

PERSONAL DASHBOARD, MODULES & GUIDES

Once a job has been submitted to MetaNets, user is taken to a personal dashboard. Each dashboard is tagged to a trackable Dashboard ID, which is displayed on the top.

There are 4 analytical and visualization modules in MetaNets:

1. Categorical Network Analysis
2. Integrated (multi-omic) Network Analysis
3. Network Composition Analysis
4. Network Property Analysis

Info tags

Access the (i) tags at various sections of the modules to get assistive information

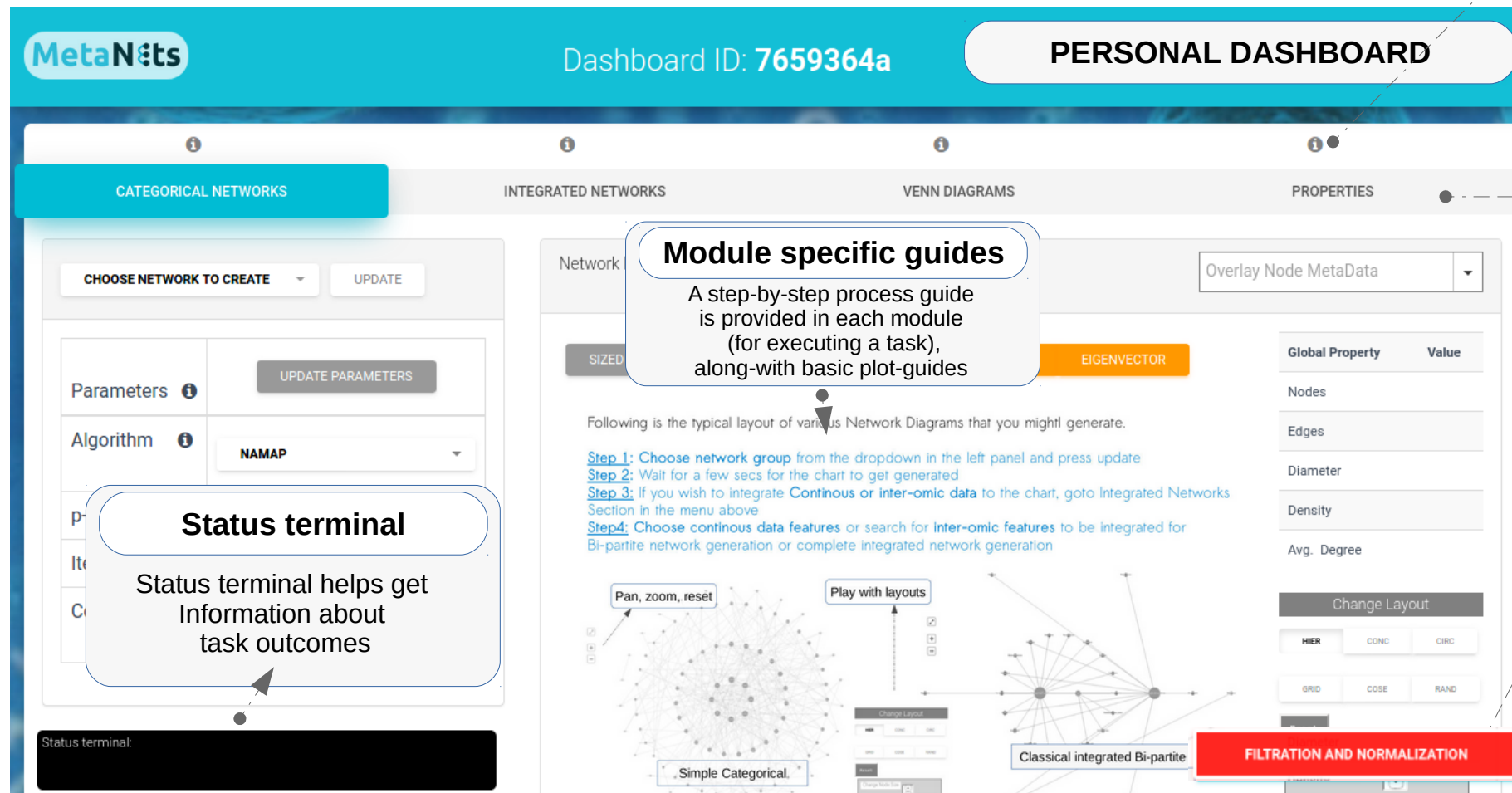
Multi-modular

Use this menu panel for Accessing multiple analysis and visualization Modules in the personal dashboard

All plots generated in MetaNets are **downloadable as Hi-Res images.**

Dynamic data management

- Use this floating button to access Various filtration, normalization and transformation methods
- This option may be used multiple times, at any point in time.



