For my Master’s Project I designed and produced HIIT a Hierarchical Intra Inter Analysis Tool that visualizes both the hierarchical and network components of the unique dataset and allows developers to verify and validate the dataset by detecting network and tree related anomalies or patterns. For this demo I used a dummy dataset of 20 trees and a network dataset of approximately 1000 intra and inter edges.

Initially when HIIT is opened it shows the Overview page in which the main purpose is to summarize the network data of all the trees at once. The Overview consists of a directed chord dependency diagram in which each tree is represented by an arc which are colored by tree type. The tree type names and percentages can be shown by hovering over the help icon in the right hand corner. Within each arc it summarizes the number of edges and where they go to. For example we can see the largest ribbon from tree name 17 is representing the 90 intra edges for tree name 5. Hovering over the tree names provides additional summary information including total number of intra and inter edges.

The user can detect more outliers and patterns by using the filtering options in the toolbar at the top of the screen. The filtering allows the user to examine tree type patterns such as tree type 1. Or explore the relationships between multiple trees such as tree name 1, 4, and 15.

After exploring the summarized relationships of the trees, the user can explore a detailed view by double clicking an arc, in this case we chose tree name 11. Now in the center of the screen we see a combined Icicle/Node-Link diagram that shows the hierarchical structure of the selected tree. Each rectangle is colored by node type and the percentages can be seen once again by hovering over the help icon. The black node-links are drawn on top of the icicle diagram to further clarify the tree representation of the of the icicle diagram. The user is able to zoom and pan the diagram and hover over the nodes to access more information.

Surrounding the Icicle/Node link diagram is a ring of arrows in which each arrow represents a tree. The lighter arrow indicates the currently selected tree that is being show in the icicle/nodelink diagram. Similarly the arrows mimic the position of the tree in the chord diagram from the overview page which can now be seen in a minimized form here to provide context.

Next a user can explore the intra edges by changing the edge type filter. The icicle rectangles are shown in the background to provide hierarchical context to the intra edges. Now hovering over a node tells you how many intra edges in total that nodes has and breaks down the intra edges into outgoing vs incoming edges. Notice how for a case where there a multiple edges for the same pair of nodes. That the edges are grouped by direction and curved to make sure there are no hidden stacked edges.

Now to get more information about the intra edges the user can look at the mini intra view to the left. The purpose of this view to provide quick summaries of node type connections and edge types of the intra dependencies. For example we can see here out of the 16 intra edges of tree name 11 there 3 that go from a yellow node to a green node and is of edge type 4. Hovering over each diagram provides the user with the node names that fit the grouping.

The user is able to find this grouping of edges by using the filtering capabilities at the top of the screen. Selecting the edge type name, as well as the node types results in the icicle/node-link diagram only showing those edges. And the mini intra view is updated as well. The combination of the icicle/node-link diagram, the mini intra view and the filtering capabilities allows the user to identify several instances anomalies and patterns.

Now to explore the inter edges, the user can use the filter and now only the inter edges appear. Notice how the inter edges are drawn from node to a block grey arrow or vice versa. These arrows tell us which additional tree an edge is connected to. As we can see here there appear to be a large amount of arrows going to this arrow tree name 1 and smaller amount of arrows going to tree name 18. If we click on the arrow a minimized version of tree name something hierarchical structure gets drawn in the mini hierarchy view.

This allows the user to see two tree structures at once and therefore enables the user to detect patterns or make comparisons associated with the number of nodes, node types, and shape of the two trees. The mini hierarchy view is also linked to the inter edges of the main icicle/node-link diagram as the nodes that are connected to the main tree on the right side are bolded in the mini icicle on the left side. Once again we can filter the edges with the toolbar and it updates the icicle/node-link, mini hierarchy and mini inter views. The main difference between the Mini intra and inter is that the edges are additionally grouped by associated tree. We can see how many edges total and edge type., node type pattern per connected tree.

After exploring the hierarchical, intra, and inter edges of the tree a user can easily perform the same tasks on a different tree by simply double clicking on the corresponding arrow. The user is also always able to return back the overview page my double clicking on the mini overview.