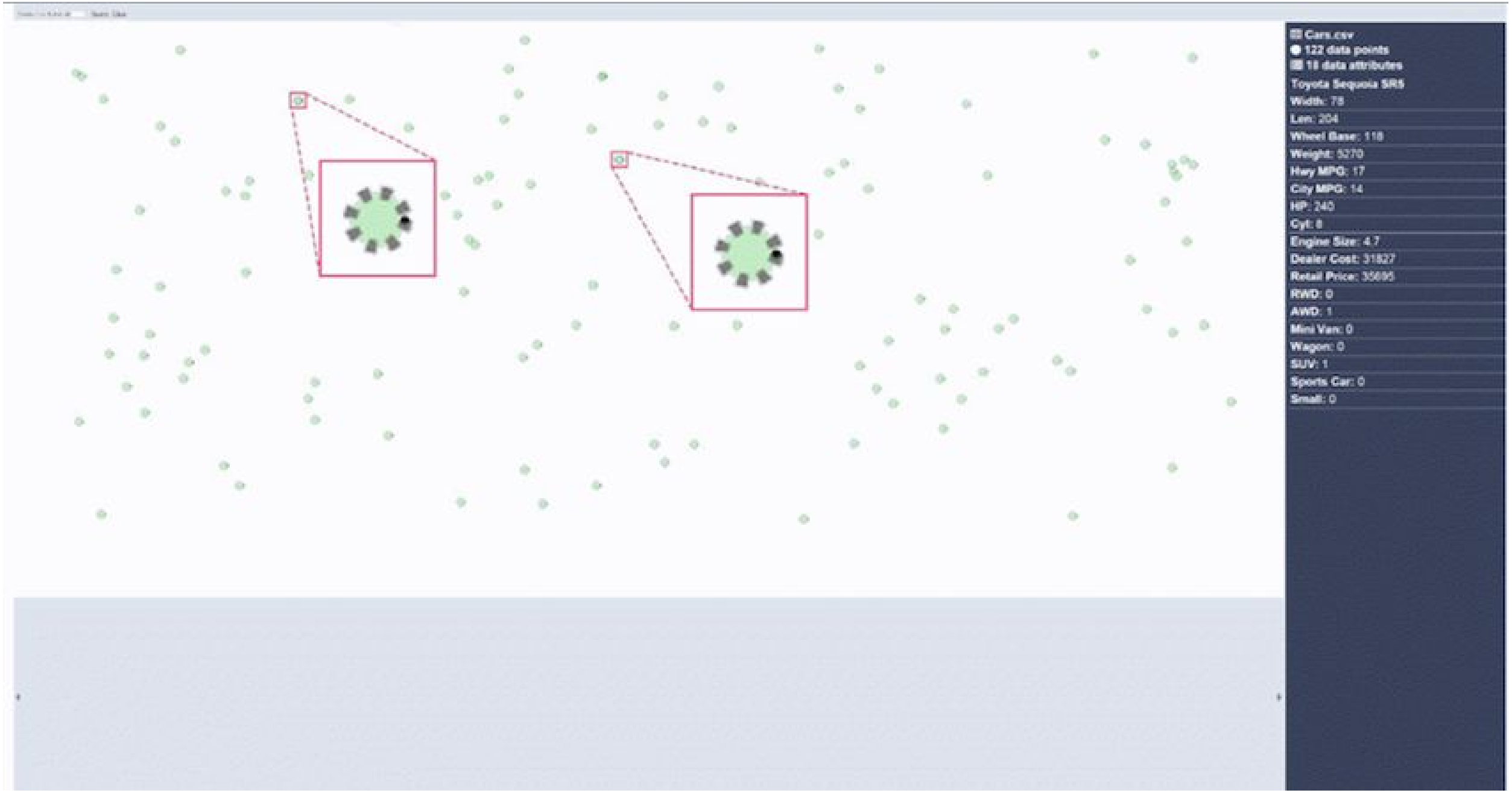
WHY → **Explore**, **compare,** and **summarize**

