

Accessible Charts: Extending AChart

Group G1:

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Information Visualisation SS 2021

Web A11y (Web Accessibility)

- Makes web content accessible to blind or colour blind people:
 - Web-UIs
 - Infographics
 - Text

- Different standards have emerged:
 - A11y Tree
 - ARIA

Rules when using ARIA

1. Always use native HTML, unless no other way to make element accessible.
2. Do not change native HTML semantics (e.g. use `<button>` and not ``).
3. Make ARIA controls keyboard accessible (`tabindex="0"`).
4. For focusable elements never add `role="presentation"` or `aria-hidden="true"`.
5. Accessible names (e.g. `aria-label="Search"` or `<label>`).

ARIA Properties

- `aria-label`: Label element with short name or value.
- `aria-labelledby`: Labeling by referring to element by id.
- `aria-describedby`: More detailed description of element.
- `aria-valuemin/aria-valuemax`: Min. and max. values of range elements.
- `aria-roledescription`: Natural-language equivalent to ARIA role.
- `aria-hidden`: Remove elements from A11y Tree. For purely decorative elements.

ARIA ARIA Graphics Module - Roles

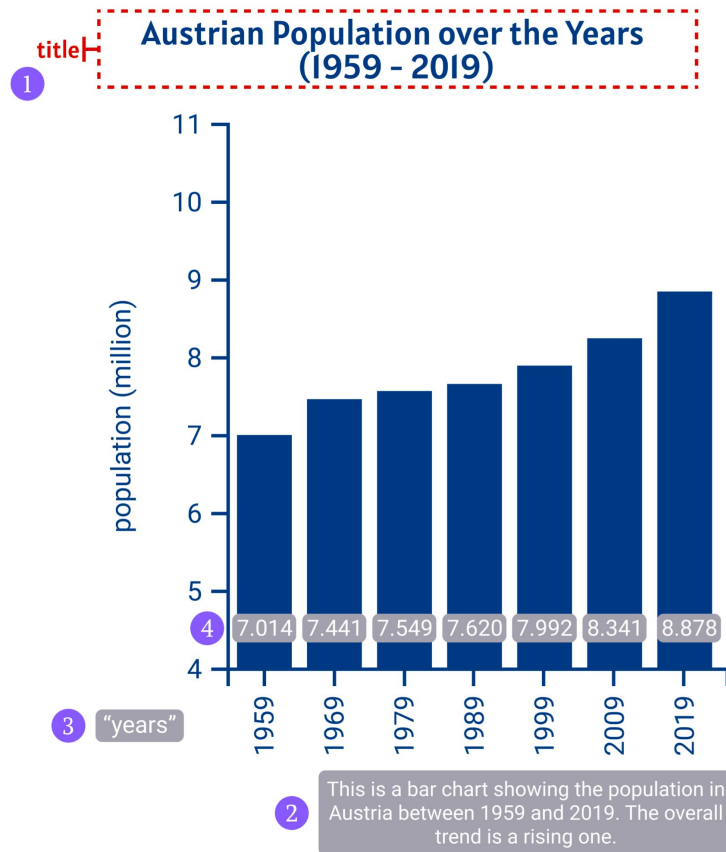
Additional roles for SVG elements:

- `graphics-document`: Document conveys meaning through visual appearance.
- `graphics-object`: Section of graphics-document. Represents distinct object or sub-component with semantic meaning.
- `graphics-symbol`: Graphical object treated as single image component.

ARIA Simply Annotated SVGs

Contains standard ARIA roles and properties.

- Visible graphic elements
- Tabindices (determine tab order)
- **Focusable elements**
- Non-visible labels (for focusable elements)

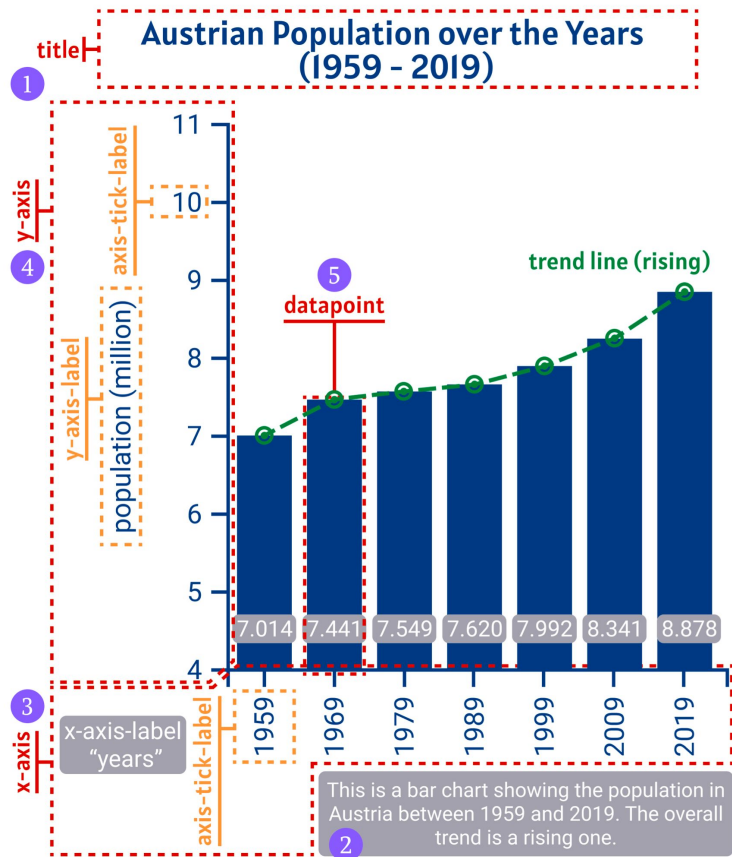


Drawn by Markus Stradner, inspired by the illustrations of a [barchart](#) from [Fizz Studio](#).

ARIA Richly Annotated SVGs

Contains additional roles and properties.

