

Radial Projection Explorer

InfoVis SS2020

G4

[24/06/2020]

Outline

- Project Specification
- Implementation
 - Tools
- Development
 - Environment
 - Experience
- The Application
 - General
 - Closer look at the views.
- Showcase

Overview

- Explore data with radial projection techniques.
- One application to visualize them all:
 - RadViz
 - Star Coordinates
 - Dust & Magnet

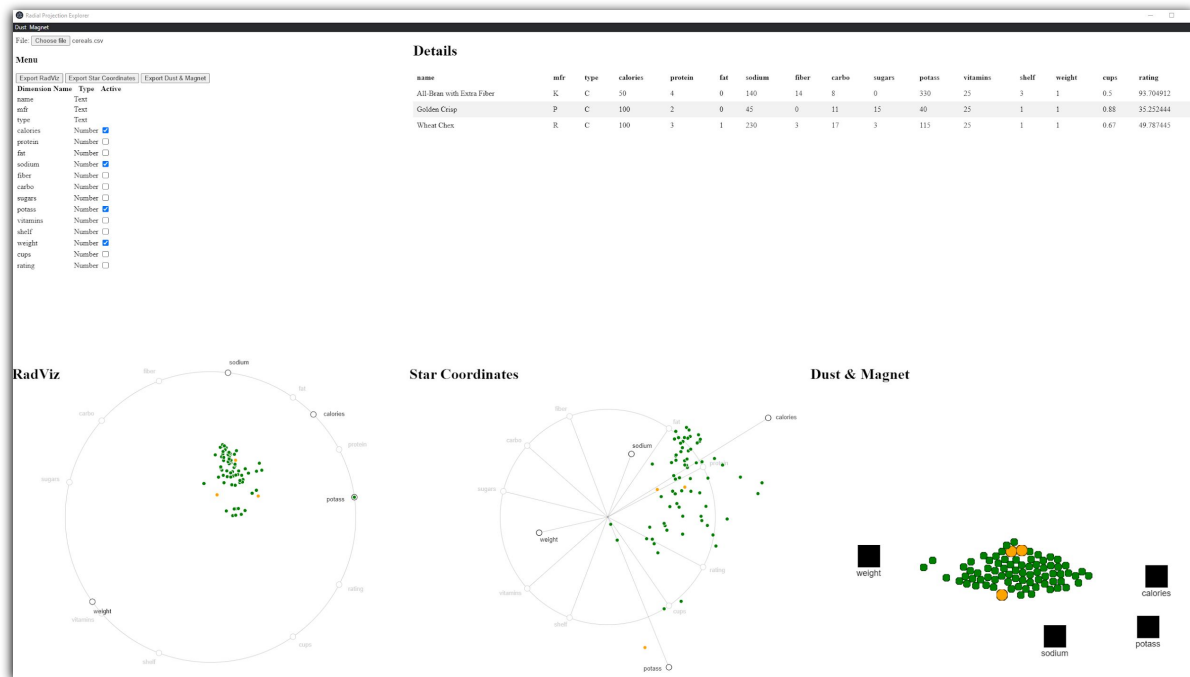


Figure 1: The Radial Projection Explorer
[Screenshot made from Radial Projection Explorer]

Implementation - Basic

- TypeScript version 3.9.3
 - JavaScript super set
 - “Strongly” typed
- Electron version 9.0.2
 - Cross platform desktop apps with JavaScript
- D3
 - CSV data parsing



ELECTRON

Figure 2: Election logo

[Graphic from

<https://www.electronjs.org/images/electron-logo.svg>]

- <https://www.typescriptlang.org/>
- <https://www.electronjs.org/>

Implementation - Drawing

- Pixi.js
 - WebGL and not SVG
 - Convert from WebGL to SVG for export
 - Open Source (MIT License)
- Two.js
 - SVG based drawing (no interactivity otherwise)
 - Used for SVG export



Figure 3: PixiJS logo
[Graphic from
<https://pixijs.download/pixijs-banner-v5.png>]

Development Environment

- Visual Studio Code
 - Editor
 - Also an electron application
- Gulp.js as task runner.
 - Create Tasks for
 - Building
 - Bundling
 - Executing
- Browserify
 - Bundle dependencies