HOW → Scatterplots and bar charts
Manipulation: resize, recolor, reposition

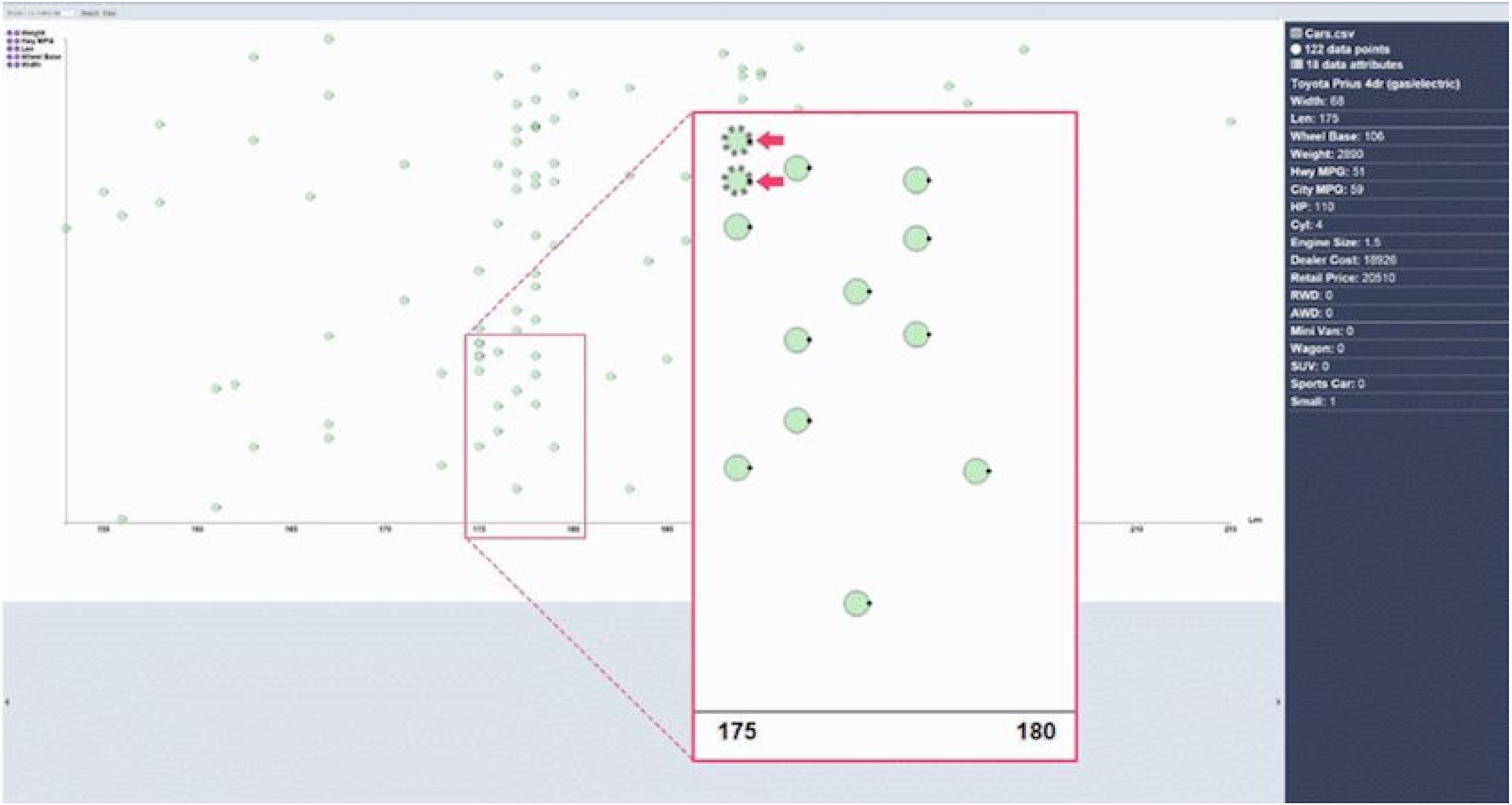


SCALE → Hundreds or Thousands

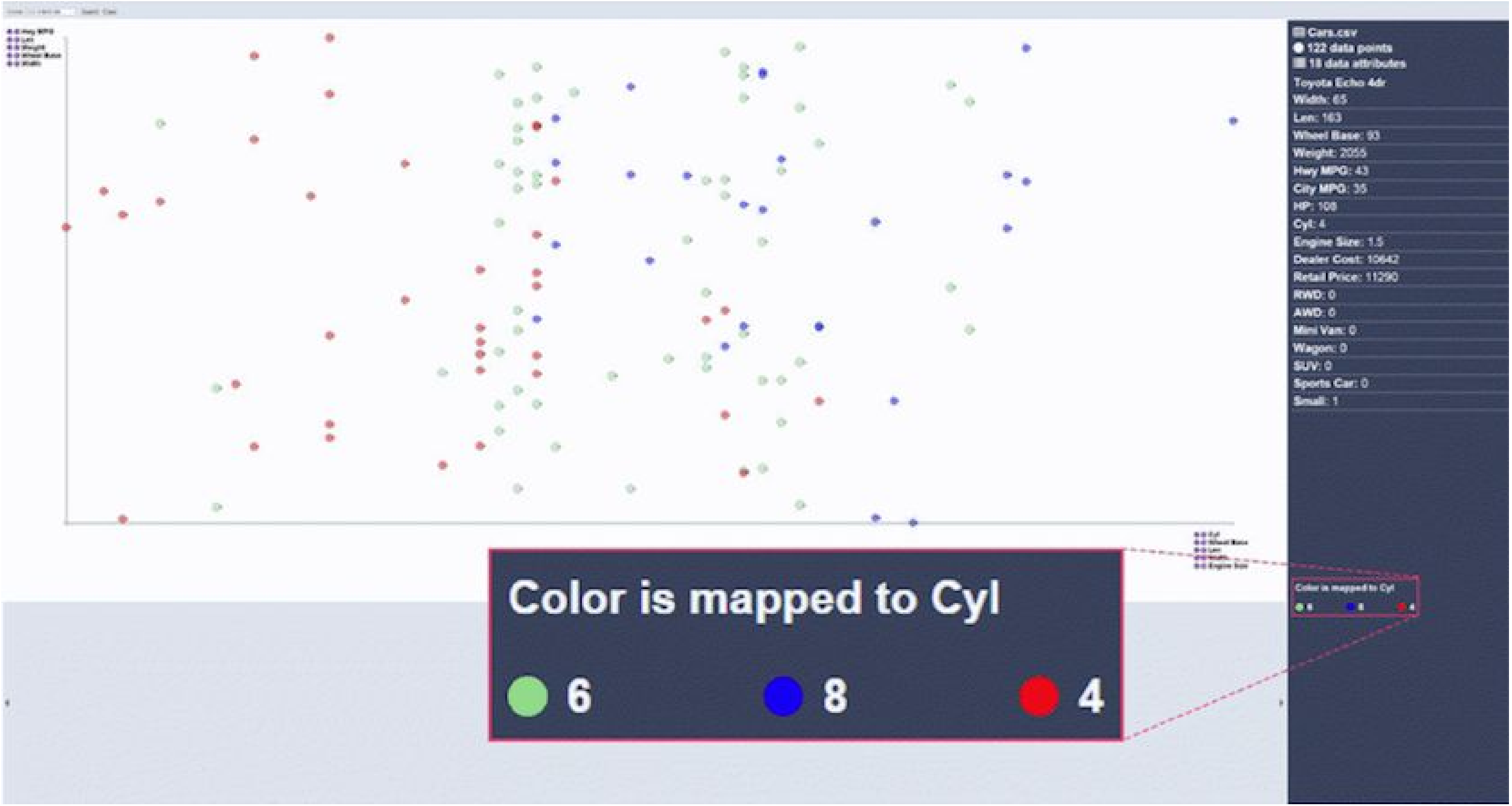