- Visible graphic elements
- Tabindices (determine tab order)
- Focusable elements
- Non-visible labels (for focusable elements)
- Focusable, visible labels
- Supplementary information



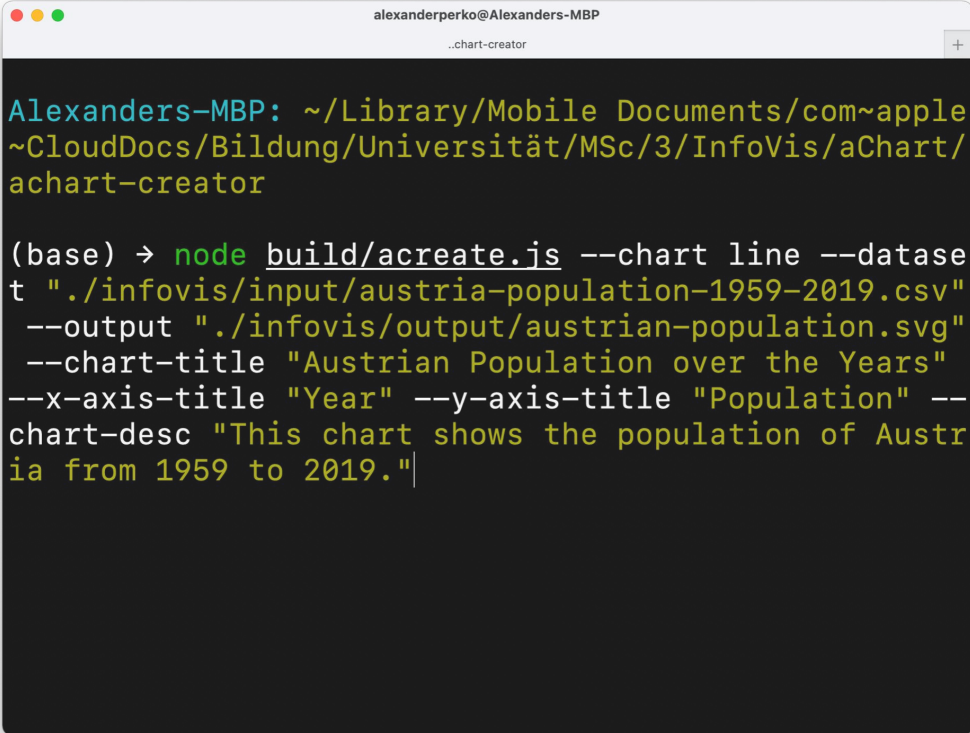
Drawn by Markus Stradner, inspired by the illustrations of a [barchart](#) from [Fizz Studio](#).

ARIA Richly Annotated SVGs

```
<g id="ChartRoot" tabindex="0" transform="translate(100,100)" aria-labelledby="title desc"
aria-charttype="bar" aria-roledescription="Bar Chart">
  <desc id="desc">
    This is a bar chart showing the population in Austria between 1959 and 2019. The overall
    trend is a rising one.
  </desc>
  <rect width="600" height="400" fill="none"></rect>
  <text id="title" text-anchor="middle" font-size="14" x="275" y="-25">
    Austrian Population over the Years
  </text>
  <g id="xScale" aria-axistype="category" aria-roledescription="x-Axis" aria-labelledby="x-
  title" tabindex="0" transform="translate(0,400)" fill="none" font-size="10" font-
  family="sans-serif" text-anchor="middle">
    <text y="50" x="300" text-anchor="middle" fill="black" font-size="12" id="x-title">
      Years
    </text>
    <path class="domain" stroke="currentColor" d="M0.5,6V0.5H600.5V6"></path>
    <g class="tick" opacity="1" transform="translate(56.757,0)">
      <line stroke="currentColor" y2="6"></line>
      <text fill="currentColor" y="9" dy="0.71em" id="x1">
        1959
      </text>
```


AChart Creator

- Command line tool.
- SVG from CSV source.
- “Recipes” for:
 - Pie chart
 - Bar chart
 - Line chart
- Additional arguments for:
 - Title
 - Legend
 - Description
 - Axis-Labels
 - ...



```
Alexanders-MBP: ~/Library/Mobile Documents/com~apple
~CloudDocs/Bildung/Universität/MSc/3/InfoVis/aChart/
achart-creator

(base) → node build/acrete.js --chart line --datase
t "./infovis/input/austria-population-1959-2019.csv"
--output "./infovis/output/austrian-population.svg"
--chart-title "Austrian Population over the Years"
--x-axis-title "Year" --y-axis-title "Population" --
chart-desc "This chart shows the population of Austr
ia from 1959 to 2019."
```

Screenshot taken by Alexander Perko from AChart Creator on 01 May 2021.

AChart Interpreter

- Webapp
- Loads SVGs from file.
- Sample SVGs available.
- Synchronized Split-Screen:
 - SVG chart on the left.
 - Textual description on the right.

The screenshot shows a web browser window titled "AChart Interpreter". The main content area is split into two panels. The left panel, titled "Graphic Panel: austrian-population.svg", contains a "Remove SVG" button and an "SVG Highlighting Mode:" section with a "Fill" radio button selected and an "Outline" radio button. Below this is a bar chart titled "Austrian Population over the Years" showing population values for the years 1959, 1969, 1979, 1989, 1999, 2009, and 2019. The right panel, titled "Text Panel", contains a description of the chart and a detailed analysis of the first bar chart.

Graphic Panel: austrian-population.svg

Remove SVG

SVG Highlighting Mode:
Fill Outline

Text Panel

▼
Graphic: contains 1 bar chart.

This chart shows the population of Austria from 1959 to 2019.

▼
Bar chart 1: "Austrian Population over the Years, This chart shows the population of Austria from 1959 to 2019.", contains 1 data series.

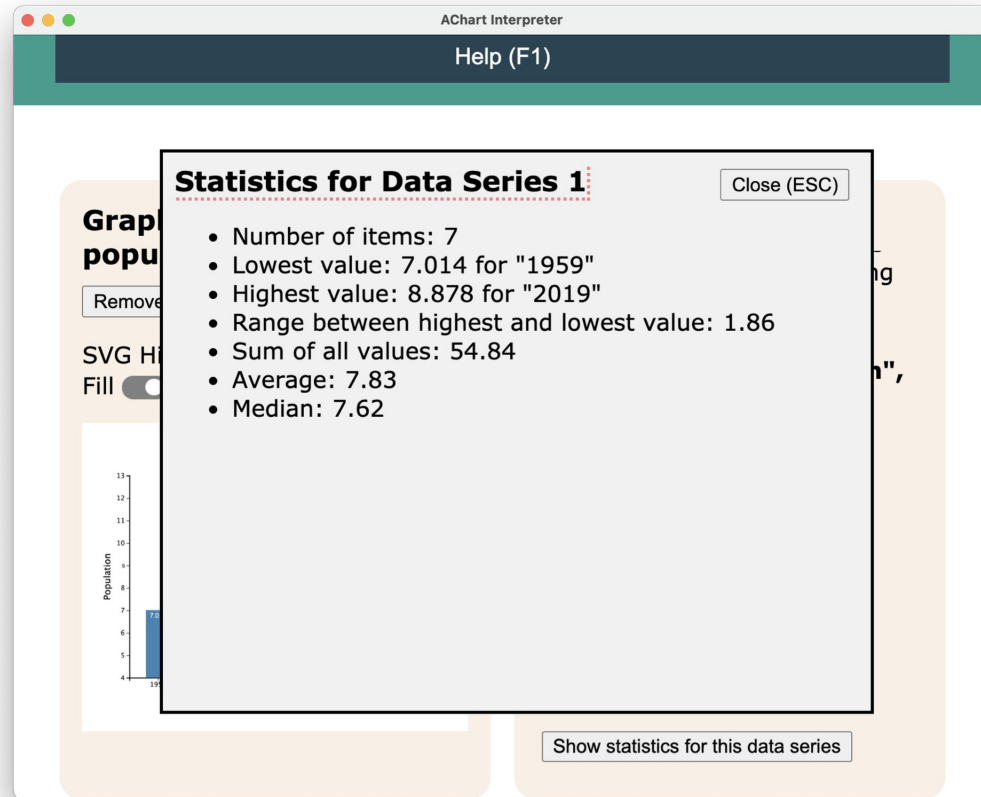
Bar chart showing "Population" in relation to "Year" from 1959 to 2019.
x-axis: "Year", contains 7 labels ranging from 1959 to 2019.

