Very Quick Cytoscape Tutorial

For Cytoscape 3.0.x
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Rintaro Saito, Ph.D.
University of California, San Diego
http://chianti.ucsd.edu/~rsaito/ENTRY1/WEB_RS3/PHP
0. Introduction
Cytoscape is an open source software platform for visualizing complex networks and integrating these with any type of attribute data. A lot of Apps (plugins) are available for various kinds of problem domains, including bioinformatics, social network analysis, and semantic web (http://www.cytoscape.org).

This tutorial is intended for prospective users who want to quickly learn how to use Cytoscape, preferentially under supervision of Cytoscape users. Before beginning this tutorial, please prepare your PC and install Cytoscape. Also having spreadsheet software such as Microsoft Excel is recommended.

1. Core concepts
There are two types of data in Cytoscape, i.e. Network and Attribute (data table). Network is mathematical graph $G = (V, E)$, where $V$ is nodes (vertices) and $E$ is edges. Nodes represent any objects, and edges represent relationships between objects.

Cytoscape is a tool for extracting meaningful information, or modules, out of large biological network data sets. It can be used for data integration (joining networks and attributes), network data analysis and visualization.

Typical workflow of using Cytoscape is as follows:
(1) Load Networks (Get network data)
(2) Load Attributes (Get data about networks)
(3) Analyze and Visualize Networks
2. Network and attributes

Basic idea behind Cytoscape is simple. Cytoscape deals with nodes and edges, which are two main components of a network. Each node can have its own attributes such as gene symbol, expression level, etc. Also each edge can have its own attributes such as type of interaction, its strength, etc. Cytoscape integrates these information onto a network.

3. Visualization
VizMapper performs visualization of given network. It maps node and edge attributes to visual attributes. A user can define how each node attribute and edge attribute will be visualized using framework called VizMapper.

<table>
<thead>
<tr>
<th>Mapper type</th>
<th>Brief Description</th>
</tr>
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<tbody>
<tr>
<td>Passthrough</td>
<td>Network attributes are passed directly through to visual attributes. The most common use case is to specify node and/or edge labels. For example, this mapper can label all nodes with their gene symbols.</td>
</tr>
<tr>
<td>Discrete</td>
<td>Discrete network attributes are mapped to discrete visual attributes. For example, a discrete mapper can map gene functions to node colors so that nodes can be colored differently depending on its gene function.</td>
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<tr>
<td>Continuous</td>
<td>Continuous network attributes are mapped to (pseudo) continuous visual attributes. For example, a continuous mapper can map gene expression levels to brightness of color of corresponding node.</td>
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</tbody>
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4. Overview of Cytoscape Desktop

![Image of Cytoscape Desktop](image.png)
5. Importing network and edge attributes

(1) Prepare edge attribute table

(2) Load the edge attribute table

Edge attributes (which usually represent network) can be prepared as table format. They can be imported to Cytoscape from File --> Import --> Network --> File pull-down menu.
6. Importing node attributes

Node attributes can also be prepared as table format. They can be imported to

(1) Prepare node attribute table

(2) Load the node attribute table
Cytoscape from File \(\rightarrow\) Import \(\rightarrow\) Table \(\rightarrow\) File pull-down menu.

Loaded attributes can be browsed by attribute browser.

7. Visualization by VizMapper

One can use VisMapper to define visual styles of the network. Choose
“VisMapper” tab on Control Panel and select appropriate attributes in Visual Mapping Browser.

8. Apps
Apps are software that enhances the functionality of Cytoscape. They were previously called “plugins”. A lot of Apps have been developed for specific purposes of network analyses such as online data import, module extraction, functional enrichment analysis, etc.

Apps can be installed from Apps --> App Manager. Usually, installed apps will be shown and can be used also from Apps pulldown menu.

Cytoscape App Store (http://apps.cytoscape.org/) introduces various Apps in a user-friendly manner.

9. Further learning
- Open Tutorials (http://opentutorials.cgl.ucsf.edu/index.php/Portal:Cytoscape)
- Cytoscape Online Tutorials (http://wiki.cytoscape.org/ Presentations)
- Cytoscape main page (http://www.cytoscape.org/)