Figure 4: VS Code logo
[Graphic from
en.wikipedia.org/wiki/File:Visual_Studio_Code_1.3_5_icon.svg]



Figure 5: gulp logo
[Graphic from
raw.githubusercontent.com/gulpjs/artwork/master/gulp-2x.png]



Figure 6: browserify logo
[Graphic from <http://browserify.org/>]

Development Experience

- All were inexperienced with TS, Node.Js, and Electron.
- Setup was very challenging.
 - One frustrating puzzle, getting all the versions to work together.
- Implementation after setup was a pleasant experience
 - TS typing is very helpful

The Application

- Chromium Base
- 5 Windows
- Resizeable
- Multi process application
 - Inter-process communication
- Easily distributed as a stand alone application.

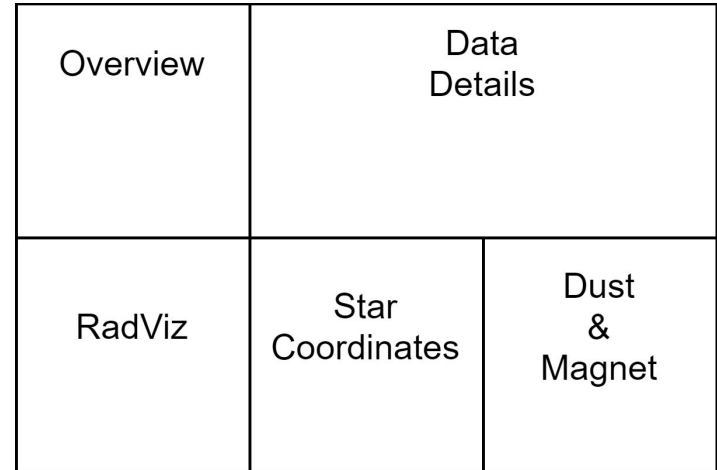


Figure 7: Layout of Radial Projection Explorer
[Graphic created by Lukas Neuhold using draw.io]

Overview & Detail Window

- Overview:
 - Load a CSV file
 - Control active inactive dimensions.
 - Export views to SVG
- Detail:
 - See actual values of data points selected.
 - Hover highlighting

Details

name	mfr	type	calories	protein	fat	sodium	fiber	carbo	sugars	potass	vitamins	shelf	weight	cups	rating
Frosted Mini-Wheats	K	C	100	3	0	0	3	14	7	100	25	2	1	0.8	58.345141
Maypo	A	H	100	4	1	0	0	16	3	95	25	2	1	1	54.850917
Muesli Raisins, Dates, & Almonds	R	C	150	4	3	95	3	16	11	170	25	3	1	1	37.136863
Muesli Raisins, Peaches, & Pecans	R	C	150	4	3	150	3	16	11	170	25	3	1	1	34.139765

Figure 9: Detail Window of Radial Projection Explorer
[Screenshot made by Lukas Neuhold from Radial Projection Explorer]

Overview

Load File: cereals.csv

Menu

Dimension Name	Type	Active
name	Text	
mfr	Text	
type	Text	
calories	Number	<input checked="" type="checkbox"/>
protein	Number	<input checked="" type="checkbox"/>
fat	Number	<input checked="" type="checkbox"/>
sodium	Number	<input checked="" type="checkbox"/>
fiber	Number	<input checked="" type="checkbox"/>
carbo	Number	<input checked="" type="checkbox"/>
sugars	Number	<input checked="" type="checkbox"/>
potass	Number	<input checked="" type="checkbox"/>
vitamins	Number	<input checked="" type="checkbox"/>
shelf	Number	<input checked="" type="checkbox"/>
weight	Number	<input checked="" type="checkbox"/>
cups	Number	<input checked="" type="checkbox"/>
rating	Number	<input checked="" type="checkbox"/>

Figure 8: Overview Window of Radial Projection Explorer
[Screenshot made by Lukas Neuhold from Radial Projection Explorer]

Dust & Magnet

- Dust & Magnet as developed by Soo Yi, Ji, et al.
- Dimensions are magnets.
- Data records are dust.
- Animated over time to help understand data.