Task Example

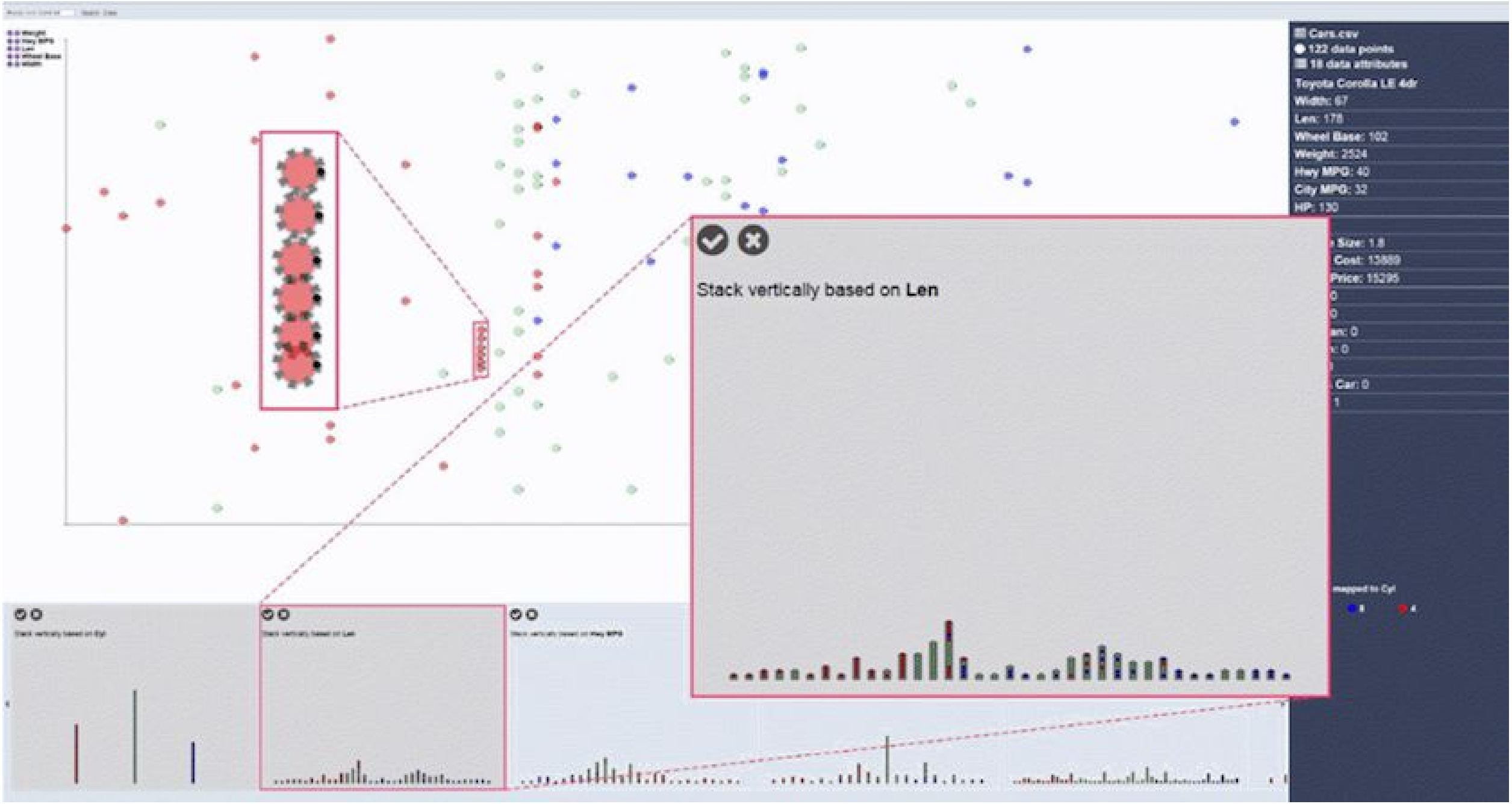

Cars.csv
122 data points
18 data attributes
Toyota Sequoia SR5
Width: 78
Len: 204
Wheel Base: 118
Weight: 5270
Hwy MPG: 17
City MPG: 14
HP: 240
Cyl: 8
Engine Size: 4.7
Dealer Cost: 31822
Retail Price: 35695
RWD: 0
AWD: 1
Mini Van: 0
Wagon: 0
SUV: 1
Sports Car: 0
Small: 0