Year	Population
1959	7,014
1969	7,651
1979	7,549
1989	7,82
1999	7,992
2009	8,341
2019	8,875

Screenshot taken by Alexander Perko from AChart Interpreter on 01 May 2021.

AChart Interpreter

- Webapp
- Loads SVGs from file.
- Sample SVGs available.
- Synchronized Split-Screen:
 - SVG chart on the left.
 - Textual description on the right.
- **Statistics on the data:**
 - Median, average, ...
 - Enables a better understanding.
- only three chart types



Screenshot taken by Alexander Perko from AChart Interpreter on 01 May 2021.

AChart Interpreter

Short Demo Video

Extension

Grouped Charts added Commands - Part 1

Command	Parameter	Description
<code>--chart**</code>	<code>bar-grouped*</code> <code>bar-stacked*</code> <code>scatter*</code> <code>parallel-coordinates*</code>	Creates a grouped bar chart. Creates a stacked bar chart. Creates a scatter plot. Creates a parallel coordinates plot.
<code>--columns*</code>	<code>"col1 col2 ... col_n"*</code>	Choose the columns which should be grouped. Works with column name or index or both. Chooses x1, x2, size and colour for scatter. Last column index chooses the colour index for parallel coordinates when also colours parameter is given.

An asterisk (*) indicates that this is a new command added by us.
Two asterisks (**) indicate that this is a command already present in AChart Creator.

Grouped Charts added Commands - Part 2

Command	Parameter	Description
<code>--colours*</code> <code>--colors*</code>	<code>"colour1 colour2 ... colour_n"*</code> <code>"color1 color2 ... color_n"*</code>	Set colour of groups. Works with colour names, hex codes, rgb and rgba.
<code>--rotate-x-labels*</code> <code>--rotate-y-labels*</code>	<code>[ROTATION]</code>	Set the rotation of x/y labels by <code>[ROTATION]</code> . If nothing is given for <code>[ROTATION]</code> the default value is set to 45°.
<code>--aria-datagroup*</code>	<code>DIMENSION</code>	Chooses by which dimension the data gets grouped. Can be rows or columns. When creating scatter it can be column name or index by which the data gets grouped.

An asterisk (*) indicates that this is a new command added by us.
Two asterisks (**) indicate that this is a command already present in AChart Creator.

Grouped Charts added Roles

Role	Element	Ancestor	Content	Description
<code>datagroup*</code>	<code><g></code>	<code>dataset**</code>	<code>datapoint**</code>	Group of data points. All data points come from the same column/group.

An asterisk (*) indicates that this is a new role added by us.
Two asterisks (**) indicate that this is a role already present in AChart Creator.

Grouped Charts added Properties

Property	Object	Value	Description
aria-charttype*	chart root	bar**/ pie** / line** / bar-grouped* /bar-stacked* /scatter* /parallel-coordinates*	Type of chart.

An asterisk (*) indicates that this is a new property/value added by us.
Two asterisks (**) indicate that this is a property/value already present in AChart Creator.

Example Call to AChart Creator

Creating a simple **stacked bar chart**

Created with `--chart bar-stacked`. Possible Call:

```
./acreate --chart bar-stacked --dataset ./data/nrw2019.csv  
--chart-title "Seats of Political Parties in Austria" --chart-desc  
"Seats of Political Parties in Austria per Federal state"
```

Example Call to AChart Creator

Creating a simple **stacked bar chart**

Created with `--chart bar-stacked`. Possible Call:

```
./acreate --chart bar-stacked --dataset ./data/nrw2019.csv  
--chart-title "Seats of Political Parties in Austria" --chart-desc  
"Seats of Political Parties in Austria per Federal state"  
--x-axis-title "Federal States" --y-axis-title "Number of Seats in  
percent"
```