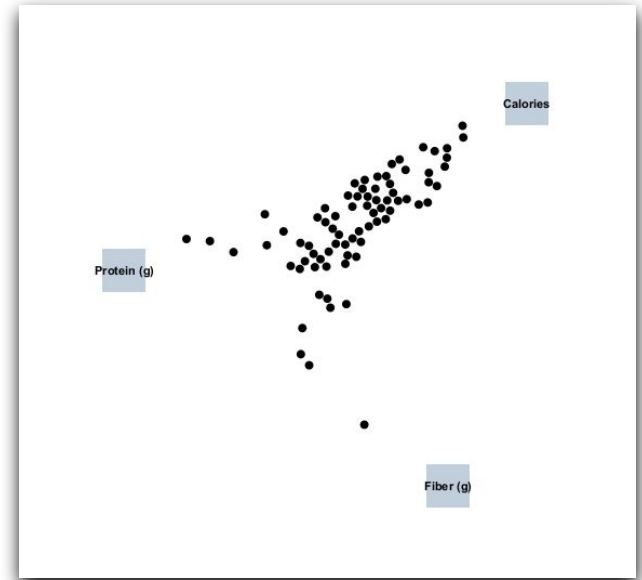


Figure 10: A simple visualization using Dust & Magnet
[Graphic created by Lukas Neuhold using Dust & Magnet
developed by Ji Soo Yi]

Soo Yi, Ji, et al. "Dust & magnet: multivariate information visualization using a magnet metaphor." Information visualization 4.4 (2005): 239-256.

Dust & Magnet - Features

- Magnets
 - Draggable
 - increase/decrease magnet strength
- Dust
 - Interactable
 - Dust can not hide behind magnets.
 - Attract Dust
 - Leave magnets static and attract dust towards them.
 - Center Dust
 - Reset dust to center of screen.
 - Spread Dust
 - Remove dust overlap

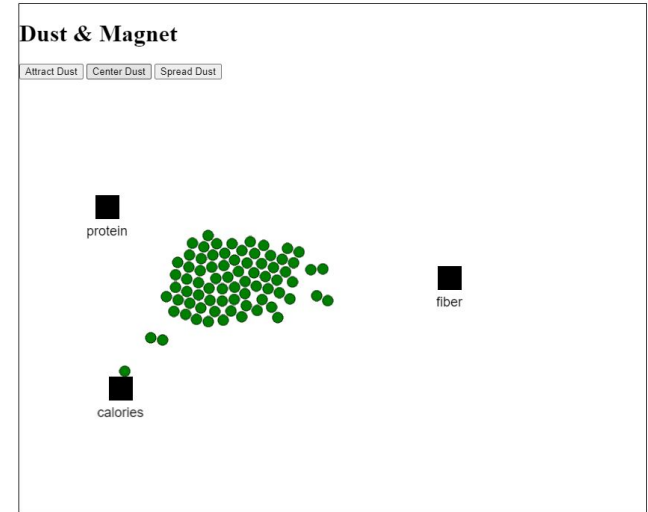


Figure 11: Dust & Magnet Visualization
[Graphic exported from Radial Projection Explorer]

RadViz - Recap

- Projection of data points follows a physical spring model.
- Values must be normalized to $[0...1]$
 - 0 being the minimum and 1 the maximum value of this dimension
- Value in one dimension defines how strong the point is pushed towards the anchor (part of the normalized mapping).
- If all dimensions have the same value, a sample maps to the anchor points' center of mass.
- All mappings are inside the circle.

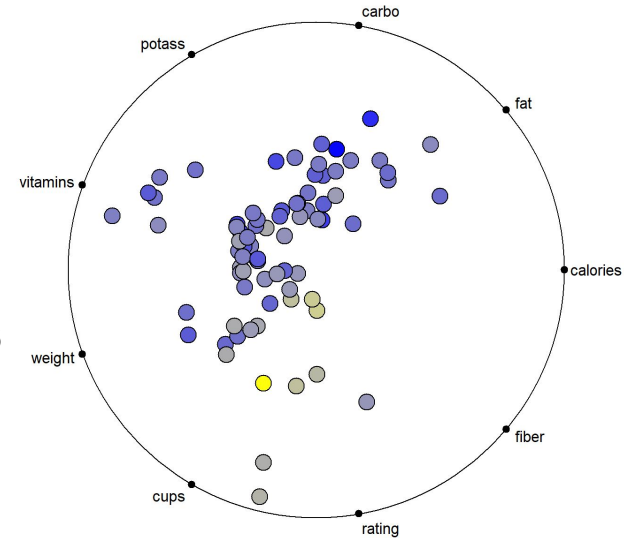


Figure 12: Basic RadViz visualization
[Screenshot made by Georg Regitnig from RadVizX]

RadViz - Features

- Implements Visualization developed by Patrick E. Hoffmann.
- Reordering of dimensional anchors via Drag & Drop.
 - Can be freely positioned 360 degrees on the circle.
- Dynamic redraw during the dragging process.
- Selection of data points
 - Coloring of selected points with a different color.

