TASK1 – FINAL PROJECT FOR SNA ALEJANDRO HERNÁNDEZ ARANDA.

1. Introduction

I chose to do it for the Faculty of Health Science (School of Medicine) because it seemed like a nice chunk of the network—big enough that you'd have hundreds of followers, but manageable. From the complete UEF co-authorship graph, I removed everything that was not relevant and manually polished the network to retain only something that really made sense inside the subgraph.

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2. Network Overview

Graph is undirected since co-authorship is mutual. After cutting the Health Science, I had 1,076 nodes and 6,872 edges. The majority of authors are connected on a giant component, yet there are several smaller disconnected groups. The average path length is 3.31, meaning that everyone's only a few steps away from everyone else — also a sign of good internal flow. Its clustering coefficient is 0.606, meaning that authors tend to work together in tight groups. It feels like each cluster is its own little academic bubble.

PageRank distribution also told me a lot. The average was 0.00093, but there's a steep drop after a few key names — the majority of authors sit low, and just a few stand out. That shows how influence and visibility aren't evenly spread, even in a focused network like this.

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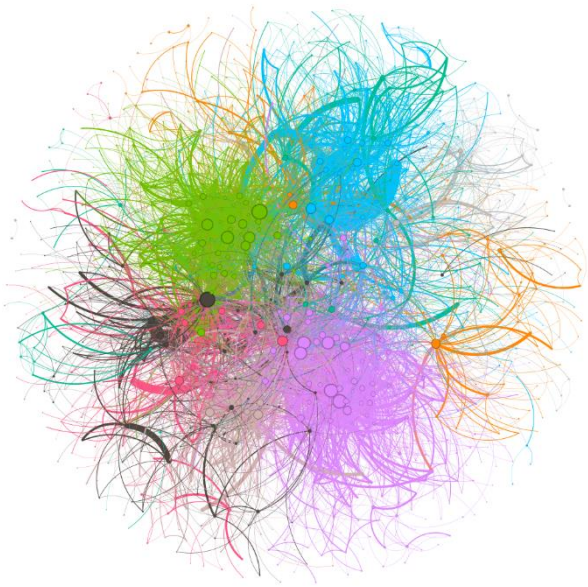
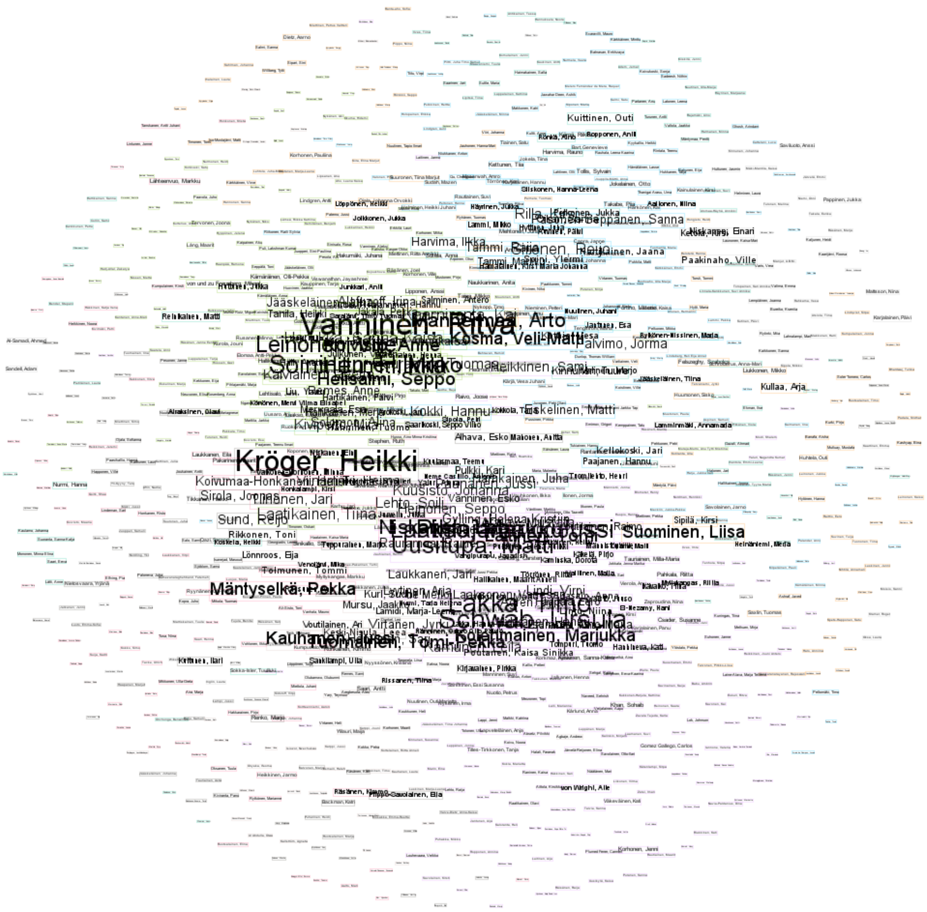
3. Graph Visualization

