Problem statement & Data Source

Our objective is to address the challenge of creating a community that is tailored to the needs of its residents. We recognize the importance of connecting residents, entrepreneurs, and local businesses within the community, but understand that current efforts may not fully meet residents' needs. By identifying key areas where improvements can be made, such as facilitating better connections and understanding residents' preferences, we aim to provide recommendations that empower communities to better serve their residents. For our dataset, we used data from Meetup.com, a website where people organize and join local events. This data represents Nashville's meetup scene, which acts like a social network. Here, people (members) are connected by the groups they join, allowing us to analyze how these groups interact.

Methodology & Results

In our methodology, we looked at how groups are connected, identified influential members, and examined event participation patterns. We also built a model to predict event attendance and developed a recommendation system for suggesting similar groups to users.

Group-to-group Analysis: Firstly, we identified the most central groups in the entire network, utilizing various centrality measures such as degree, betweenness, closeness, and eigenvector centrality. Additionally, we explored the correlation between group size and centrality to understand if larger groups tend to be more central. Then we focused specifically on Career & Business meetup groups, aligning with our objective of supporting local entrepreneurs, we identified communities of groups within this category. Furthermore, we pinpointed the most central groups within the Career & Business category, providing insights into key players in this domain. Lastly, we applied topic modeling techniques to uncover underlying themes and topics within the Career & Business meetup groups, enhancing our understanding of the interests and discussions prevalent in this community. We identified that those topics were marketing, networking, women, and real estate. Please refer to the *Appendix 1* for more details.

Member-to-member Analysis: To condense our dataset, we've reduced it to 1000 rows. The utilization of visualizations facilitates a better understanding of the network's configuration and the identification of key members who hold significant sway. Each centrality metric—Degree, Closeness, Betweenness, and Eigenvector—is represented in a separate plot highlighting the top 3 members with the highest centrality scores. Identifying key nodes (members) that play significant roles in connecting different parts of the network holds considerable importance for event organizers, entrepreneurs, and the broader community. For results and visuals, please consult the *Appendix 2*.

Member-to-event Analysis: We aimed to determine the group with the highest number of events associated with a specific topic; 'Hiking in Nashville.' This involved identifying relevant groups and tallying the number of related events they hosted. We sought to construct a bi-partite network, incorporating both members and the events they attended within the 'Hiking in Nashville' group. In this bi-partite network analysis, our aim was to pinpoint the most influential members and events. Influential members were identified as those who facilitated connections between different members. To achieve this, we conducted a betweenness centrality analysis. Our findings from the network analysis reveal that many members within the group only participate in a single event. Given their existing connections within the network, it should be easier to encourage these members to attend other events compared to recruiting entirely new members. Therefore, our

strategy should focus on targeting the top influential members, as they have the potential to attract the largest number of attendees from one event to others. For detailed results, refer to *Appendix 3*.

Predict Event Participation: We've developed a prediction model using XGBoost to forecast the number of participants for Meetup events based on various features such as the event's category, month, day of the week, and time of the day. By training the model on historical data, we're able to provide event organizers (such as the Town Hall) with insights into the expected attendance, aiding in planning and resource allocation. For example, we demonstrated the model's predictive capabilities by making predictions for a hypothetical event, such as a Tech-themed event on a Sunday afternoon in July, with a predicted attendance of 11 people. Then, through feature importance extraction, we uncovered that optimal conditions for a successful event entail it being categorized under Tech, scheduled for a Thursday afternoon in March. For more details, consult *Appendix 4*.

