

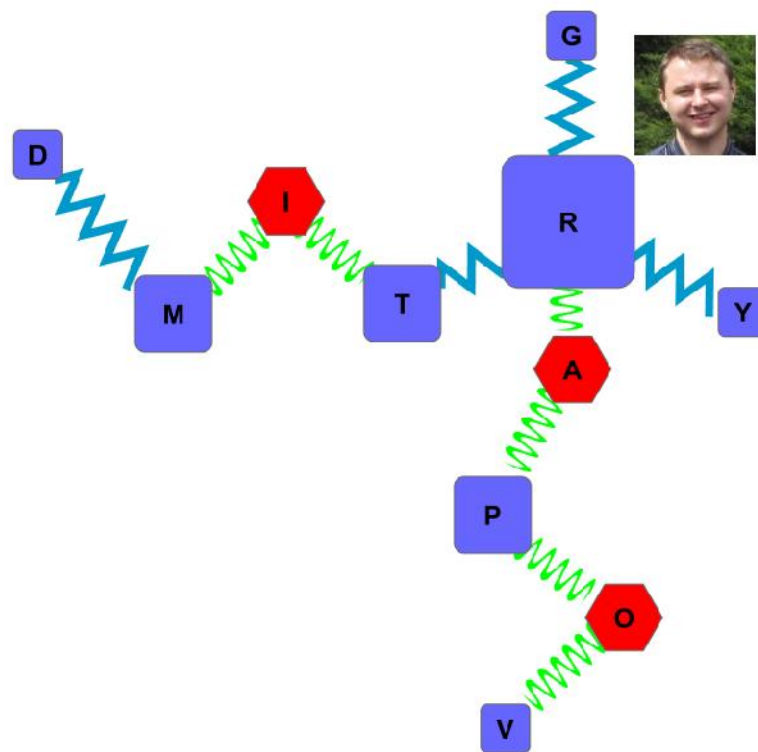
Introduction to network mapping

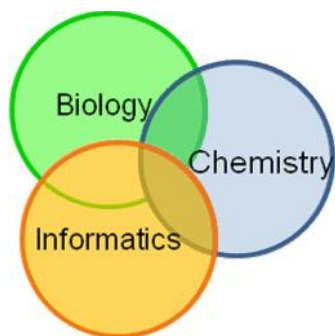


Goal: Generate a mapped “name” network

Topics:

1. Edge list
2. Node attributes
3. Network Mapping
4. Cytoscape





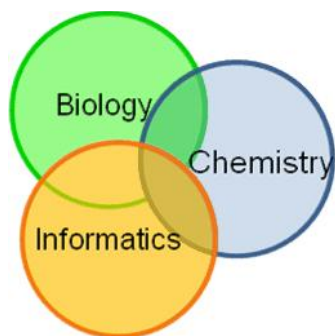
Network Mapping



Steps:

1. Make Edge list
2. Make Node attributes
3. Generate Network
4. Map node attributes
5. Final touches

See Items in “Network” folder for results



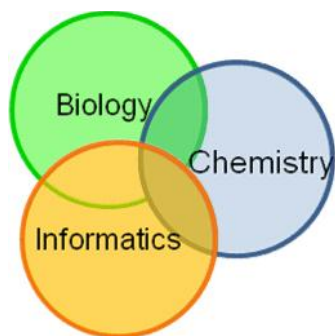
Edge List

Minimum Requirements:

- 2 column matrix with source (start) and target (end) nodes (e.g. letters)
- extra columns can be used to set edge (connection) aesthetics (e.g. width, color, etc.)
- See file “[name edge list.xlsx](#)” for an example edge list defining how the letters in my name (Dmitry Grapov) are connected with an extra column identifying consonants



	A	B	C	D
1	source	target	consonant cluster	
2	D	M	1	
3	M	I	0	
4	I	T	0	
5	T	R	1	
6	R	Y	1	
7	G	R	1	
8	R	A	0	
9	A	P	0	
10	P	O	0	
11	O	V	0	
12				
13				



Node Attributes



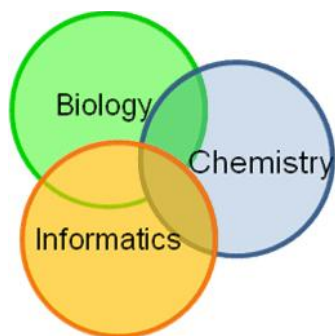
Network Mapping

Minimum Requirements:

- ID for nodes (rows) must match the edge ID
- Extra columns can be used to set each nodes properties (e.g. color, size, image, etc.)
- See file “[node attributes.xlsx](#)” for an example node attributes file

A screenshot of an Excel spreadsheet with the following data:

	A	B	C	D	E	F
1	ID	color	size	node image		
2	D	1	1			
3	M	1	2			
4	I	0	2			
5	T	1	2			
6	R	1	4	http://m.c.lnkd.licdn.com/mpr/pub/ir		
7	Y	1	1			
8	G	1	1			
9	A	0	2			
10	P	1	2			
11	O	0	2			
12	V	1	1			
13						
14						



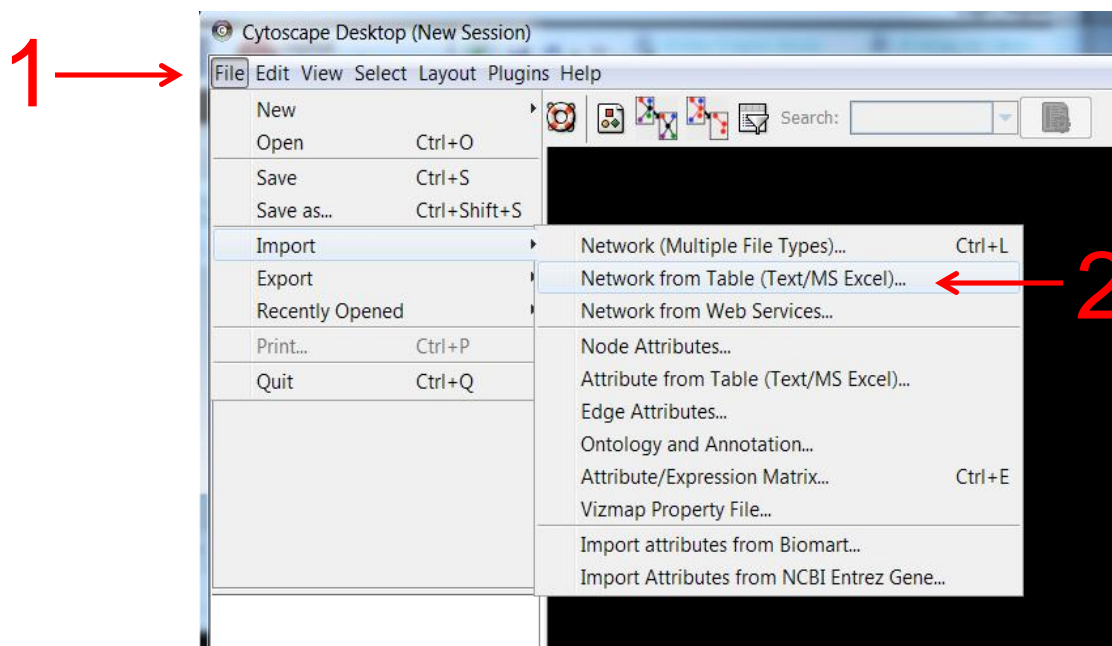
Network Generation

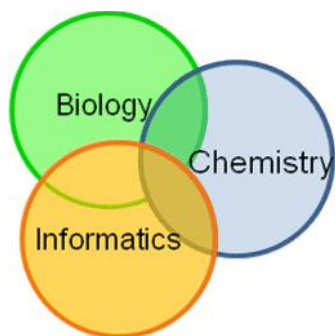


Use Cytoscape to generate network (v2.83)
(<http://www.cytoscape.org/>)

- Import Edge list (this can be many forms)

Network Mapping





Network Generation (cont.)



1. Select file for edge list
 2. Identify columns for edge (connection) source and target. Double click column to enable edge attributes.
- Hint: Show Text File Import Options>>Transfer first line.....