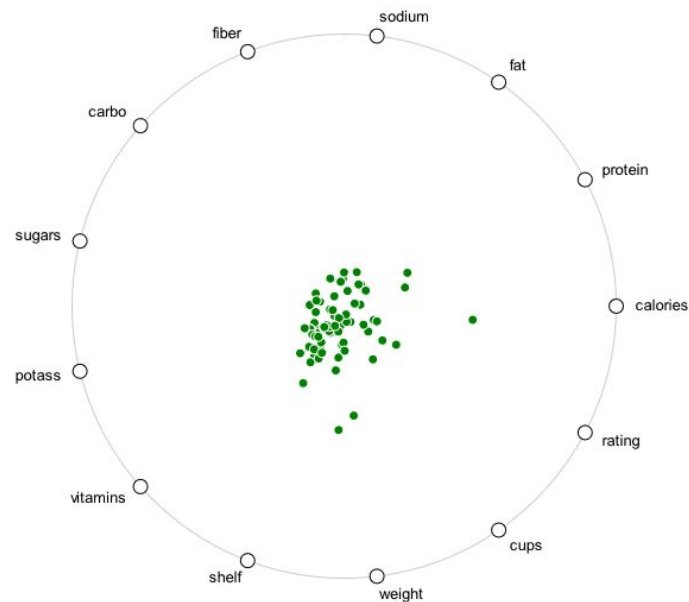


Figure 13: Basic RadViz Visualization
[Graphic exported from Radial Projection Explorer]

Star Coordinates - Recap

- Each dimension in a sample is multiplied with respective axis' unit vector.
- The mapped point is the sum of all these vectors (Vector Sum).
- Values can be negative.
- The mapping is linear, no normalization is done.
- Records can be mapped to points outside the unit circle.

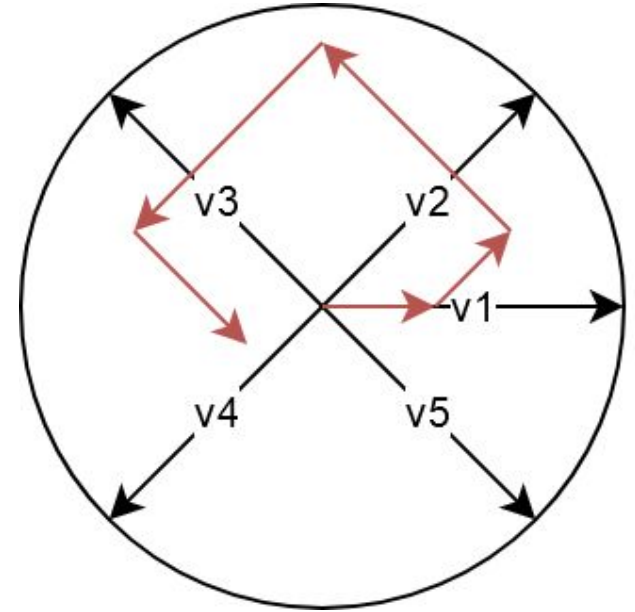


Figure 14: Star Coordinates Vector Sum
[Graphic created by Georg Regitnig using draw.io]

Kandogan, Eser. "Star coordinates: A multi-dimensional visualization technique with uniform treatment of dimensions." *Proceedings of the IEEE Information Visualization Symposium*. Vol. 650. Citeseer, 2000.

