Package: reglScatterplotR (via r-universe)

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Type Package

Title Interactive WebGL Scatterplots for Biological Data Exploration

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Description Lightweight 'htmlwidgets' interface to the JavaScript 'regl-scatterplot' library, rendering millions of two-dimensional points in the browser via WebGL. Designed for exploratory visualisation of single-cell, spatial transcriptomics and other high-dimensional biological data. Features include synchronised pan/zoom across multiple plots, categorical and continuous colour mapping, lasso selection, range and category filtering, PNG/SVG/PDF export, and Shiny integration. The widget works in the 'RStudio' Viewer, standalone HTML files, Shiny applications and Jupyter notebooks running the 'IRkernel'.

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URL https://github.com/george123ya/reglScatterplotR

BugReports https://github.com/george123ya/reglScatterplotR/issues

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Contents

`enableReglScatterplotSync` *Link the camera of multiple scatterplots*

Description

Enables (or disables) synchronised pan/zoom across the `reglScatterplot` widgets identified by `plotIds`. Must be called from inside a Shiny reactive context.

Usage

```
enableReglScatterplotSync(
  plotIds,
  enabled = TRUE,
  session = shiny::getDefaultReactiveDomain()
)
```

Arguments

`plotIds`	Character vector of `plotId` strings.
`enabled`	Logical; `TRUE` to enable sync, `FALSE` to disable.
`session`	Shiny session object (defaults to the active one).

Value

Invisibly `NULL`. Called for its side effect of sending a custom message to the browser.

Examples

```
if (interactive()) {
    enableReglScatterplotSync(c("plotA", "plotB"))
}
```

`reglScatterExample` *Example single-cell UMAP embedding*

Description

A small, synthetic single-cell-style dataset for trying out `reglScatterplot()` without downloading anything or installing a Bioconductor data package. It mimics a PBMC UMAP: eight cell-type clusters arranged as Gaussian blobs in two dimensions, plus a handful of continuous covariates and one marker-gene-like gradient.

Usage

```
data(reglScatterExample)
```

Format

A `data.frame` with 3,400 rows (cells) and 7 columns:

UMAP_1, UMAP_2 Numeric. Two-dimensional UMAP coordinates.

celltype Factor with 8 levels (`"CD4 T"`, `"CD8 T"`, `"NK"`, `"B"`, `"Monocyte"`, `"Dendritic"`, `"Platelet"`, `"Progenitor"`). Use as a categorical `colorBy`.

nCount Integer. Total counts per cell (library size).

nFeature Integer. Number of detected features per cell.

percentMito Numeric. Percent mitochondrial counts (0-25).

CD3D Numeric. Log-normalised expression of a T/NK marker, with dropout. Use as a continuous `colorBy`.

Details

The data are simulated (see `data-raw/make_reglScatterExample.R`) and carry no biological meaning beyond being shaped like real scRNA-seq output. They exist purely so the examples, vignette and tests have something realistic to draw.

Source

Simulated. Generation script in `data-raw/`.

Examples

```
data(reglScatterExample)
# Colour by cell type (categorical)
reglScatterplot(reglScatterExample,
    x = "UMAP_1", y = "UMAP_2", colorBy = "celltype"
)
# Colour by a continuous marker gene
reglScatterplot(reglScatterExample,
    x = "UMAP_1", y = "UMAP_2", colorBy = "CD3D",
    continuousPalette = "viridis", vmax = "p99"
)
```

`reglScatterplot` *Interactive WebGL scatterplot*

Description

Renders a `regl-scatterplot` widget capable of displaying millions of points in the browser. Works in standalone HTML, the RStudio Viewer, Shiny applications and Jupyter notebooks (via IRkernel).

