Tools for 3D/4D interactive visualisation of cells and biological tissue

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useR!2019
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Capturing biological processes with images

**3D microscopy images** to capture biological processes at cell and organ scale.

![Diagram](image)

*Arabidopsis thaliana*
LR: lateral root; PR: primary root

3D time serie of the development of a lateral root (time in HH:mm)

![Image](image)

Light sheet microscope

Mounting: Root is lying on a gel cylinder hold by a glass capillary
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Biological images are data

Image processing (tracking and segmentation) to extract biological information.

(A) Raw 3D image. (B) 3D surface segmentation. (C-D) Close-ups on the segmented mesh.

(E) Raw 3D time serie (in HH:mm). (F) Tracked time serie (in HH:mm).
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1. **Visualise**
   - Spatio-temporal context

2. **Gather**
   - Many images over time (movie)
   - Many individuals to compare
   - Many image processing softwares outputs
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**cellviz3d**: visualisation and gathering of bioimage data

- Available on GitHub: marionlouveaux/cellviz3d
- Wrapper on the `{plotly}` package
- Meshes and points structures
- 2D, 3D and 3D+time
- One or several individuals

```r
install.packages("devtools")  # if not yet installed
developmenttools::install_github("marionlouveaux/cellviz3d", build_vignettes = TRUE)
```
Visualisation of meshes

- **3D mesh**: `{rgl}` "mesh3d" object & "mesh3d" type for `{plotly}` traces
- **Color** = biological properties (area, number of neighbours...)
- 2D/3D: `plotlyMesh()` & **3D+time** (with a slider): `plotlyMesh_all()`
Visualisation of meshes

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Visualisation of points

- **3D scatterplot**: scatter3d type in `{plotly}`
- **Color** = biological properties (area, number of neighbours...)
- 2D/3D: `plotlySpots()` & **3D+time** (with an animation): `plotlySpots_all()`
Visualisation of points

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Gathering several individuals

Several plotly animations in a `{shiny}` application with `plotlyOutput()` in `ui` and `renderPlotly()` in `server`
{cellviz3d}: visualisation and gathering of bioimage data

Summary

- Available on GitHub: marionlouveaux/cellviz3d
- Wrapper on the `{plotly}` package
- Meshes and points structures, complementary to `{mgx2r}` and `{mamut2r}`
- 2D, 3D and 3D+time
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Discussion starters

- Feedbacks? Questions?
- `{plotly}` and/or `{rgl}` enthusiasts?
  => See you at the coffee break!

Acknowledgements

- Friedrike Preu
- Sébastien Rochette
- ThinkR
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