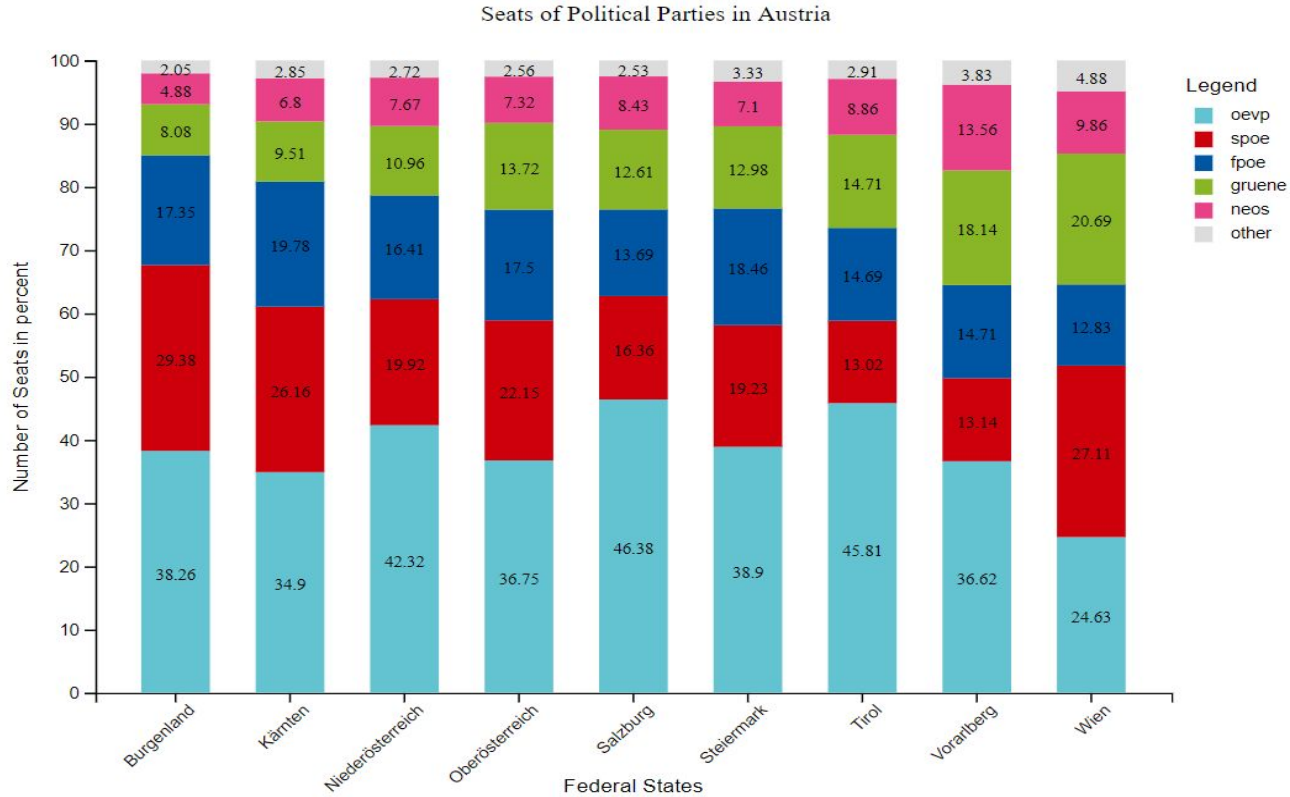
Example Call to AChart Creator

Creating a simple **stacked bar chart**

Created with `--chart bar-stacked`. Possible Call:

```
./acreate --chart bar-stacked --dataset ./data/nrw2019.csv  
--chart-title "Seats of Political Parties in Austria" --chart-desc  
"Seats of Political Parties in Austria per Federal state"  
--x-axis-title "Federal States" --y-axis-title "Number of Seats in  
percent" --colours "#63C3D0 #CE000C #0056A2 #88B626 #E84188"  
--rotate-x-labels
```

Stacked Bar Chart

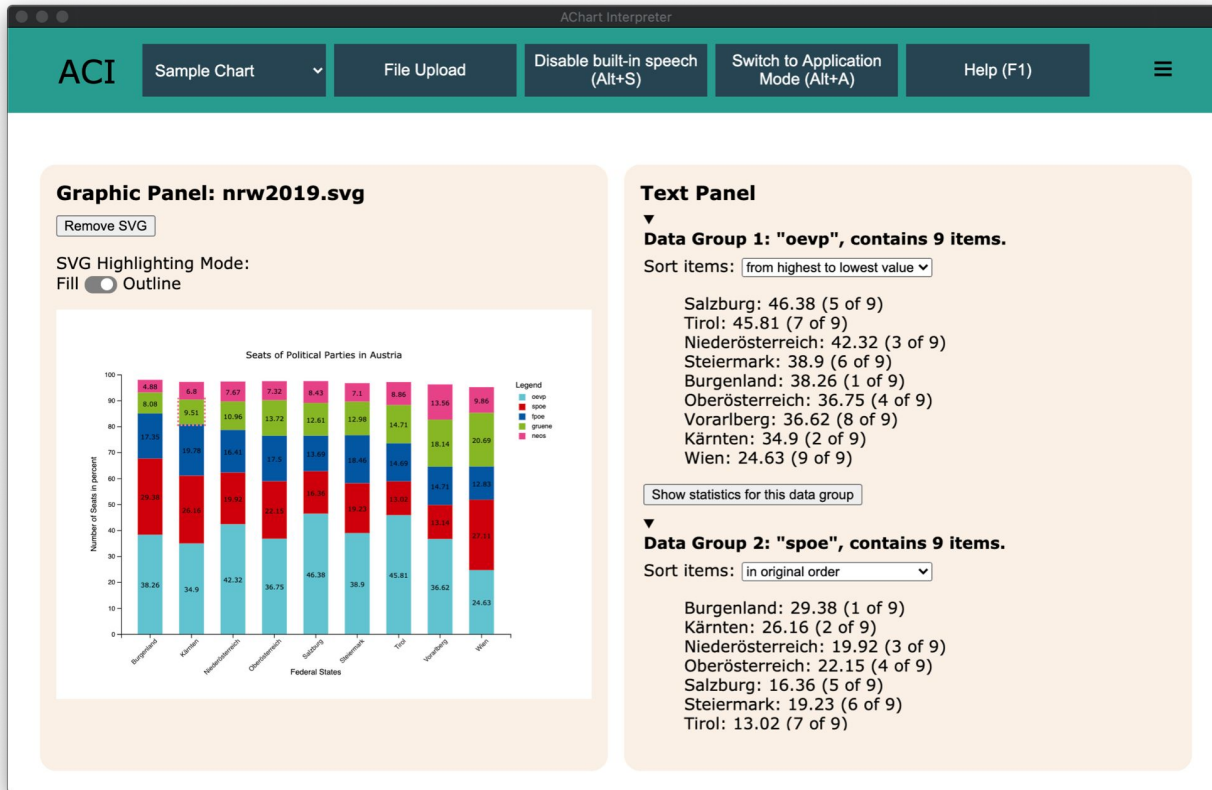


Screenshot taken by Moritz Erlacher on 21 June 2021. Stacked bar chart created with AChart Creator.

