Using the Google Visualisation API with R

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useR! 2011
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Motivation

● New ‘Statistics Relating to Lloyd’s’
  ○ Desire to help readers using the data
● Hans Rosling's (Gapminder) TED talk
  ○ Hans Rosling shows the best stats you've ever seen
● Sebastián Pérez Saaibi talk on motion charts at Rmetrics 2010
  ○ Visualisation of multivariate data over time
● Increased access to public data, e.g.
  ○ World Bank, Google Open Data Explorer
Output example: Google Motion Chart

- A dynamic chart to explore several indicators over time.
- The chart is rendered within the browser using Flash.

Source: http://google-motion-charts-with-r.googlecode.com/svn/trunk/inst/doc/MotionChart.pdf

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Input example: Google Motion Chart

```html
<html>
<head>
<script type="text/javascript" src="http://www.google.com/jsapi"></script>
<script type="text/javascript">
    google.load('visualization', '1', {'packages':['motionchart']});
    google.setOnLoadCallback(drawChart);
    function drawChart()
    {
        var data = new google.visualization.DataTable();
        data.addColumn('string', 'Fruit');
        data.addColumn('date', 'Date');
        data.addColumn('number', 'Sales');
        data.addColumn('number', 'Expenses');
        data.addColumn('string', 'Location');
        data.addRows(["Apples", new Date(1988,0,1),1000,300,'East'],
                      ["Oranges", new Date(1988,0,1),1150,200,'West'],
                      ["Bananas", new Date(1988,0,1),300,250,'West'],
                      ["Apples", new Date(1989,6,1),1200,400,'East'],
                      ["Oranges", new Date(1989,6,1),750,150,'West'],
                      ["Bananas", new Date(1989,6,1),788,617,'West'])
        var chart = new google.visualization.MotionChart(document.getElementById('chart_div'));
        chart.draw(data, {width: 600, height:300});
    }
</script>
</head>
<body>
    <div id="chart_div" style="width: 600px; height: 300px;"></div>
</body>
</html>


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```
Google Visualisation API

- Google Charts Tools provide interactive charts for web pages
- API uses JavaScript and DataTable / JSON as input
- Output is either HTML5/SVG or Flash
- Browser with internet connection required to display chart
- Read the [Google Terms of Use](http://code.google.com/apis/chart/interactive/docs/gallery.html)
  - Charts using geo location data may require a license

Source: http://code.google.com/apis/chart/interactive/docs/gallery.html

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The googleVis package for R

- Interface between R and the Google Visualisation API
- Development started in August 2010 by
  - Markus Gesmann and Diego de Castillo
- Project web site (with examples and case studies):
- Key ideas:
  - Transform R data frames into
    - JSON objects with RJSONIO
    - Create HTML code with JavaScript references
    - Display the HTML output with the R HTTP help server
- Read overview document and/or vignette
Overview googleVis

- googleVis plot method uses R HTTP help server
- Some charts use Flash and require web server
- Chart options follow those of the Google documentation
- See the demos for more examples
  - demo(package="googleVis")
Current googleVis interfaces

- Version 0.2.8 provides interfaces to:
  - Motion Charts
  - Annotated Time Lines
  - Maps
  - Geo Maps and Charts
  - Intensity Maps
  - Tables
  - Gauges
  - Tree Maps
  - Line-, Bar-, Column-, Area-, Combo-, Scatter-, Candlestick-, Pie- and Org Charts

- See the project page for examples
Output example: `gvisMotionChart()`

By default files are written into temp folder and displayed via R HTTP

```r
library(googleVis)
M <- gvisMotionChart(
  Fruits,
  idvar="Fruit",
  timevar="Year"
)
plot(M)
```

Click on the chart id to get access to the underlying HTML code

Screen cast: goo.gl/zfQdG
The googleVis concept

- Charts: ‘gvis’ + ChartType
- Output of googleVis is a list of list
- Specific parts can be extracted, e. g. the data or chart