Usage

```
reglScatterplot(
  data = NULL,
  x,
  y,
  colorBy = NULL,
  groupBy = NULL,
  assay = NULL,
  filterBy = NULL,
  pointSize = NULL,
  opacity = NULL,
  pointColor = NULL,
  sizeBy = NULL,
  opacityBy = NULL,
  tooltipBy = NULL,
  pixelRatio = NULL,
  categoricalPalette = "Set1",
  continuousPalette = "viridis",
  customPalette = NULL,
  customColors = NULL,
  pointLabels = NULL,
  xlab = "X",
  ylab = "Y",
  title = NULL,
  legendTitle = NULL,
```

```
  xrange = NULL,
  yrange = NULL,
  rangePadding = 0.15,
  vmin = NULL,
  vmax = NULL,
  centerZero = FALSE,
  showAxes = TRUE,
  showTooltip = TRUE,
  backgroundColor = NULL,
  axisColor = "#333333",
  legendBg = "#ffffff",
  legendText = "#000000",
  legendOpacity = NULL,
  legendBlur = NULL,
  toolbarPosition = "none",
  zoomOnSelection = FALSE,
  legendPosition = "top-right",
  draggableLegend = TRUE,
  width = NULL,
  height = NULL,
  enableDownload = FALSE,
  plotId = NULL,
  syncPlots = NULL,
  elementId = NULL,
  dataVersion = NULL,
  masterId = NULL,
  autoFit = FALSE,
  margins = NULL,
  fontSize = 12,
  legendFontSize = 12,
  filteredIndices = NULL,
  selectedIndices = NULL,
  syncState = TRUE
)
```

Arguments

data	Optional input object. Accepts a `data.frame` (or anything that supports `[[`), a numeric coordinate `matrix`, a `SingleCellExperiment`, a `SpatialExperiment`, a `Seurat` object, or an in-memory `AnnData` (from the `anndataR` or `anndata` packages). For a `data.frame`, `x`, `y`, `colorBy`, `groupBy` and the columns named in `filterBy` are looked up by name. For a `matrix`, the first two columns are used as coordinates unless `x` / `y` give column indices or names. When `NULL`, these arguments must be vectors of matching length. For single-cell objects, see the *Single-cell data structures* section below.
x, y	Either column names (when `data` is non-NULL) or numeric vectors giving point coordinates. For `SingleCellExperiment` / `SpatialExperiment` inputs, pass the `reducedDim` name as `x` (e.g. `"UMAP"`); `y` is ignored. Use `"spatial"` for

tissue coordinates on a SpatialExperiment.

colorBy — Optional column name or vector used to colour points. Character/factor input is treated as categorical, numeric as continuous.

groupBy — Optional column name or vector. Used by the legend to expose a second categorical filter that intersects with colorBy.

assay — Name of the assay to read when colorBy names a feature row of an SCE (default "logcounts", falls back to assay #1). Ignored for plain data frames.

filterBy — Optional data.frame of additional numeric covariates that the JavaScript widget exposes for range filtering.

pointSize, opacity — Numeric. When NULL, sensible defaults are picked based on the number of points (pointSize = 3 and opacity = 0.8 for small data; pointSize = 1, opacity = 1 once n > 500000).

pointColor — Optional fixed hex colour. When given, overrides colorBy.

sizeBy, opacityBy — Optional numeric column name or vector mapped to point size / opacity. They share one data channel, so both encode the same variable.

tooltipBy — Optional extra fields to show on hover: column name(s) (when data is a data.frame) or a data.frame / named list of vectors.

pixelRatio — Optional numeric device-pixel-ratio for the WebGL backing store. When NULL (default) the widget renders at max(devicePixelRatio, 2) for crisp output - this matters in the RStudio Viewer, an embedded browser that reports devicePixelRatio = 1 even on HiDPI screens, making the plot look soft at the library default. For very large data (n > 500000, performance mode) the true ratio is used to keep the pixel count down. Pass an explicit value (e.g. 1 to save GPU memory, 3 for extra-sharp export-quality rendering) to override.

categoricalPalette, continuousPalette — Names of fallback palettes (a RColorBrewer name and a viridisLite name respectively).

customPalette, customColors — Optional explicit palettes. customColors is a named character vector mapping level -> hex; customPalette is an unnamed vector used in level order.

pointLabels — Optional character vector aligned to the points; shown in the hover tooltip. Use this for gene names, cell barcodes, etc.

xlab, ylab, title, legendTitle — Axis/labels.

xrange, yrange — Optional length-2 numeric vectors fixing the axes instead of using the data range. When supplied, they bypass the automatic padding from rangePadding.

rangePadding — Fractional padding added to each side of the data range when xrange / yrange aren't supplied (default 0.1 = 10% on each side, matching the ggplot2 convention). Set to 0 to draw exactly the data range.

vmin, vmax — Continuous-colour clipping. Accepts a number, "min", "max", or a percentile string like "p99".