Stacked Bar Chart

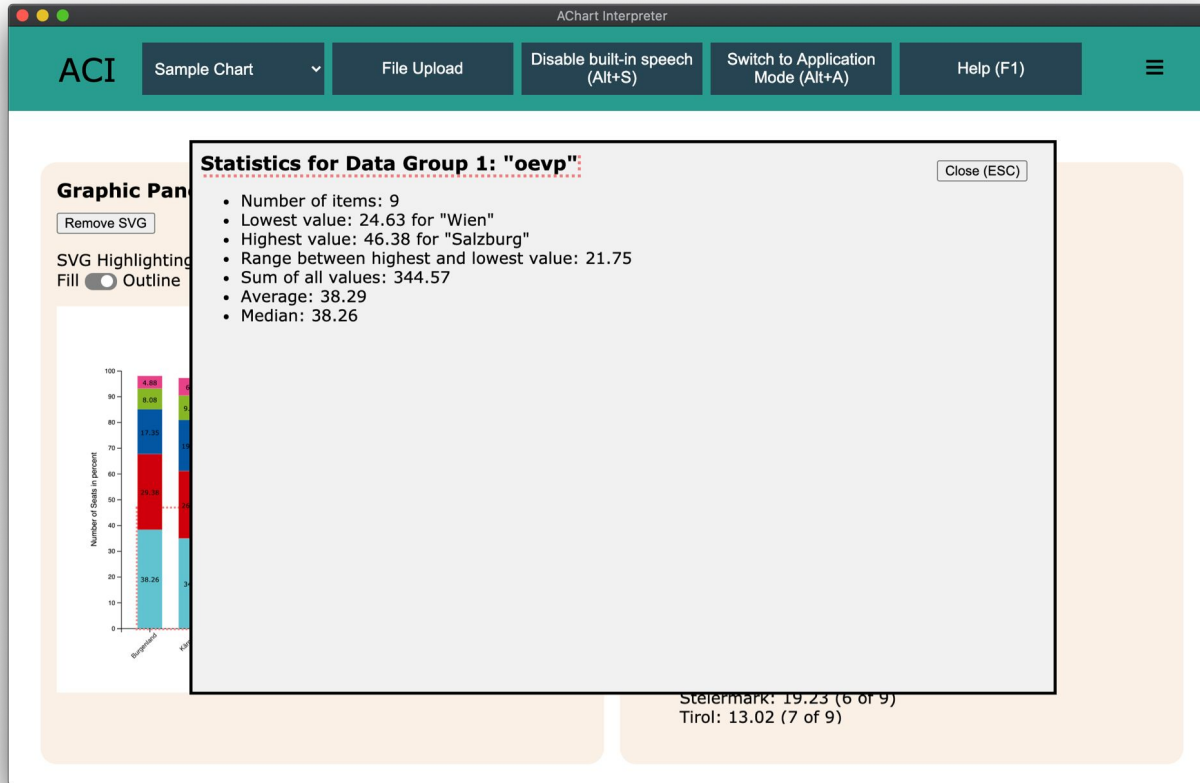
```
<g id="dataset" role="dataset" tabindex="0" aria-labelledby="dataset-title">
  <title role="heading" id="dataset-title">Seats of Political Parties in Austria</title>
  <g id="datagroup-1" role="datagroup" tabindex="0" aria-labelledby="datagroup-title-1">
    <title role="heading" id="datagroup-title-1">Burgenland</title>
    <g tabindex="0" transform="translate(25.532,246.96)" role="datapoint" aria-
      labelledby="legenditem1">
      <rect fill="#63C3D0" width="38.298" height="153.04"/>
      <text x="19.149" y="81.52" text-anchor="middle" font-size="10" fill="black"
        role="datavalue" id="value1-1">38.26</text>
    </g>
    <g tabindex="0" transform="translate(25.532,129.44)" role="datapoint" aria-
      labelledby="legenditem2">
      <rect fill="#CE000C" width="38.298" height="117.52"/>
      <text x="19.149" y="63.76" text-anchor="middle" font-size="10" fill="black"
        role="datavalue" id="value1-2">29.38</text>
    </g>
    <g tabindex="0" transform="translate(25.532,60.04)" role="datapoint" aria-
      labelledby="legenditem3">
      <rect fill="#0056A2" width="38.298" height="69.4"/>
      <text x="19.149" y="39.7" text-anchor="middle" font-size="10" fill="black"
        role="datavalue" id="value1-3">17.35</text>
    </g>
  </g>
</g>
```

Stacked Bar Chart



Screenshot by Lisa Habich on 21 June 2021. Stacked bar chart created with AChart Creator opened with AChart Interpreter.

Stacked Bar Chart - Statistics

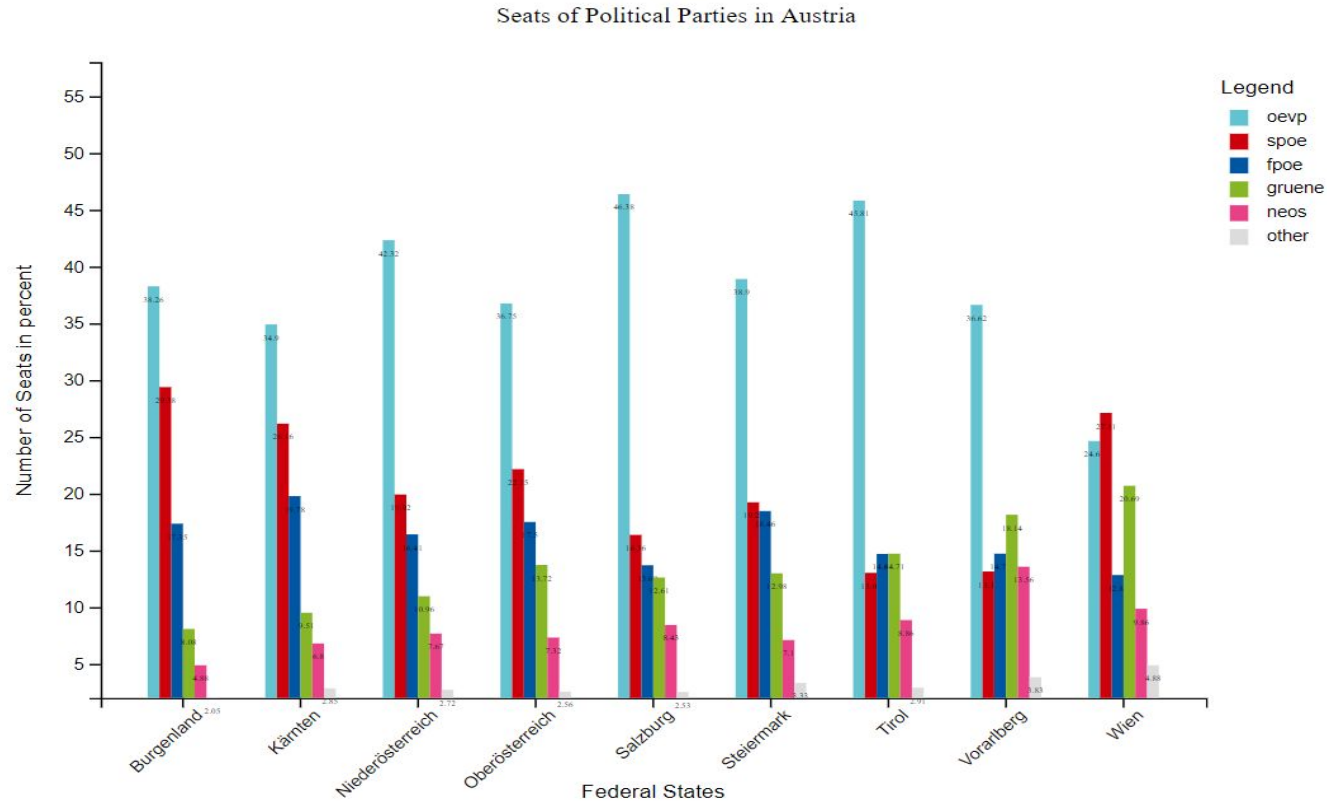


Screenshot by Lisa Habich on 21 June 2021. Stacked bar chart created with AChart Creator opened with AChart Interpreter.