Module specific guides
A step-by-step process guide is provided in each module (for executing a task), along-with basic plot-guides

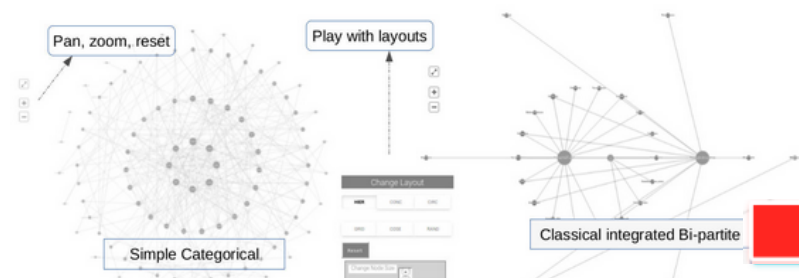
Status terminal
Status terminal helps get Information about task outcomes

Module specific guides

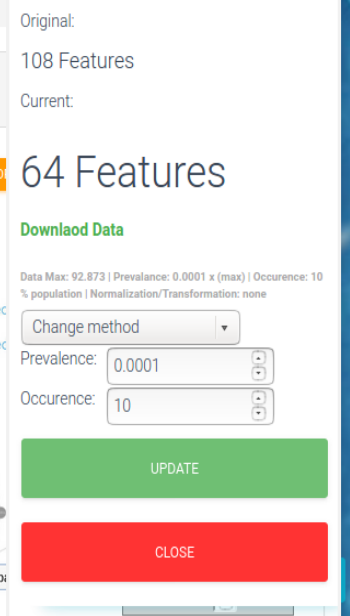
A step-by-step process guide is provided in each module (for executing a task), along-with basic plot-guides

Following is the typical layout of various Network Diagrams that you might generate.

[Step 1:](#) Choose network group from the dropdown in the left panel and press update
[Step 2:](#) Wait for a few secs for the chart to get generated
[Step 3:](#) If you wish to integrate Continuous or inter-omic data to the chart, goto Integrated Networks Section in the menu above
[Step 4:](#) Choose continuous data features or search for Inter-omic features to be integrated for Bi-partite network generation or complete integrated network generation



FILTRATION AND NORMALIZATION



Original:
108 Features

Current:
64 Features

generate.
press update
goto Integrated to be integrated

Change method
Prevalence: 0.0001
Occurrence: 10

UPDATE
CLOSE

MODULE1: CATEGORICAL NETWORKS

MetaNets creates group level networks for each category (also called Environment) in the supplied meta-data . For example, for Geography environment, categorical groups can be India, US, Japan, Europe etc. MetaNets automatically infers all possible categorical groups in the meta-data and provides options to perform network analysis on each of such groups.