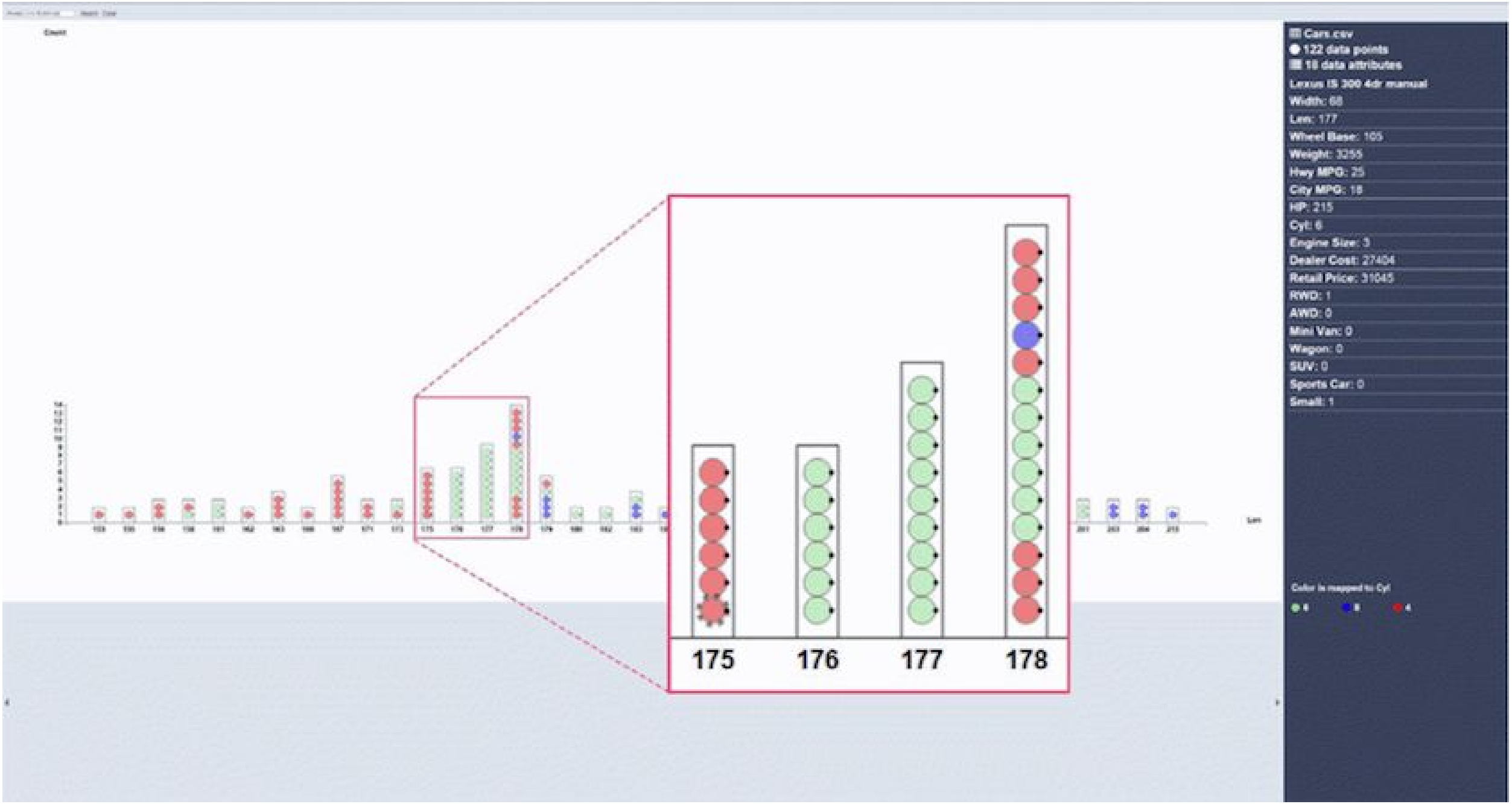
Weight
Hwy MPG
Len
Wheel Base
Width
Len
Wheel Base
HP
Cyl
Hwy MPG
Cars.csv
122 data points
18 data attributes
Honda Civic Hybrid 4dr manual (gas/electric)
Width: 68
Len: 175
Wheel Base: 103
Weight: 2732
Hwy MPG: 51
City MPG: 46
HP: 93
Cyl: 4
Engine Size: 1.4
Dealer Cost: 18451
Retail Price: 20140
RWD: 0
AWD: 0
Mini Van: 0
Wagon: 0
SUV: 0
Sports Car: 0
Small: 1