To make sense of all this visually, I used three different versions of the graph. One clean version with color-coded communities and node size based on PageRank. Another with all the names visible, and one that just shows the most relevant authors, kind of like a word cloud. They each reveal something different — from structure to individual importance. The layout was done with Fruchterman-Reingold because it helps highlight community separation without forcing it too much.

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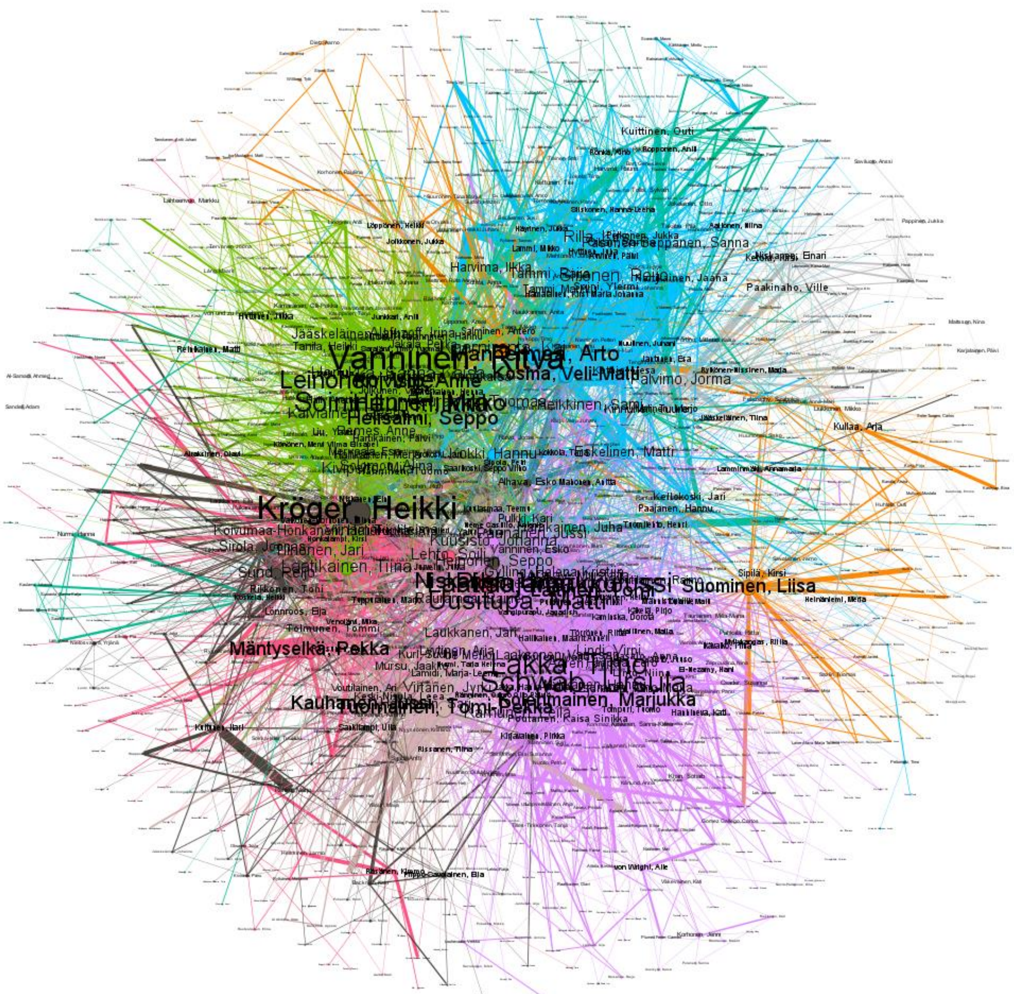
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4. Centrality and Roles