TRIBAL UPDATE

Parameters UPDATE PARAMETERS

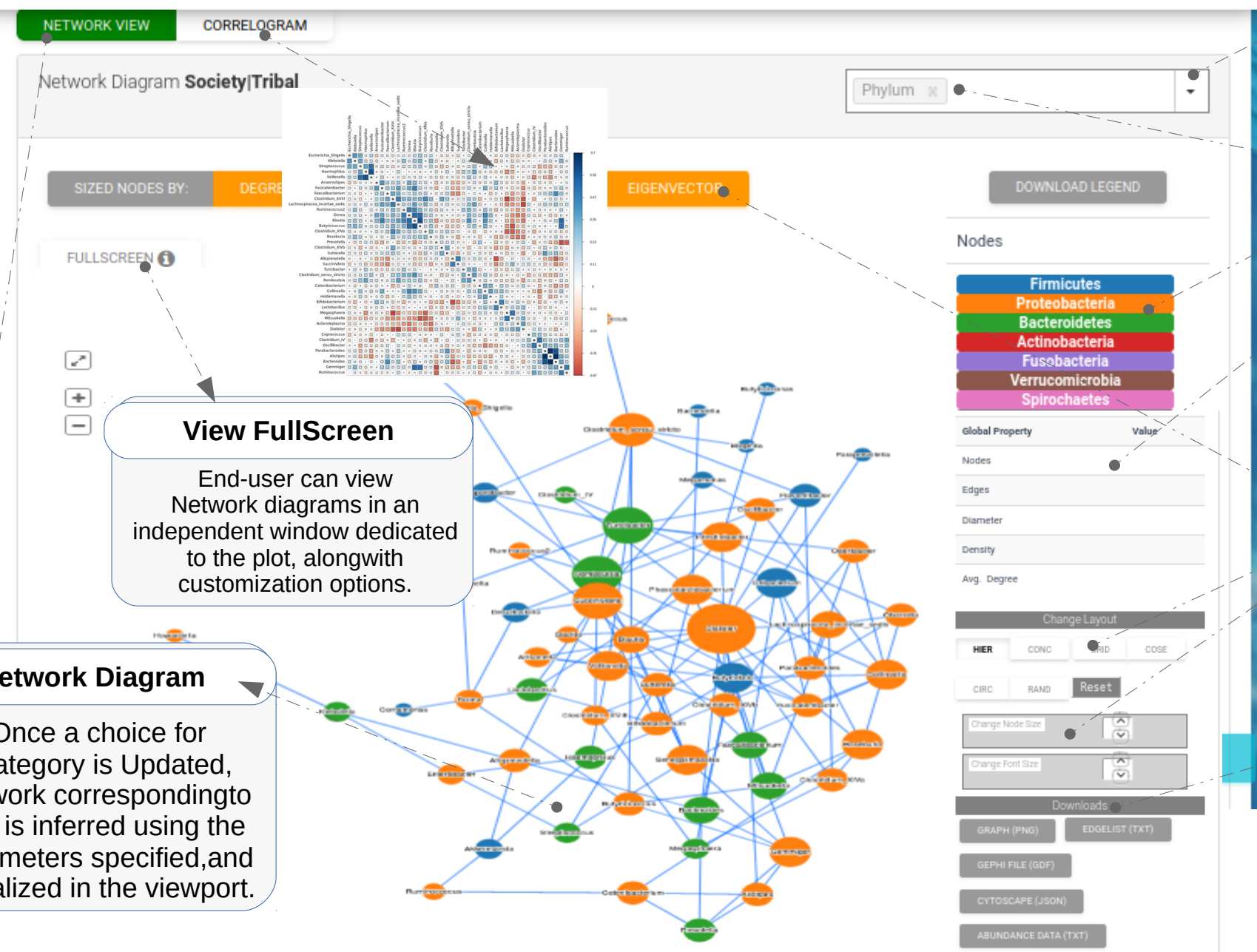
Algorithm NAMAP W/ SPEARMAN

p-value

Iterations

Corr. cutoff CRITICAL-R

Refer Next Slide



Node meta-data
Dropdown option to overlay Node meta-data

Overlay Node MetaData
Median_Abandance
Phylum

Global Properties
Tabulated summary of the key global Properties of the network being analysed.

Customizations

- Layouts
- Property mapping
- Node and Font sizes

Download Options

- Plot Downloads
- Cytoscape and Gephi compatible files
- Edgelist
- Abundance Data

View FullScreen
End-user can view Network diagrams in an independent window dedicated to the plot, alongwith customization options.

Network Diagram
Once a choice for a category is Updated, Network corresponding to that is inferred using the parameters specified, and visualized in the viewport.