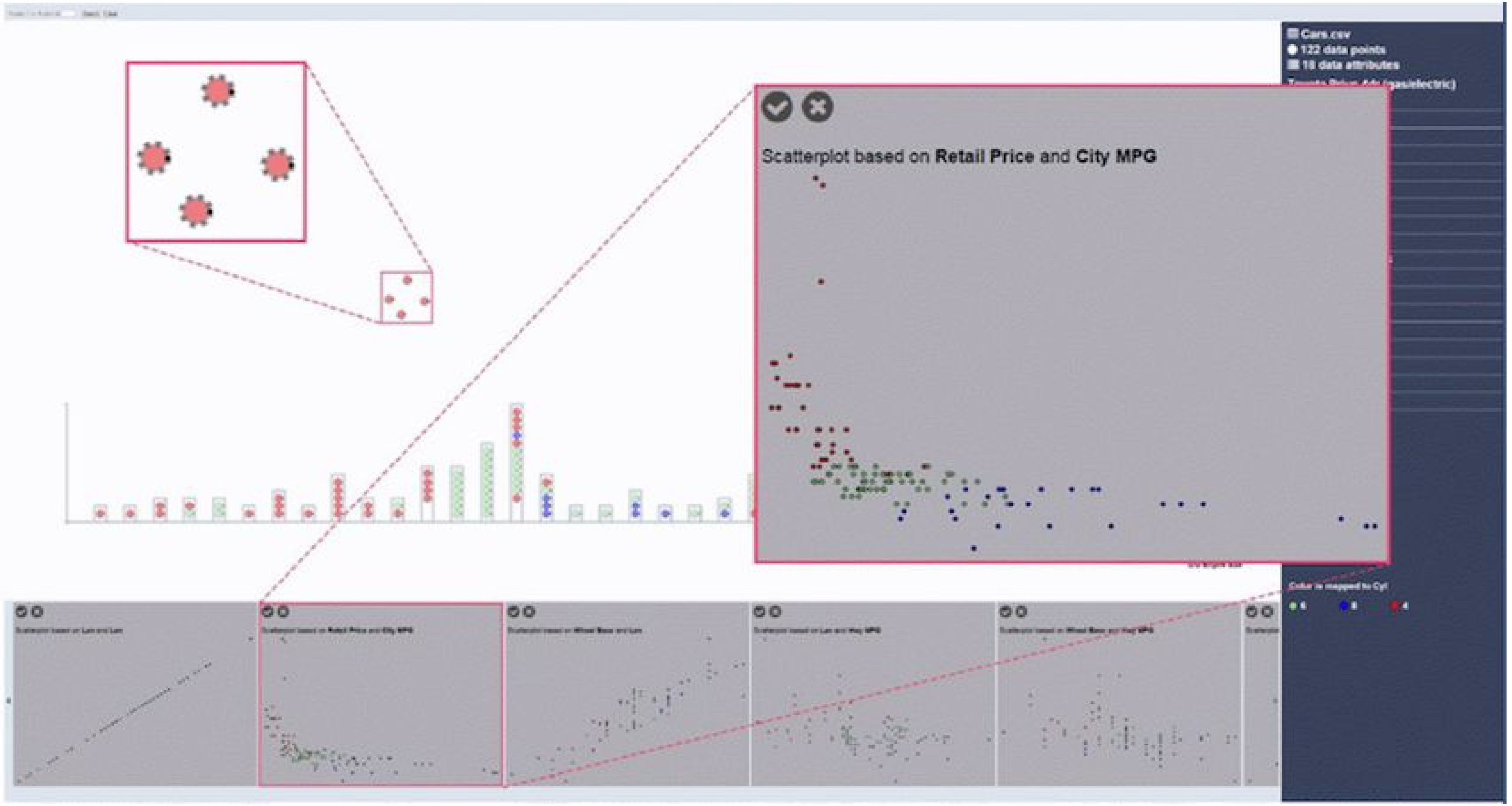

Cars.csv
122 data points
18 data attributes
Toyota Prius 4dr (gas/electric)
Width: 68
Len: 175
Wheel Base: 106
Weight: 2890
Hwy MPG: 51
City MPG: 59
HP: 110
Cyl: 4
Engine Size: 1.5
Dealer Cost: 18926
Retail Price: 20510
RWD: 0
AWD: 0
Mini Van: 0
Wagon: 0
SUV: 0
Sports Car: 0
Small: 1
175
180