```r
gvisMotionChart(data, idvar, timevar, options)
```

---

**gvis-object:**

<table>
<thead>
<tr>
<th>type</th>
<th>chartid</th>
</tr>
</thead>
<tbody>
<tr>
<td>html</td>
<td></td>
</tr>
<tr>
<td></td>
<td>header</td>
</tr>
<tr>
<td></td>
<td>chart</td>
</tr>
<tr>
<td></td>
<td>jsHeader</td>
</tr>
<tr>
<td></td>
<td>jsData</td>
</tr>
<tr>
<td></td>
<td>jsDrawChart</td>
</tr>
<tr>
<td></td>
<td>jsDisplayChart</td>
</tr>
<tr>
<td></td>
<td>jsChart</td>
</tr>
<tr>
<td></td>
<td>jsFooter</td>
</tr>
<tr>
<td></td>
<td>divChart</td>
</tr>
<tr>
<td></td>
<td>caption</td>
</tr>
<tr>
<td></td>
<td>footer</td>
</tr>
</tbody>
</table>

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Embedding googleVis dynamically

● Mix HTML and R code in one file
● Use Apache with the RApache module to host those files
● The R brew function with RApache executes the R chunks to create the HTML output (like Sweave for .Rnw)

```html
<html>
<body>
<% library(googleVis) %>
<% M <- googleVis::gvisMotionChart(Fruits, idvar="Fruit",timevar="Year") %>
<% M$html$chart %>
</body>
</html>
```

● See the googleVis package vignette for more details
System Monitoring: Memory Usage

Screen cast: goo.gl/Y9Ihy
Case study: System Monitoring

- Visualise long time historical computing performance
- Use linux tool `sysstat` to collect performance data
- Create dynamic page with `googleVis` & `RApache/brew`
- User selections can be processed further
Other case studies

- Statistics Relating to Lloyd’s
  - www.lloyds.com/stats

- Analysis of the US domestic airline market from 1999 - 2010

- Linguistic analysis of the English language
Conclusions

● googleVis enables R-users to
  ○ create quickly powerful analysis tools,
  ○ which can be shared online.

● The Google charting interface is easily accessible to
  ○ data analysts and
  ○ non-data analysts.

● Potential next steps
  ○ Feedback loop to R
  ○ Development of dashboards
Thank you

- Any questions?

- Any feedback is much appreciated, e.g. via our feedback form
- Please contact us with ideas, suggestions or if you would like to collaborate
  - rvisualisation@gmail.com
Some other R packages of interest ...

- R.rsp **R Server Pages and Light-weight HTTP daemon (server)**
- RJSONIO reading and writing data in JSON
- XML reading and writing XML/HTML
- plotGoogleMaps: Plot HTML output with Google Maps API and your own data
- R2GoogleMaps: Provides a mechanism to generate JavaScript code from R that displays data using Google Maps
- RgoogleMaps: Overlays on Google map tiles in R
- R animation package allows to create SWF, GIF and MPEG directly, e.g. bubble animation
- playwith: A GUI for interactive plots using GTK+
- iplots: iPlots - interactive graphics for R
- rggobi: Interface between R and GGobi
Thanks to ...

- Henrik Bengtsson for providing the 'R.rsp: R Server Pages' package and his reviews and comments
- Duncan Temple Lang for providing the 'RJSONIO' package
- Sebastian Pérez Saaibi for his inspiring talk on 'Generator Tool for Google Motion Charts' at the R/RMETRICS conference 2010
- All the guys behind www.gapminder.org and Hans Rosling for telling everyone that data is not boring
- Deepayan Sarkar for showing us in the lattice package how to deal with lists of options
- Google, who make the visualisation API available
- Paul Cleary for a bug report on the handling of months: Google date objects expect the months Jan.- Dec. as 0 - 11 and not 1 - 12.
- Ben Bolker for comments on plot.gvis and the usage of temporary files
- John Verzani for pointing out how to use the R http help server
- Cornelius Puschmann and Jeffrey Breen for highlighting a dependency issue with RJONSIO version 0.7-1
- Manoj Ananthapadmanabhan and Anand Ramalingam for providing ideas and code to animate a Google Geo Map