Status terminal
Status terminal helps get Information about task outcomes

```
Status terminal:
Network processed!
```

TRIBAL UPDATE

Parameters **i**

UPDATE PARAMETERS

Algorithm **i** NAMAP W/ SPEARMAN

p-value **i**

Iterations **i**

Corr. cutoff **i** CRITICAL-R

TRIBAL

Environment: Society

Tribal

Urban

Environment: Geography

Assam

Andhra

Sikkim

Manipur

Ahmedabad

Environment: Sex

Male

Female

Environment: Diet

Non_Vegetarian

Vegetarian

Unknown

Categorical Networks

Comprehensive analysis and visualization of all Categorical networks identified through metadata

Update Parameters

Use this option to propagate the chosen options across all the modules of MetaNets. If not clicked, the chosen parameters will be applicable only for the current module.

Algorithm **i** NAMAP W/ SPEARMAN

p-value **i**

Iterations **i**

Corr. cutoff **i**

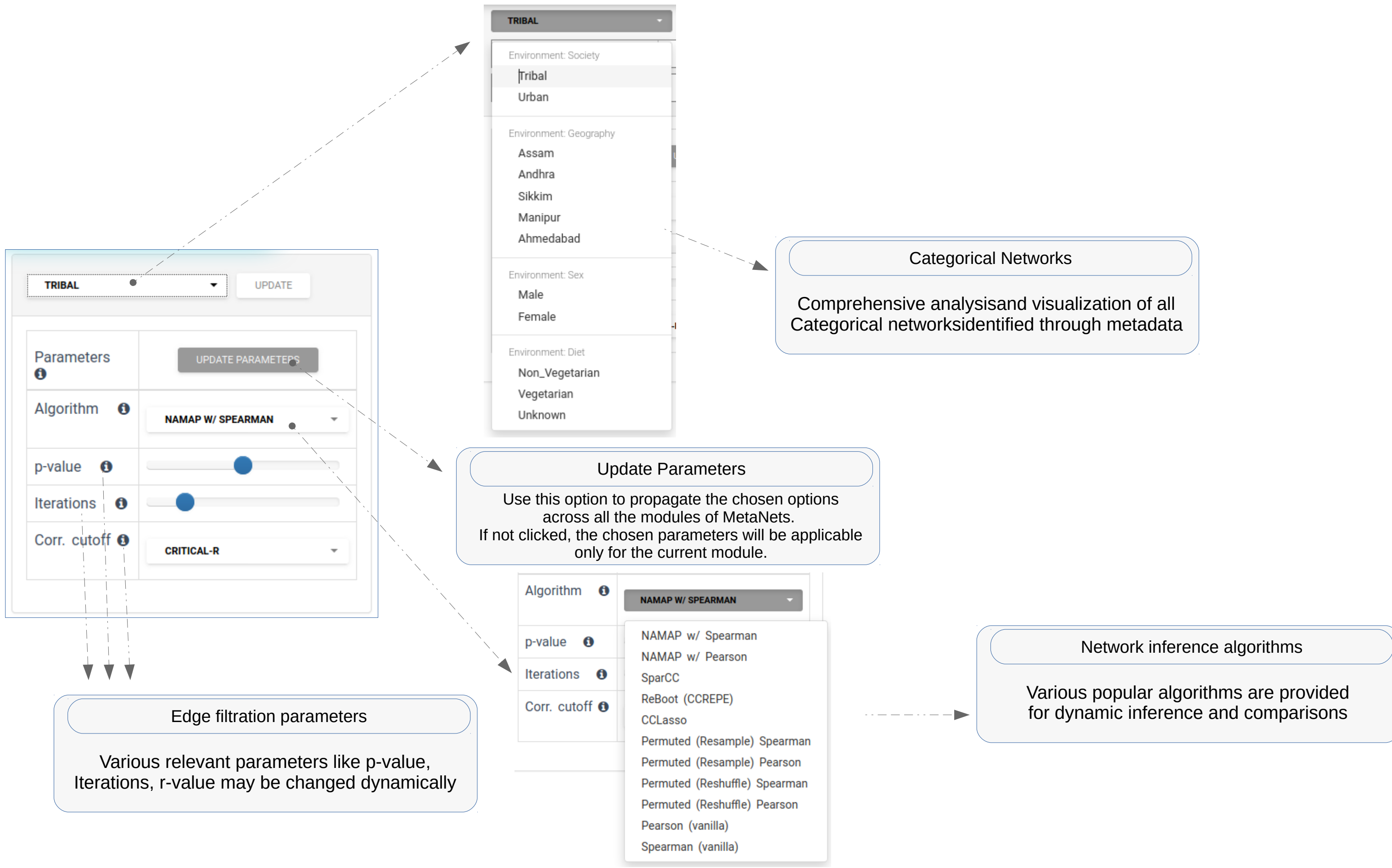
- NAMAP w/ Spearman
- NAMAP w/ Pearson
- SparCC
- ReBoot (CCREPE)
- CCLasso
- Permuted (Resample) Spearman
- Permuted (Resample) Pearson
- Permuted (Reshuffle) Spearman
- Permuted (Reshuffle) Pearson
- Pearson (vanilla)
- Spearman (vanilla)