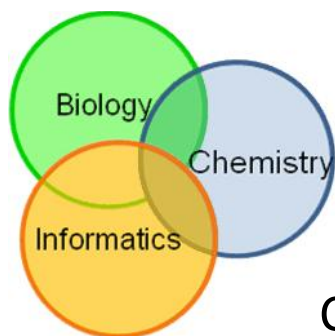
Network Mapping

The screenshot shows the 'Import Network and Edge Attributes from Table' dialog box. Red arrows and numbers 1 through 6 point to specific features:

- 1: Points to the 'Select File(s)' button in the 'Data Sources' section.
- 2: Points to the 'Source Interaction' dropdown menu in the 'Interaction Definition' section.
- 3: Points to the 'Target Interaction' dropdown menu in the 'Interaction Definition' section.
- 4: Points to the 'Show Text File Import Options' checkbox in the 'Advanced' section.
- 5: Points to the 'Transfer first line as attribute names' checkbox in the 'Attribute Names' section.
- 6: Points to the 'Import' button at the bottom right.

The 'Preview' section at the bottom shows an Excel workbook with the following data:

source	target	consonant cl...
D	M	1
M	I	0
I	T	0
T	R	1
R	Y	1
G	R	1
R	A	0
A	P	0
P	C	0
O	V	0