`centerZero` Logical. If `TRUE`, the continuous colour scale is forced to be symmetric around zero (useful for log-fold-change displays).

`showAxes`, `showTooltip`
Logical toggles.

`backgroundColor`, `axisColor`, `legendBg`, `legendText`
Hex colour overrides for cosmetic styling.

`legendOpacity` Opacity (0-1) of the frosted legend card background. `NULL` (default) uses `0.55`.

`legendBlur` Backdrop blur in pixels behind the legend card. `NULL` (default) uses `10`; set `0` to disable the frosted effect.

`toolbarPosition`
Show an in-plot toolbar (pan / lasso / zoom-to- selection / reset / screenshot). One of `"none"` (default), `"left"` (vertical) or `"top"` (horizontal).

`zoomOnSelection`
Logical; when `TRUE`, the camera zooms to fit the lasso-selected points.

`legendPosition` Starting position of the legend. One of `"top-right"` (default), `"top-left"`, `"bottom-right"`, `"bottom-left"`, or a length-2 numeric vector `c(x, y)` giving absolute pixel offsets from the top-left of the plot.

`draggableLegend`
Logical; when `TRUE` (default), the legend can be dragged with the mouse. Set to `FALSE` to pin it to `legendPosition`.

`width`, `height` Widget dimensions (any valid CSS unit). When `NULL`, `htmlwidgets` picks defaults appropriate to the host context.

`enableDownload` Logical. Show the download (PNG/SVG/PDF) button. Defaults to `FALSE` because the button is unreliable inside IDE iframes (RStudio Viewer, VSCode Jupyter), where browser download dialogs and `html2canvas`/`jsPDF` script injections often fail. Set to `TRUE` explicitly for standalone HTML files or Shiny apps; even then the button is hidden automatically when the widget is running inside an IDE iframe.

`plotId` Optional string identifying the plot. Required when linking plots together via `enableReglScatterplotSync()`.

`syncPlots` Optional character vector of plot ids to sync with.

`elementId` DOM id for the containing div (passed to `htmlwidgets`).

`dataVersion` Optional integer/string used by the JS layer to detect when the underlying data has changed.

`masterId` Optional id of another plot whose camera should seed this one's view (used when a plot is added to an already-synced group).

`autoFit` Logical. When `TRUE`, the camera zooms to fit the data region exactly on initial render.

`margins` Optional `list(top, right, bottom, left)` of pixel margins.

`fontSize`, `legendFontSize`
Numeric font sizes in pixels.

`filteredIndices`, `selectedIndices`
Optional 0-based integer vectors for server-driven filtering / selection.

`syncState` Logical. When `FALSE`, the widget starts with global sync disabled.

Value

An `htmlwidgets` object of class `"reglScatterplot"`.

Single-cell data structures

When `data` is a `SingleCellExperiment` or `SpatialExperiment`, the function reroutes through a helper that pulls coordinates from `reducedDim()` (e.g. `x = "UMAP"`) - or from `spatialCoords()` when `x = "spatial"` for a `SpatialExperiment`. `colorBy` and `groupBy` may then name either a `colData` column or a feature in `rownames(sce)` (in the latter case `assay()` is read - `"logcounts"` by default, or the assay named by the `assay` argument).