Network inference algorithms

Various popular algorithms are provided for dynamic inference and comparisons

Edge filtration parameters

Various relevant parameters like p-value, Iterations, r-value may be changed dynamically



MODULE 2: INTEGRATED NETWORKS

Integrated Networks are created for a categorical group by combining continuous groups/ features having continuous values from Primary Metadata and/ or Secondary Input data to create a complex or inter-omic view of the microbiome associations. User can also change the layouts and reset the node sizes as required.

The screenshot displays the 'INTEGRATED NETWORKS' section of a software interface. It includes a sidebar with a 'TRIBAL' dropdown and an 'UPDATE' button. Below this, there are input fields for 'BMI' and 'Age', and a list of metabolic pathways such as 'Glycolysis_Gluconeogenesis' and 'Citrate_cycle_TCA_cycle'. The main area shows a 'Network Diagram Society/Tribal' with nodes and edges. A 'VENN DIAGRAMS' section is also visible. A 'Status terminal' at the bottom left shows the command: 'Network processed! Society/Tribal using namap at p-val: 0.05'. Three callout boxes provide additional information:

- Continuous Metadata:** Integrate continuous meta-data with primary data for finding correlating taxa against Continuous factors.
- Inter-omic options:** Switch between Complete and Bi-partite Integrated inter-omic networks.
- Searchable inter-omic data:** Search and specify inter-omic features of interest for integrating into network inference.

On the right side, there are two additional visualizations:

- Bi-partite plots:** Edges exclusively between the inter-omic data and continuous metadata groups can be visualized through highly intuitive Bi-partite plots.
- Heatmap:** A heatmap showing correlations between various taxa (e.g., Cetobacterium, Clostridium_sensu_stricto) and features (e.g., Age, Citrate_cycle_TCA_cycle, Glycolysis_Gluconeogenesis, BMI_values).

MODULE3: NETWORK COMPOSITIONS (VENN DIAGRAMS)

This module allows group level comparisons for each environment in the MetaData, in terms of **Node and Edge compositions** of various networks in the environmental category. This is enabled through interactive Venn diagrams for node and edge composition of all networks in a chosen Environment. This visualisation may take some time to load. Please be patient.

CATEGORICAL NETWORKS
INTEGRATED NETWORKS
VENN DIAGRAMS
PROPERTIES

Geography Update

Class

Tribe_name

Sex

Age_Range_yrs

Diet_Vegetarian_or_Non_Vegetarian

BMI_RANGE

UPDATE PARAMETERS

Iterations [Slider]

Corr. cut-off CRITICAL-R

Venn Diagram for networks in **Geography** environment

Venn of Nodes

Change view mode: CLASSIC EDWARDS

CHOOSE NETWORK COMPONENT

Download options

- Download PNG image
- Download SVG image
- Download CSV lists

Compositional Comparisons

Compare networks of various groups within a Category of Metadata (e.g networks of all states in a given Geography), in terms of their Node and Edge composition