AChart Creator & Interpreter Extensions

LIVE DEMO

Grouped Bar Chart

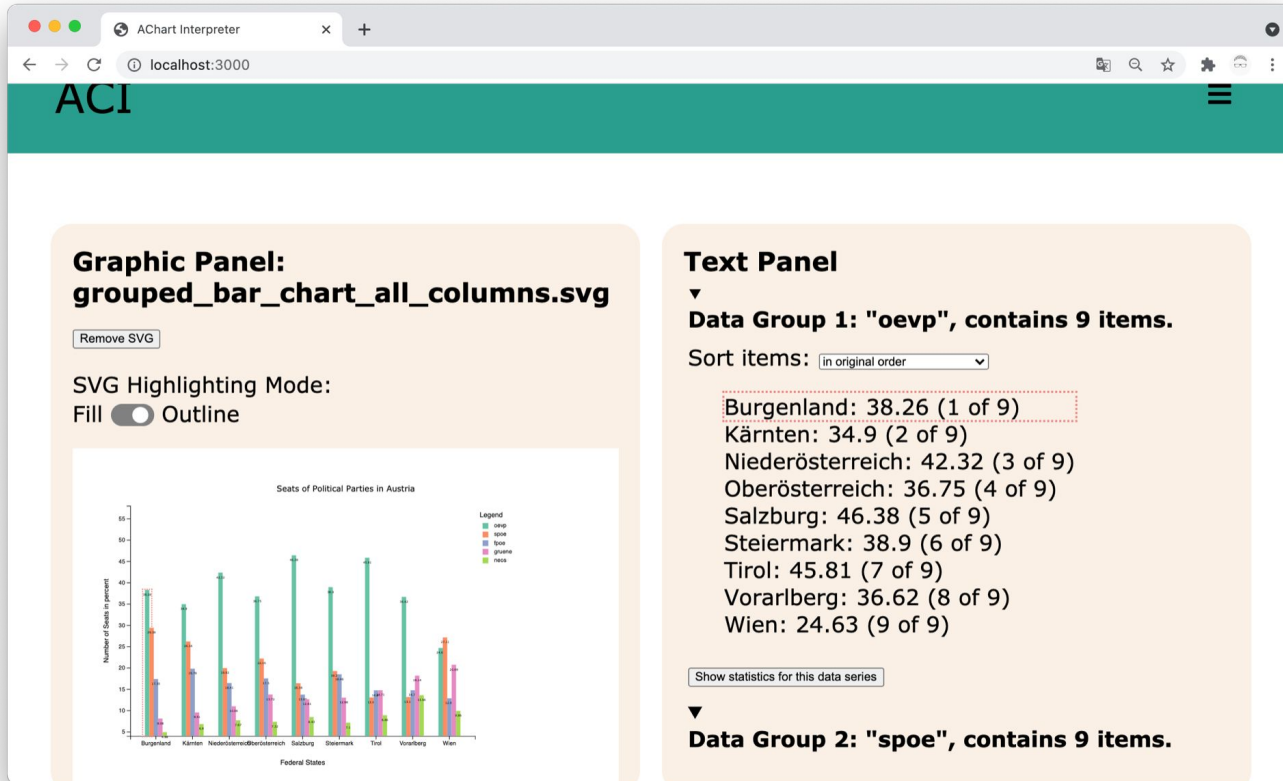


Screenshot taken by Moritz Erlacher on 21 June 2021. Grouped bar chart created with AChart Creator.

Grouped Bar Chart

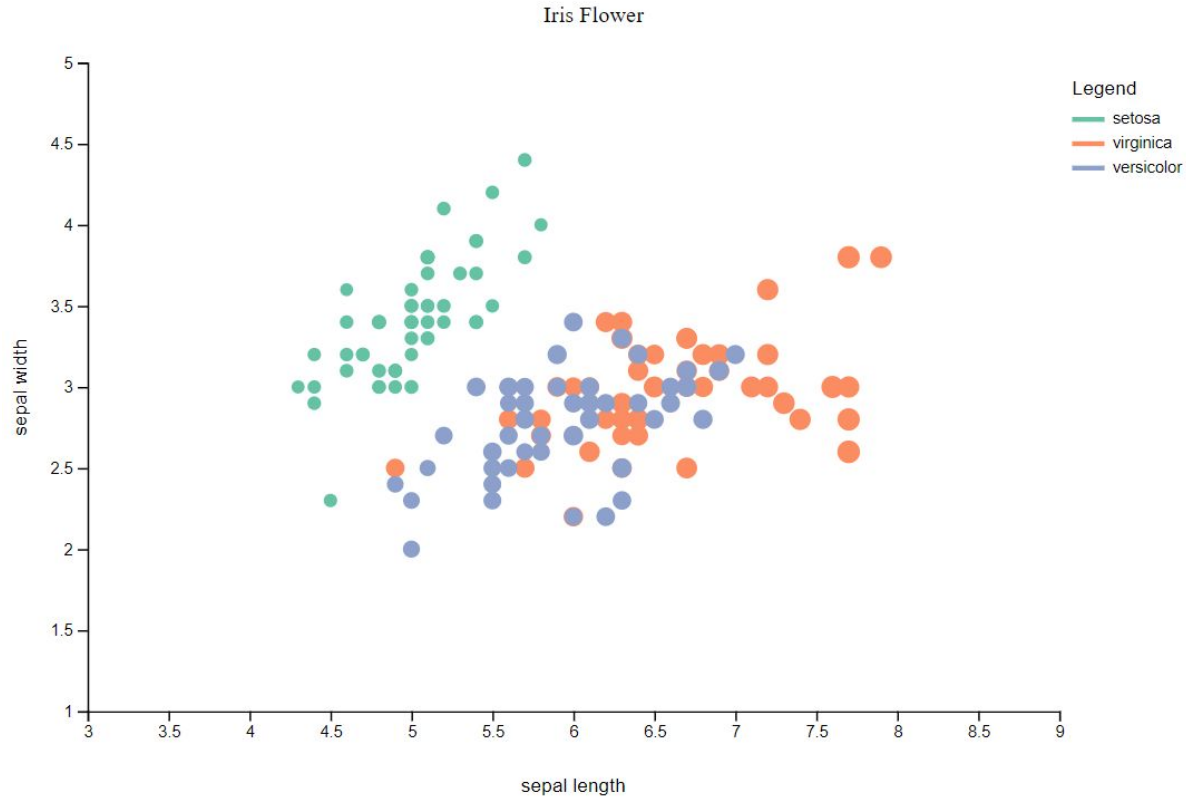
```
<title role="heading" id="dataset-title">Seats of Political Parties in Austria</title>
<g id="datagroup-1" role="datagroup" tabindex="0" aria-labelledby="datagroup-title-1">
  <title role="heading" id="datagroup-title-1">Burgenland</title>
  <g tabindex="0" transform="translate(25.532,141)" role="datapoint" aria-
    labelledby="legenditem1">
    <rect fill="#63C3D0" width="6.383" height="259"/>
    <text x="3.192" y="10" text-anchor="middle" font-size="5" fill="black"
      role="datavalue" id="value1-1">38.26</text>
  </g>
  <g tabindex="0" transform="translate(31.915,204.429)" role="datapoint" aria-
    labelledby="legenditem2">
    <rect fill="#CE000C" width="6.383" height="195.571"/>
    <text x="3.192" y="10" text-anchor="middle" font-size="5" fill="black"
      role="datavalue" id="value1-2">29.38</text>
  </g>
  <g tabindex="0" transform="translate(38.298,290.357)" role="datapoint" aria-
    labelledby="legenditem3">
    <rect fill="#0056A2" width="6.383" height="109.643"/>
    <text x="3.192" y="10" text-anchor="middle" font-size="5" fill="black"
      role="datavalue" id="value1-3">17.35</text>
  </g>
</g>
```

Grouped Bar Chart



Screenshot by Alexander Perko on 21 June 2021. Grouped bar chart created with AChart Creator opened with AChart Interpreter.