When `data` is a `Seurat` object, coordinates come from `Embeddings()` for the reduction named by `x` (default `"UMAP"`, matched case-insensitively; falls back to the first of `umap`/`tsne`/`pca` present). `colorBy` and `groupBy` are resolved with `FetchData()`, so they may name either a `meta.data` column or a feature. For Seurat, the `assay` argument selects the *layer* to read for features (`"data"`, i.e. log-normalised, by default; works with both v4 `slots` and v5 `layers`); to colour by a non-default modality such as ADT, set `Seurat::DefaultAssay()` before calling.

When `data` is an in-memory `AnnData` (from `anndataR` or the `anndata` CRAN package), coordinates come from an `obsm` embedding named by `x` (default `"UMAP"`, auto-prefixed to the scanpy-style `"X_umap"` and matched case-insensitively). `colorBy` / `groupBy` resolve against `obs` columns or `var_names` features, and `assay` selects the layer to read for features (`NULL` -> `X`, a layer name, or `"raw"`). An AnnData read with `zellkonverter::readH5AD()` arrives as a `SingleCellExperiment` and uses the SCE path above instead.

See Also

`enableReglScatterplotSync()`, `updateReglPointSize()`

Examples

```
set.seed(1L)
df <- data.frame(
    x = rnorm(2000),
    y = rnorm(2000),
    group = sample(letters[1:4], 2000, replace = TRUE),
    score = runif(2000)
)
reglScatterplot(df, x = "x", y = "y", colorBy = "group")
reglScatterplot(df,
    x = "x", y = "y", colorBy = "score",
    continuousPalette = "magma"
)


# Single-cell UMAP from a SingleCellExperiment
# reglScatterplot(sce, dimred = "UMAP", colorBy = "cluster")
# Colour by a gene
# reglScatterplot(sce, dimred = "UMAP", colorBy = "MS4A1")
# Spatial coordinates from a SpatialExperiment
# reglScatterplot(spe, dimred = "spatial", colorBy = "celltype")
```

`reglScatterplot-shiny` *Shiny bindings for reglScatterplot*

Description

Output and render functions for using `reglScatterplot()` inside Shiny applications and interactive R Markdown documents.

Usage

```
reglScatterplotOutput(outputId, width = "100%", height = "600px")

renderReglScatterplot(expr, env = parent.frame(), quoted = FALSE)
```

Arguments

`outputId`	Output variable name (character).
`width, height`	CSS unit (e.g. `"100%"`, `"600px"`).
`expr`	An expression that produces a `reglScatterplot` widget.
`env`	Environment in which to evaluate `expr`.
`quoted`	Is `expr` already quoted? Default `FALSE`.

Value

`reglScatterplotOutput()` returns a Shiny output element; `renderReglScatterplot()` returns a render function.

Examples

```
if (interactive()) {
    ui <- shiny::fluidPage(reglScatterplotOutput("plot"))
    server <- function(input, output, session) {
        output$plot <- renderReglScatterplot({
            reglScatterplot(iris,
                x = "Sepal.Length", y = "Sepal.Width",
                colorBy = "Species"
            )
        })
    }
    shiny::shinyApp(ui, server)
}
```

toBase64 *Encode a numeric vector as a base64 Float32 payload*

Description

Serialises a numeric vector as little-endian 32-bit floats and prefixes the result with `"base64:"` so the companion JavaScript widget recognises it as a binary buffer rather than a JSON array. Using this transfer path keeps the payload size at ~25% of the equivalent JSON representation.

Usage

```
toBase64(vec)
```

Arguments

`vec`	Numeric vector. `NULL` is returned unchanged.

Value

Character string of the form `"base64:..."` or `NULL`.

Examples

```
toBase64(c(1, 2, 3.5))
```

updateReglPointSize *Update the point size of one or more scatterplots*

Description

Update the point size of one or more scatterplots

Usage

```
updateReglPointSize(plotIds, size, session = shiny::getDefaultReactiveDomain())
```

Arguments

`plotIds`	Character vector of plot ids whose size should be updated.
`size`	Numeric pixel size.
`session`	Shiny session.

Value

Invisibly `NULL`.

Examples

```
if (interactive()) {
    updateReglPointSize("plotA", size = 5)
}
```

Index