Having been clean the network was also hunky dory, but I didn't stop there, I then scanned through a number of centrality measures, asking just who holds the whole thing together. PageRank showed me who's well connected to highly influential people, kind of like academic popularity by association. Betweenness displayed the "bridges," the people who span otherwise isolated groups. And Authority gestured toward researchers who are regarded as touchstone figures by others.

And still their names — Ritva Vanninen, Heikki Kröger, Hilkka Soininen — kept popping up. Vanninen had the highest PageRank — she is in the most coönnected community, but is not a bridge. Kröger, meanwhile, was particularly high in Betweenness — not in terms of centrality, but as a link between clusters. These are interesting these role don't always coincide. That you are in the center does not make you the glue. And the connector isn't always the most visible.

I discovered authors like Sohvi Koponen as well — whose PageRank and other metrics were low but whose Betweenness was high. Not a "star" but subtly holding parts of the network together. Those quiet connectors count for more than they're given credit for.

After staring at the sort of usual suspects, PageRank or Authority or whatever, I still didn't feel like I had a complete story on this network. So I dug into a couple of less conventional centrality measures to have a different perspective: Harmonic Closeness and Bridging Centrality.

Harmonic Closeness provided me with a better sense of how "reachable" each author is, even in a disconnected network. It showed that people like Vanninen and Kröger were not only central — they were accessible from a variety of places. Sort of a natural shortcut in the network.

Then came Bridging Centrality, with another layer. It imagined those authors who quietly bridge discrete communities together — not the loudest names, but the ones who keep the whole thing from disintegrating. Koponen did a really good job here once again, that silent connector.

These two measures didn't just parrot what I already observed — they made me see function, not just fame. Who's visible is one thing. Who's useful, that's another.

5. Additional Network-Level Measures:

So I didn't want to get stuck at purely path length and clustering, so I dug into a couple more metrics to learn more about how this thing behaves as a whole.

Its graph diameter is not very large (9), so even the two farthest researchers in the largest component are no more than nine steps away from each other. For a network that size, that's actually kind of impressive — it means things are more connected than you might think.

Then I checked **eccentricity**, just to see how far authors are from the rest. Most fall between 6 and 8, with a peak at 7. The radius is 5, meaning that the most "central" people aren't more than five steps away from anyone. So yeah, it's accessible — even for the ones who aren't that visible.

Finally, I looked at the extremes. There are **37 nodes sitting right on the edge** (eccentricity 9) and **8 right at the center** (eccentricity 5). That contrast shows the structure pretty clearly — not everyone is equally close to the action, but the whole system still holds together.

6. Communities & Modularity

Applying the modularity algorithm resulted in a total of 13 well-defined communities. The value was 0.645 — high enough to suggest these divisions aren't just happenstance. The graph itself told that story as well: clusters were in evidence without any nudging, often around a known history of collaboration or shared research interest. What I found fascinating is that some authors almost serve as anchors in those groups, while others are located on the edges and reaching out to other clusters. That complexity adds layers — it's not just who's linked but how.