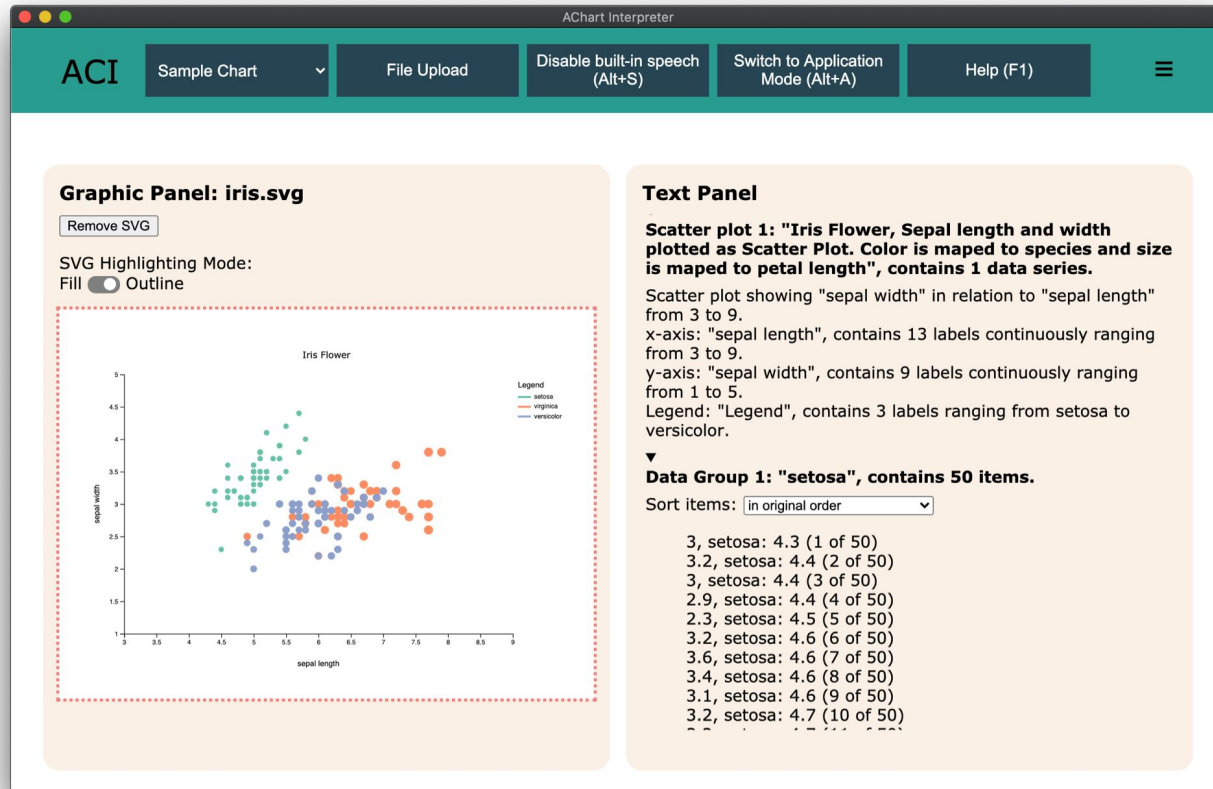
Scatter Plot



Scatter Plot

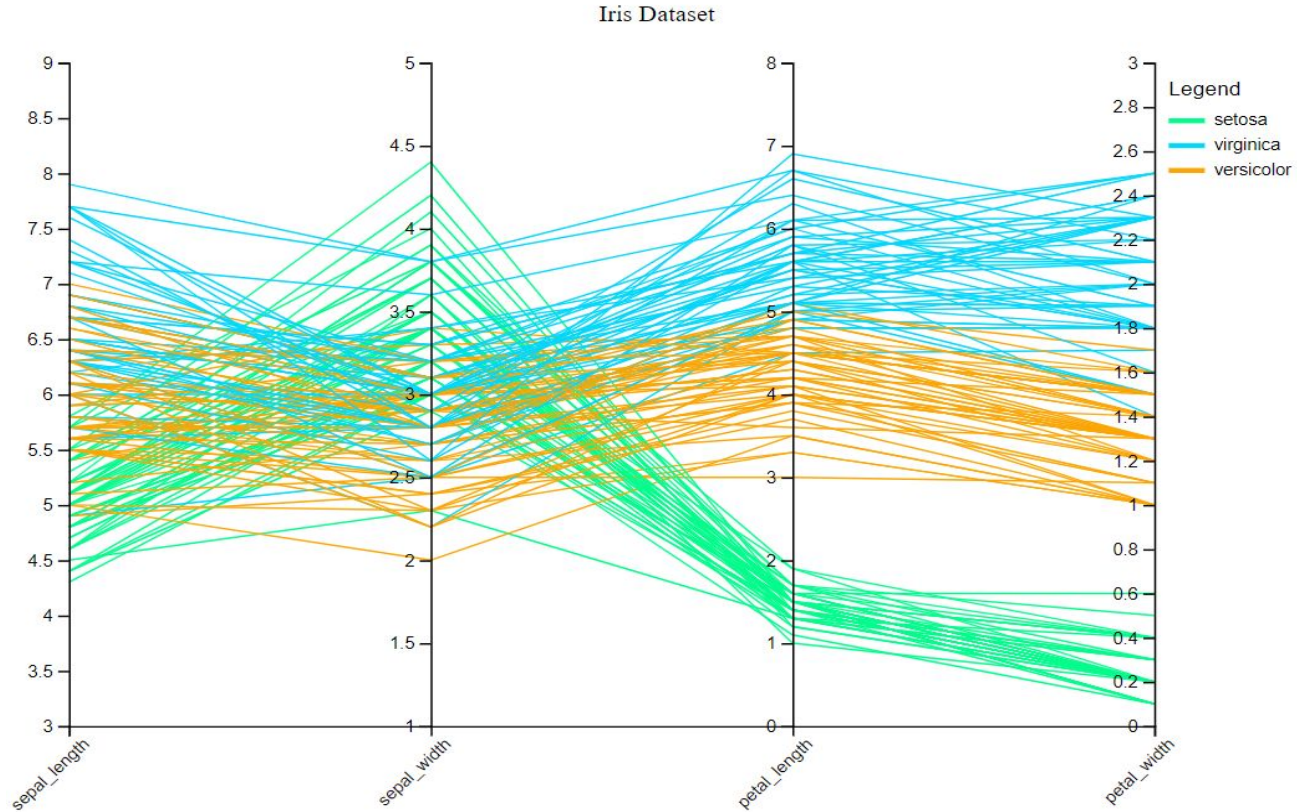
```
<g id="dataarea" role="dataset" aria-roledescription="Data Series">
  <g id="datagroup-1" role="datagroup" tabindex="0" aria-labelledby="datagroup-title-1">
    <title role="heading" id="datagroup-1">setosa</title>
    <g tabindex="0" role="datapoint" aria-labelledby="x1-1-1 x2-1-1 legenditem1">
      <title>x1: 4.3, x2: 3, size: 1.1, class: setosa</title>
      <desc role="datavalue" id="x1-1-1" aria-labelledby="xScale">4.3</desc>
      <desc role="datavalue" aria-labelledby="yScale" id="x2-1-1">3</desc>
      <circle class="dot" cx="130" cy="200" r="4.0508474576271185" fill="#66c2a5"/>
    </g>
    <g tabindex="0" role="datapoint" aria-labelledby="x1-1-2 x2-1-2 legenditem1">
      <title>x1: 4.4, x2: 3.2, size: 1.3, class: setosa</title>
      <desc role="datavalue" id="x1-1-2" aria-labelledby="xScale">4.4</desc>
      <desc role="datavalue" aria-labelledby="yScale" id="x2-1-2">3.2</desc>
      <circle class="dot" cx="140" cy="180" r="4.1525423728813555" fill="#66c2a5"/>
    </g>
    <g tabindex="0" role="datapoint" aria-labelledby="x1-1-3 x2-1-3 legenditem1">
      <title>x1: 4.4, x2: 3, size: 1.3, class: setosa</title>
      <desc role="datavalue" id="x1-1-3" aria-labelledby="xScale">4.4</desc>
      <desc role="datavalue" aria-labelledby="yScale" id="x2-1-3">3</desc>
      <circle class="dot" cx="140" cy="200" r="4.1525423728813555" fill="#66c2a5"/>
    </g>
  </g>
</g>
```