Recommendation System: We've developed a recommendation system to suggest new groups to users based on their interests in certain Meetup groups. This enhances users' experience and engagement with the platform. Our method involves TF-IDF Vectorization with TfidfVectorizer from sklearn to convert group descriptions (names) into numerical vectors for similarity calculation. Then, cosine similarity is computed to quantify likeness between groups. A recommendation function identifies top 5 similar groups based on cosine scores. Here's an example, recommending top 5 groups similar to "Nashville Hiking Meetup":

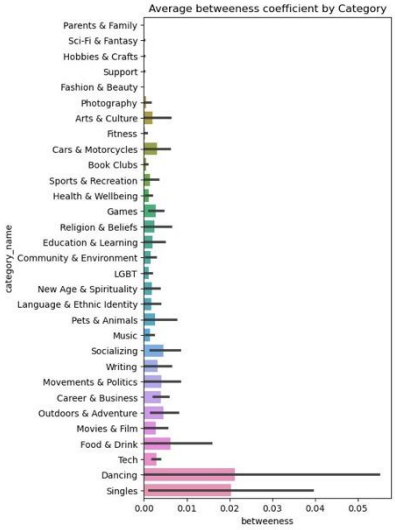
```
Top 5 recommended groups similar to Nashville Hiking Meetup :
Hendersonville Hiking Meetup
Middle Tennessee Hiking Meetup
Tennessee Hiking Group
Nashville Pilgrimage Hiking & Walking Meetup Group
Hiking Club of Nashville and Suburbs
```

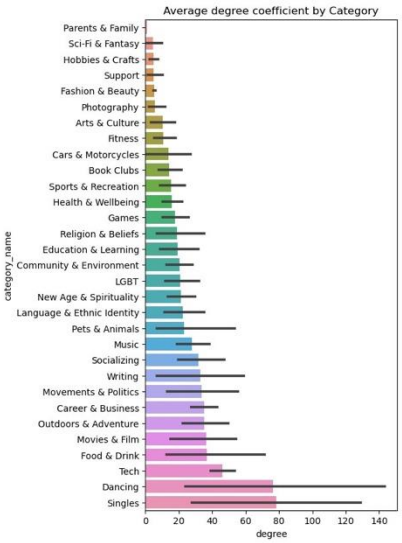
Expected Impacts and Benefits

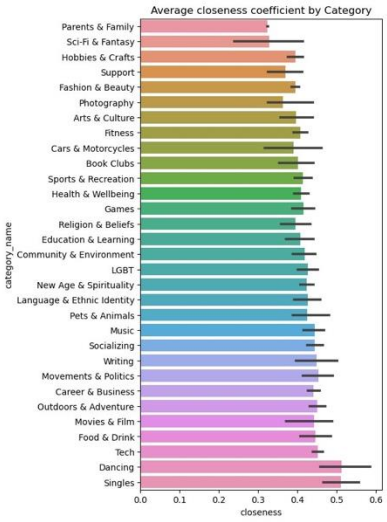
Our analysis brings many benefits to our main stakeholders: entrepreneurs, residents, and the town hall. Entrepreneurs gain valuable insights, residents discover exciting local events, and the town hall fosters a vibrant community. Plus, our analysis isn't limited to Nashville; it **can be applied in any city** with an online community platform like Meetup.com.

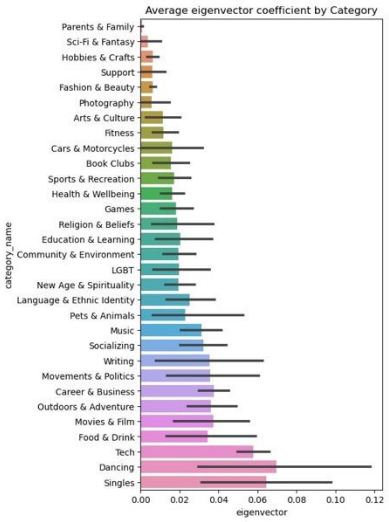
BENEFITS FOR STAKEHOLDERS		
Community Entrepreneurs	**Residents**	**Town Hall**
Discover market gaps: Analyze meetup groups to find underserved niches for business ideas.	**Personalized events:** Enjoy meetups and activities matched to their hobbies and interests.	**Increased foot traffic:** Attract people from outside the town with diverse meetup events.
Target specific communities: Tailor products and marketing to resonate with local interests.	**Sense of belonging:** Foster a welcoming environment where people feel connected and valued.	**Motivated city:** Facilitate a thriving, engaged community that attracts residents and businesses.
Identify social cause-commerce opportunities: Find groups where business meets social good.	**Stronger community:** Build connections with like-minded people and strengthen local bonds.	**Strong emotional capital:** Cultivate a vibrant community with positive social interactions.