Red
Blue
Cyl: 4
Engine Size: 1.5
Dealer Cost: 18926
Retail Price: 20510
RWD: 0
AWD: 0
Mini Van: 0
Wagon: 0
SUV: 0
Sports Car: 0
Small: 1
Cars.csv
122 data points
18 data attributes
Toyota Prius 4dr (gas/electric)
Width: 68
Len: 178
Wheel Base: 106
Weight: 2890
Hwy MPG: 51
City MPG: 59
HP: 110
Cyl: 4
Engine Size: 1.5
Dealer Cost: 18926
Retail Price: 20510
RWD: 0
AWD: 0
Mini Van: 0
Wagon: 0
SUV: 0
Sports Car: 0
Small: 1


Cars.csv
122 data points
18 data attributes
Toyota Echo 4dr
Width: 65
Len: 163
Wheel Base: 93
Weight: 2055
Hwy MPG: 43
City MPG: 35
HP: 108
Cyl: 4
Engine Size: 1.5
Dealer Cost: 10642
Retail Price: 11290
RWD: 0
AWD: 0
Mini Van: 0
Wagon: 0
SUV: 0
Sports Car: 0
Small: 1
Color is mapped to Cyl
6
8
4


Cars.csv
122 data points
18 data attributes
Toyota Corolla LE 4dr
Width: 67
Len: 178
Wheel Base: 102
Weight: 2524
Hwy MPG: 40
City MPG: 32
HP: 130
Stack vertically based on Len


Count
Cars.csv
122 data points
18 data attributes
Lexus IS 300 4dr manual
Width: 68
Len: 177
Wheel Base: 105
Weight: 3255
Hwy MPG: 25
City MPG: 18
HP: 215
Cyl: 6
Engine Size: 3
Dealer Cost: 27404
Retail Price: 31045
RWD: 1
AWD: 0
Mini Van: 0
Wagon: 0
SUV: 0
Sports Car: 0
Small: 1
Color is mapped to Cyl
4
6
8
175
176
177
178


Cars.csv
122 data points
18 data attributes
Scatterplot based on Retail Price and City MPG
Color is mapped to Cyl
4
6
8