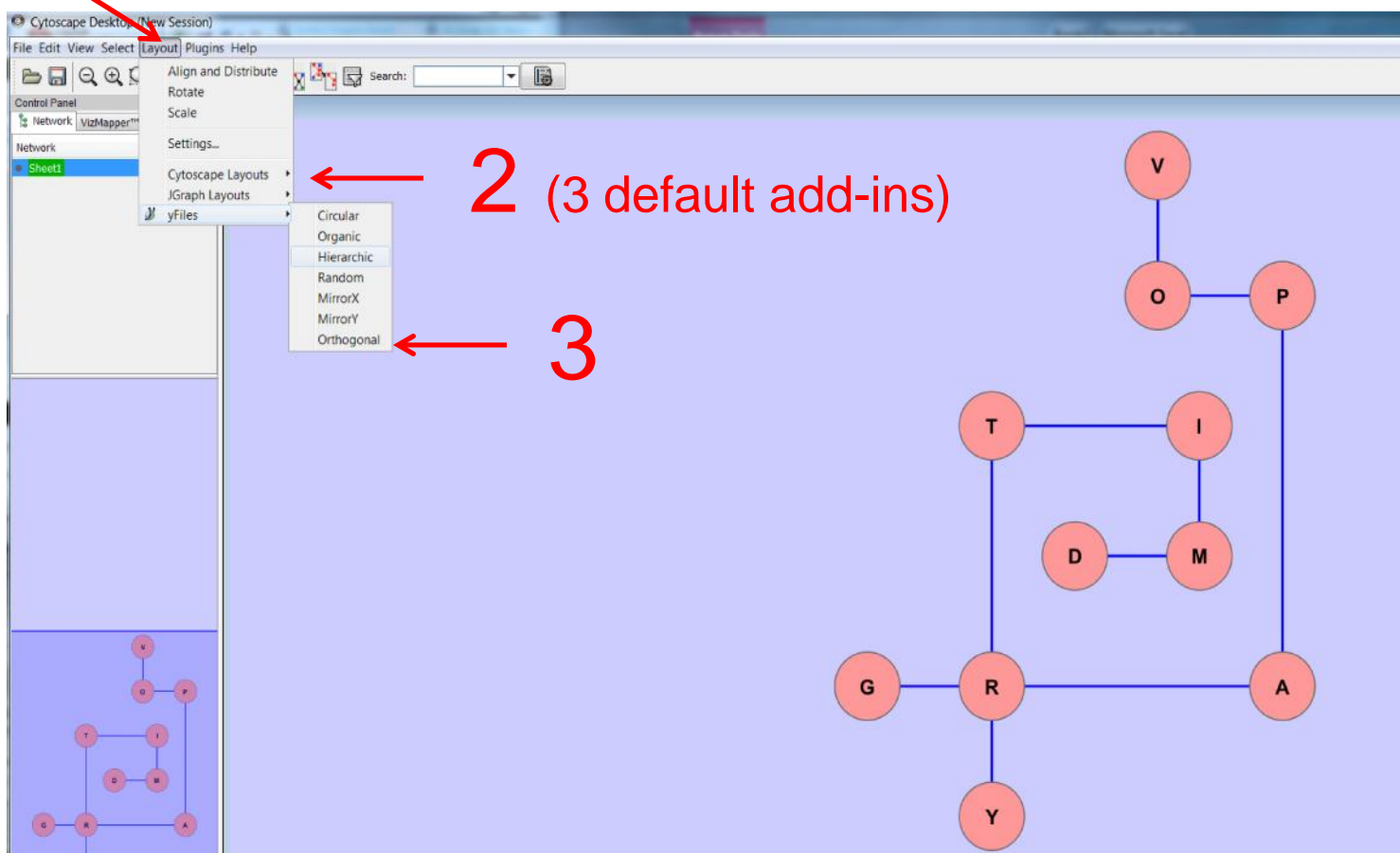


Node Layout

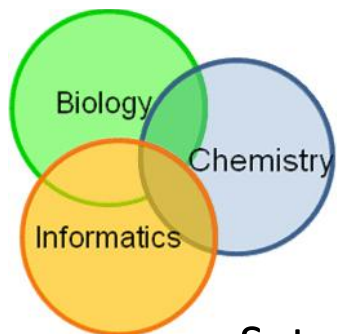


Cytoscape provides many options to help auto-optimize the node (letters) layout

1



Network Mapping



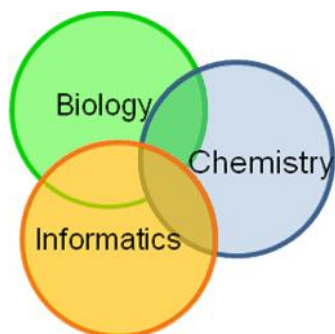
Global Defaults



Set defaults to modify global node, edge and other options.
Double-click on Defaults image

Network Mapping

The screenshot shows the Cytoscape Desktop interface. On the left, the 'Control Panel' has a 'Defaults' section with a red arrow labeled '1' pointing to the 'Source' and 'Target' node icons. Below this is the 'Visual Mapping Browser' with a list of properties. In the center, a network diagram is shown with red circular nodes labeled with letters (D, I, M, T, R, Y, A, P, O, V, G) connected by wavy edges. On the right, the 'Default Appearance for default' dialog is open, showing a preview of the 'Source' and 'Target' nodes. A red arrow labeled '2' points to the 'Node' tab, and a red arrow labeled '3' points to the 'EDGE_FONT_SIZE' property, which is set to 10.0.



Modify Edge Attributes

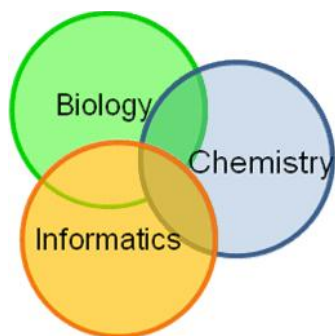


Use the VizMapper to map “extra columns” in edge list (attributes) to aesthetics.

Network Mapping

1 →

The screenshot shows the Cytoscape Desktop interface. The top menu bar includes File, Edit, View, Select, Layout, Plugins, and Help. Below the menu is a toolbar with various icons. The main window is divided into several panels. On the left is the 'Control Panel' with tabs for Network, VizMapper, Editor, and Filters. The 'VizMapper' tab is active, showing the 'Current Visual Style' set to 'default'. Below this is the 'Visual Mapping Browser' with a tree view showing 'Edge Visual Mapping' expanded. Under 'Edge Visual Mapping', there are three sections: 'Edge Color' (Mapping Type: Discrete Mapping, with a color bar showing a gradient from green to blue), 'Edge Line Style' (Mapping Type: Discrete Mapping, with a color bar showing a gradient from green to blue, and options for SINEWAVE and ZIGZAG), and 'Edge Line Width' (Mapping Type: Continuous Mapping, with a graphical view showing a linear gradient from 0.00 to 1.00). The main canvas on the right displays a network diagram with nodes labeled with letters (D, M, I, T, R, Y, G, A, P, O, V) and edges represented by wavy lines of different colors and styles, corresponding to the mappings defined in the VizMapper panel.



Node Attributes

Select file for the node attributes. Extra options can be used to select node ID (must match edge list), change the file delimiter, etc.