Scatter Plot



Screenshot by Lisa Habich on 21 June 2021. Scatter plot created with AChart Creator opened with AChart Interpreter.

Parallel Coordinates Plot



Parallel Coordinates Plot

```
<g id="dataarea" role="dataset" aria-roledescription="Data Series">
  <g id="datagroup-1" role="datagroup" tabindex="0" aria-labelledby="datagroup-title-1">
    <title role="heading" id="datagroup-title-1">setosa</title>
    <g tabindex="0" role="datapoint" aria-labelledby="datavalue1-1-1 datavalue1-1-2 datavalue1-1-3
datavalue1-1-4 legenditem1">
      <path class="line" stroke-width="1" fill="None" d="M0,313.333L200,200L400,345L600,386.667"
stroke="#03FC8C"/>
      <title>sepal_length: 4.3 sepal_width: 3 petal_length: 1.1 petal_width: 0.1 </title>
      <desc role="datavalue" id="datavalue1-1-1" aria-labelledby="yScale1">4.3</desc>
      <desc role="datavalue" id="datavalue1-1-2" aria-labelledby="yScale2">3</desc>
      <desc role="datavalue" id="datavalue1-1-3" aria-labelledby="yScale3">1.1</desc>
      <desc role="datavalue" id="datavalue1-1-4" aria-labelledby="yScale4">0.1</desc>
    </g>
    <g tabindex="0" role="datapoint" aria-labelledby="datavalue1-2-1 datavalue1-2-2 datavalue1-2-3
datavalue1-2-4 legenditem1">
      <path class="line" stroke-width="1" fill="None" d="M0,306.667L200,180L400,335L600,373.333"
stroke="#03FC8C"/>
      <title>sepal_length: 4.4 sepal_width: 3.2 petal_length: 1.3 petal_width: 0.2 </title>
      <desc role="datavalue" id="datavalue1-2-1" aria-labelledby="yScale1">4.4</desc>
      <desc role="datavalue" id="datavalue1-2-2" aria-labelledby="yScale2">3.2</desc>
      <desc role="datavalue" id="datavalue1-2-3" aria-labelledby="yScale3">1.3</desc>
      <desc role="datavalue" id="datavalue1-2-4" aria-labelledby="yScale4">0.2</desc>
    </g>
  </g>
</g>
```

Parallel Coordinates Plot

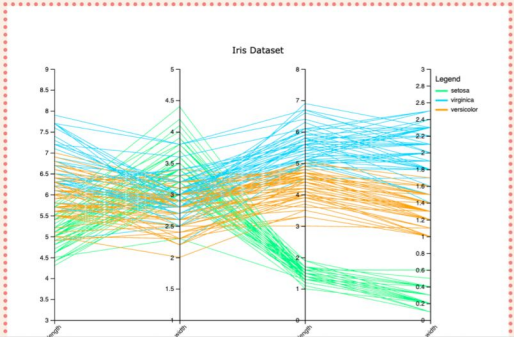
ACHart Interpreter

ACI Sample Char ▾ File Upload Disable built-in speech (Alt+S) Switch to Application Mode (Alt+A) Help (F1) ☰

Graphic Panel: iris_parallel.svg

Remove SVG

SVG Highlighting Mode:
Fill Outline



The figure is a parallel coordinates plot titled "Iris Dataset". It displays the relationship between "sepal_length" and three species: setosa, virginica, and versicolor. The x-axis represents "sepal_length" with four major ticks at 4.3, 5.0, 5.7, and 6.4. The y-axis represents "sepal_length" with 13 major ticks from 3 to 9. The legend indicates three series: setosa (blue), virginica (orange), and versicolor (green). The plot shows that setosa has the highest sepal_length values (around 6.5-7.5), virginica has intermediate values (around 5.0-6.0), and versicolor has the lowest values (around 4.3-5.0).

Text Panel

▼ **Graphic: contains 1 parallel coordinates plot.**

Iris Dataset

▼ **Parallel coordinates plot 1: "Iris Dataset, Iris Dataset", contains 0 data series.**

Parallel coordinates plot showing "sepal_length" in relation to values from 4.3 to 7.9.

x-axis: contains 4 labels continuously ranging from 4.3 to 7.9.

y-axis: "sepal_length", contains 13 labels continuously ranging from 3 to 9.

Legend: "Legend" contains 3 labels ranging

Screenshot by Alexander Perko on 22 June 2021. Scatter plot created with AChart Creator opened with AChart Interpreter.