Number of chosen components in each Network

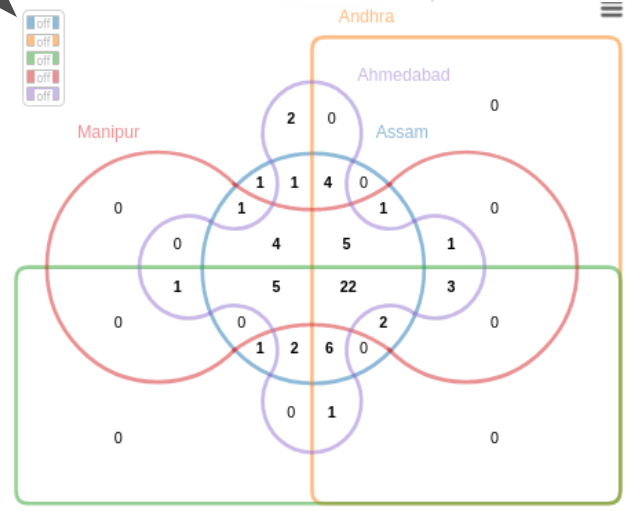
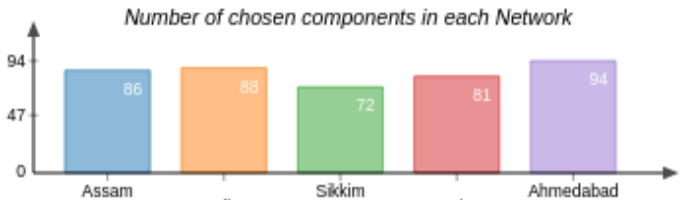
State	Number of Nodes
Assam	86
Andhra	88
Sikkim	72
Manipur	81
Ahmedabad	94

Download options

- Download PNG image
- Download SVG image
- Download CSV lists

Dynamically generated Venn Diagrams for Node as well as Edge composition of various network groups in an environment

Compositional Comparisons
Compare networks of various groups within a Category of Metadata (e.g networks of all states in a given Geography), in terms of their Node and Edge composition



MODULE 4: NETWORK PROPERTIES

This module of MetaNets allows computation and analysis of network properties (centrality measures) for each of the network in an environment using selected algorithm and associated parameters. There are two methods of analysis and visualization available:

- 1). Tabulated view (sortable, searchable and exportable tables)
- 2). Grouped Boxplots of properties for all networks in an environment, thereby enabling comparison.

The interface is divided into two main sections: 'Network Properties' (left) and 'Network Properties Box Plots' (right).

Network Properties: This section displays a table of network properties for a selected group (e.g., 'MALE'). The table includes columns for Node_Index, Label, Degree, Cluster_Coeff, Closeness, Betweenness, Eigen_Vector, and Eccentricity. A 'Switch Mode' button allows toggling between 'TABLES' and 'PLOTS'. A search bar and pagination controls are also present.

Node_Index	Label	Degree	Cluster_Coeff	Closeness	Betweenness	Eigen_Vector	Eccentricity
1	Acidaminococcus	7	0.333333	0.150746	0.247722	1.534740e-02	4
2	Anaerobiospirillum	2	1.000000	0.134130	0.000000	1.674160e-03	5
3	Bifidobacterium	15	0.285714	0.162119	0.659270	8.504360e-02	4
4	Clostridium_XIVa	8	0.535714	0.155624	0.190473	1.652360e-02	4
5	Faecalibacterium	10	0.533333	0.158805	0.116501	6.225580e-02	4
6	Megamonas	5	0.600000	0.153263	0.062776	2.460040e-02	4
7	Megasphaera	6	0.266667	0.147445	0.565031	1.130090e-02	5
8	Sutterella	11	0.327273	0.156832	0.173658	4.289290e-02	4

Network Properties Box Plots: This section displays grouped boxplots for the same network properties across different groups (e.g., Assam, Andhra, Sikkim, Manipur, Ahmedabad). The y-axis represents 'Values' ranging from 0 to 24. A 'Switch property' dropdown is set to 'DEGREE'. A 'Layout' selector at the bottom offers options: CLASSIC, NOTCHED, VIOLIN, BEAN, BEESWARM, and SCATTER. A 'Download' button is also available.

Network Properties: Interactive, searchable and exportable network property tables for each group of an environment

Network Properties Box Plots: Interactive, downloadable, trend enabled, boxplots (and variants) for each network property, for each group of an environment

Graph type and trend lines: Use the buttons to change graph type Or overlay trend-lines for better comparison. Download option available as well.