Network Mapping

1

2

3

4

5

6

The screenshot shows the Cytoscape Desktop (New Session) window. The File menu is open, showing options like New, Open, Save, Save as..., Import, Export, Recently Opened, Print..., and Quit. The Import option is highlighted, and a submenu is visible with options like Network (Multiple File Types)..., Network from Table (Text/MS Excel)..., Network from Web Services..., Node Attributes..., Attribute from Table (Text/MS Excel)..., Edge Attributes..., Ontology and Annotation..., Attribute/Expression Matrix..., Vizmap Property File..., Import attributes from Biomart..., and Import Attributes from NCBI Entrez Gene....

The Import Annotation File dialog is open, showing the Import Attribute from Table tab. The Input File is set to file:/C:/Users/dgrapov/Desktop/cytoscape%20network%20mapping%20demo/node%20attributes.xlsx. The Advanced section shows Show Mapping Options, Show Text File Import Options, Import everything (Key is always ID), and Case Sensitive. The Annotation File to Attribute Mapping section shows the Primary Key as ID. The Text File Import Options section shows the Delimiter as Tab. The Attribute Names section shows Transfer first line as attribute names. The Preview section shows a table of attributes.

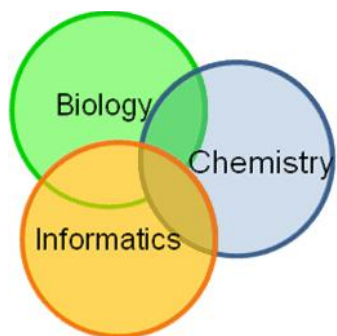
Alias/	Column (Attribute Name)	Data type
ID		String
color		Integer
size		Integer
node image		String

Legend: Key Alias

Key Attributes: A, D, G, I, M, O, P, R

File Size: 9 KBytes

Import Cancel



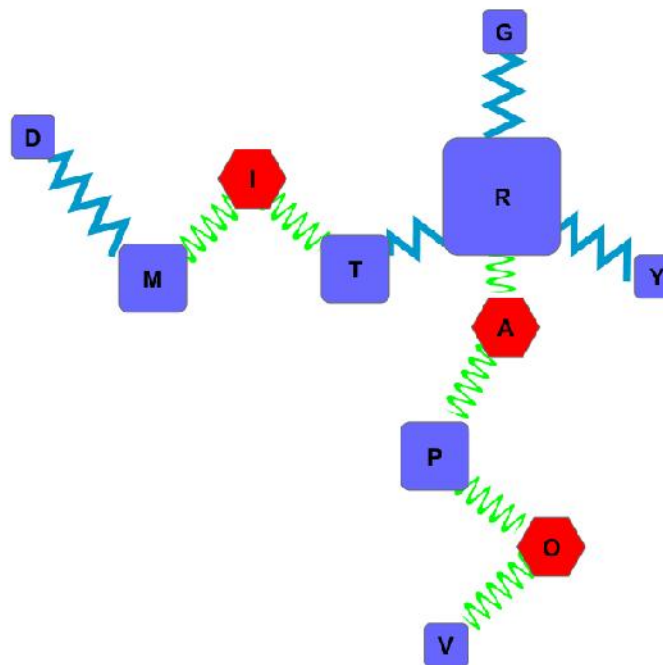
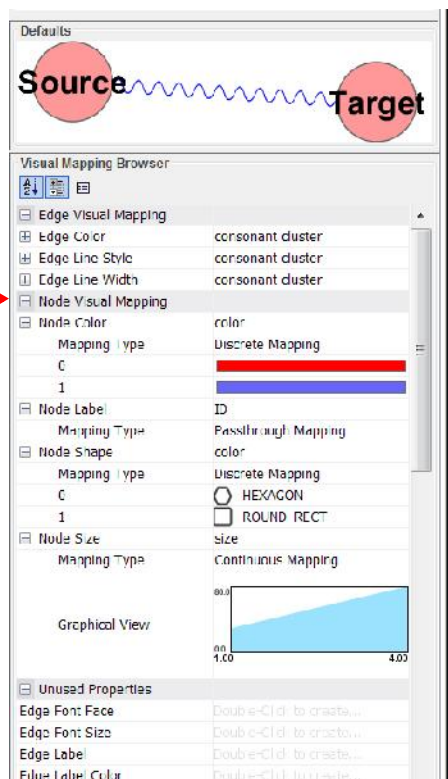
Modify Node Attributes

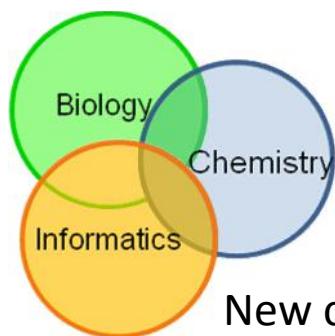


Use the VizMapper to map node attributes.