Star Coordinates

- Implements Visualization developed by Kandogan
- Data records are mapped to the vector sum of their dimension's values
- Features:
 - Scale dimensional axes to modify their contribution
 - Rotate dimensional axes to modify the direction they add to the mapping
 - Dynamic redraw during the dragging process

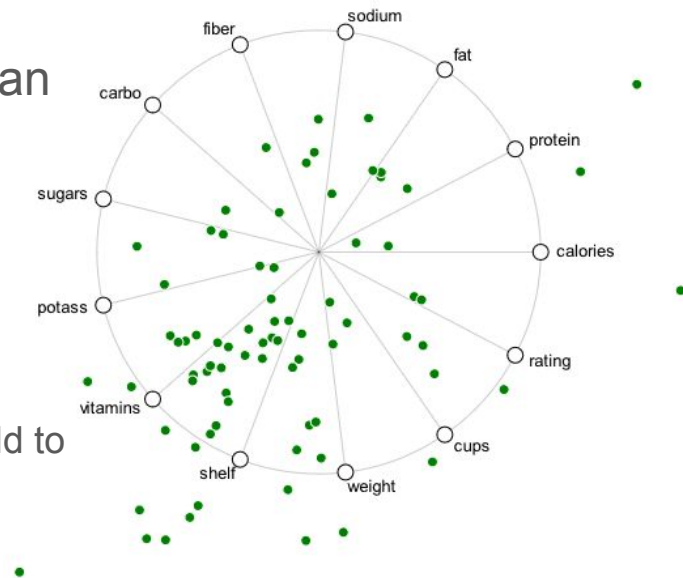


Figure 15: Basic Star Coordinates Visualization
[Graphic exported from Radial Projection Explorer]

Kandogan, Eser. "Star coordinates: A multi-dimensional visualization technique with uniform treatment of dimensions." *Proceedings of the IEEE Information Visualization Symposium*. Vol. 650. Citeseer, 2000.

Menu

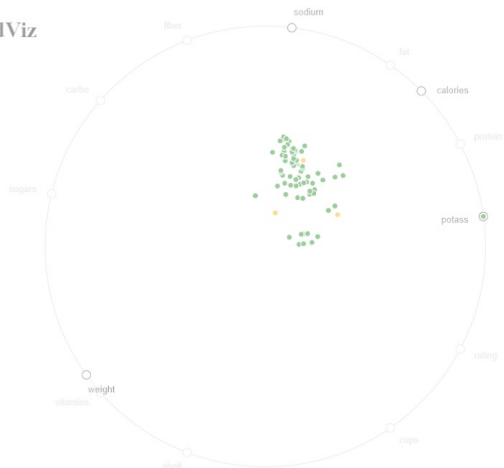
Dimension Name Type Active

- name Text
- mfr Text
- type Text
- calories Number
- protein Number
- fat Number
- sodium Number
- fiber Number
- carbo Number
- sugars Number
- potass Number
- vitamins Number
- shelf Number
- weight Number
- cups Number
- rating Number

Details

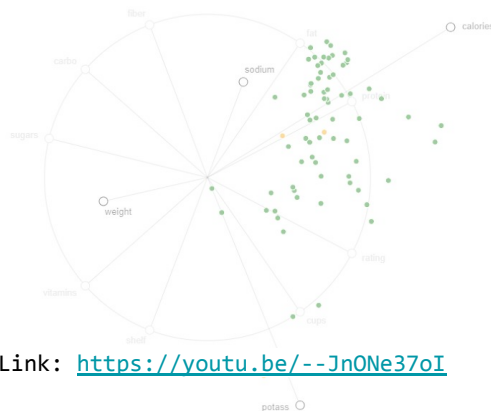
name	mfr	type	calories	protein	fat	sodium	fiber	carbo	sugars	potass	vitamins	shelf	weight	cups	rating
All-Bran with Extra Fiber	K	C	50	4	0	140	14	8	0	330	25	3	1	0.5	93.704912
Golden Crisp	P	C	100	2	0	45	0	11	15	40	25	1	1	0.88	35.252444
Wheat Chex	R	C	100	3	1	230	3	17	3	115	25	1	1	0.67	49.787445

RadViz

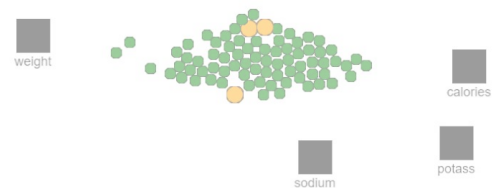


Star Coordinates

Showcase!



Dust & Magnet



Link: <https://youtu.be/--Jn0Ne37oI>