Potential Transformations

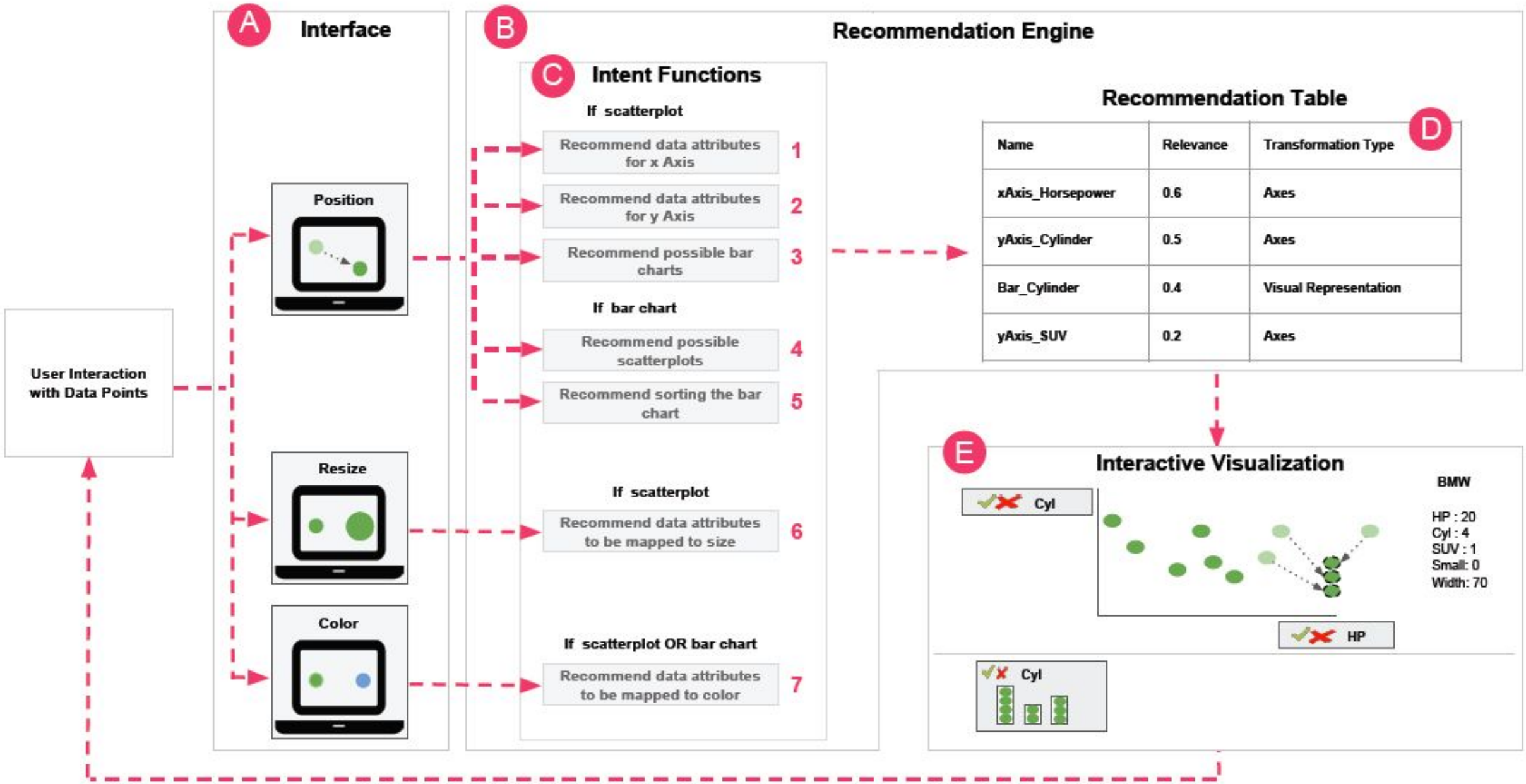
1. **Visual Representation**
2. Data Mapping
3. Axes
4. View Specification

1. Visual Representation
2. **Data Mapping**
3. Axes
4. View Specification

1. Visual Representation
2. Data Mapping
3. **Axes**
4. View Specification

1. Visual Representation
2. Data Mapping
3. Axes
4. **View Specification**

Recommendation Engine


A
Interface
B
Recommendation Engine
C
Intent Functions
If scatterplot
Recommend data attributes for x Axis
1
Recommend data attributes for y Axis
2
Recommend possible bar charts
3
If bar chart
Recommend possible scatterplots
4
Recommend sorting the bar chart
5
If scatterplot
Recommend data attributes to be mapped to size
6
If scatterplot OR bar chart
Recommend data attributes to be mapped to color
7
Position
Resize
Color
User Interaction with Data Points
Recommendation Table
D
Name
Relevance
Transformation Type
xAxis_Horsepower
0.6
Axes
yAxis_Cylinder
0.5
Axes
Bar_Cylinder
0.4
Visual Representation
yAxis_SUV
0.2
Axes
E
Interactive Visualization
Cyl
BMW
HP : 20
Cyl : 4
SUV : 1
Small: 0
Width: 70
HP
Cyl

Discussion

1

Tradeoff between
flexibility of vis-by-demonstration
vs.
the loss of formality

2

Other vis techniques

3

No sophisticated analytic operations

4

Transforming to vis techniques with different graphical encodings

5

Consistency in visual mappings

6

Exploring methods of presenting recommendations in visualizations

Critique

1. No **validation**
2. Need to keep track of favorite points -> makes **comparison** hard
3. Cannot **set axis** to a certain attribute
4. Great start to the exploration problem.

Thank you!

Dilan Ustek