Network Mapping

1





Add node images



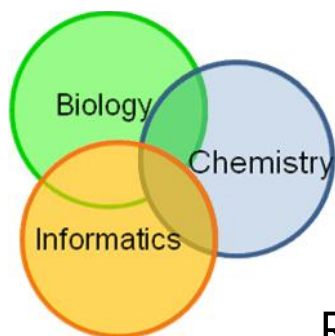
New columns can be added to the node attributes and change the mapping in existing networks. Here I'll add a url for a .png to use as a custom node image. Custom images can also be defined as local file path (e.g. windows: file:///C:\.....)

Network Mapping

LinkedIn

A screenshot of a LinkedIn profile for Dmitry Grapov. The profile shows his name, title 'Principal Statistician at UC Davis, NIH West Coast', and various affiliations. A context menu is open over the profile picture, showing options like 'Save image as...', 'Copy image URL', 'Copy image', 'Open image in new tab', 'Search Google for this image', 'Print...', and 'Inspect element'. The 'Copy image URL' option is highlighted.

ID	color	size	node image
D	1	1	
M	1	2	
I	0	2	
T	1	2	
R	1	4	http://m.c.lnkd.licdn.com/mpr
Y	1	1	
G	1	1	
A	0	2	
P	1	2	
O	0	2	
V	1	1	



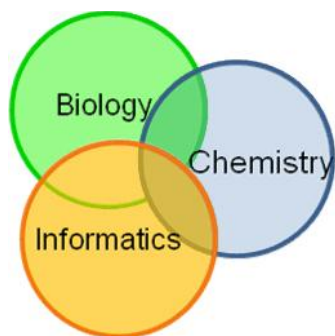
Override mapped attributes



Right-click on an edge or node to manually change their aesthetics

Network Mapping

The screenshot shows the Cytoscape Desktop interface. On the left is the 'Control Panel' with tabs for 'Networks', 'Visual Mapping', 'Editor', and 'Filters'. The 'Visual Mapping' tab is active, showing a 'Visual Mapping Browser' with various properties like 'Node Color', 'Node Shape', 'Node Size', etc. The main window displays a network graph with nodes labeled with letters (D, M, T, R, G, P, V, A, O) and edges. A right-click context menu is open over node 'R', showing options like 'Visual Mapping Bypass', 'Nested Network', 'Use Web Services', 'Hide Node', and 'LinkOut'. A sub-menu is also visible, listing various visual mapping properties that can be overridden, such as 'Node Color', 'Node Border Color', 'Node Shape', etc. Red arrows numbered 1, 2, and 3 point to the context menu, the sub-menu, and a specific property in the sub-menu, respectively.



Export Network as Image



Export as .pdf or .svg to further modify (and beautify) the network.

Network Mapping

1

The screenshot shows the Cytoscape Desktop interface. The main window displays a network diagram with nodes labeled D, M, I, T, R, G, Y, P, V, and O. The nodes are connected by edges, some of which are highlighted in green. A small portrait of a man is visible near node R. The left sidebar contains the 'Control Panel' and 'Visual Mapping Browser'. The 'Export Bitmap' dialog box is open on the right, showing the image size and resolution settings.

2

Export Bitmap O...

Image Size

Zoom: 100 %

Width: 1,904 pixels

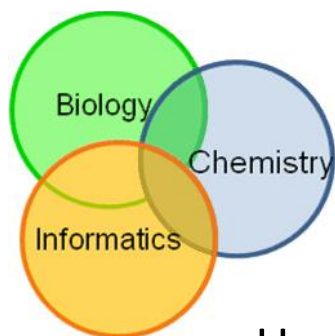
Height: 867 pixels

Width: 26.444 inches

Height: 12.042 inches

Resolution: 72 DPI

Cancel OK



Final Touches



Use irfanview (<http://www.irfanview.com/>) for minor edits or inkscape (<http://www.inkscape.org/en/>) for complete control of final touches including making legends.

Network Mapping