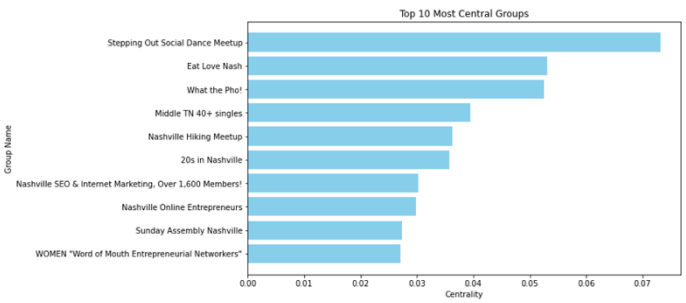
Appendix 1



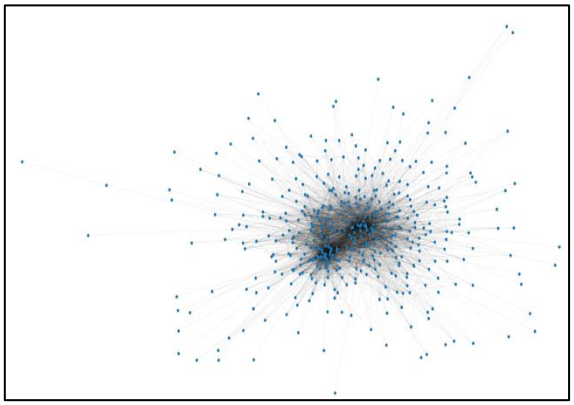




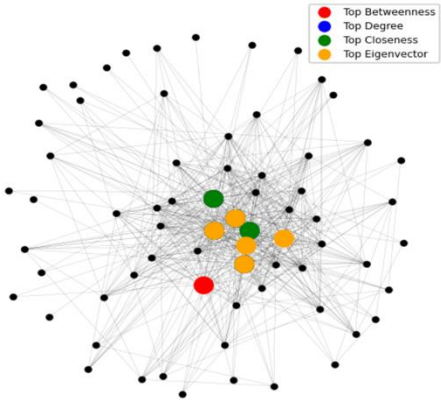




These represent the top 10 most central groups in the whole network.

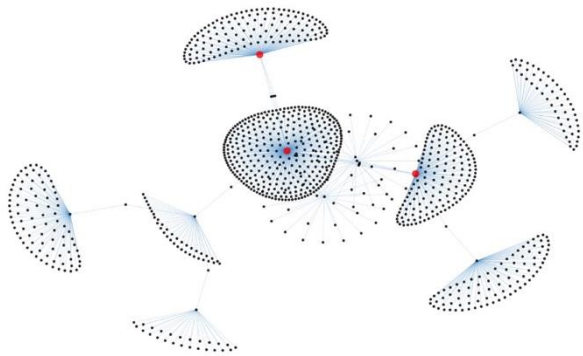


```
Most central groups in Community 0...
    Nashville SEO & Internet Marketing, Over 1,600 Members!
    Nashville Online Entrepreneurs
    Nashville Online Business Strategy Meetup
    SCORE Nashville Events, Networking and Workshops
Most central groups in Community 1...
    Nashville Networking Business Luncheon
    Greater Nashville Networking Group
    Nashville Young Professionals Meetup
    Let's Talk Franklin Toastmasters Club
Most central groups in Community 2...
    WOMEN "Word of Mouth Entrepreneurial Networkers"
    Women's  Business Network
    Women 'n' Wine of Williamson County
    Nashville's Society of Women Business Owners (SOWBO)
Most central groups in Community 3...
    Real Estate Investors of Nashville Meetup Group
    Tennessee Real Estate Investors Meetup
    Nashville Real Estate Investor Network
    Escape The Rat Race With Real Estate Investing!!
```



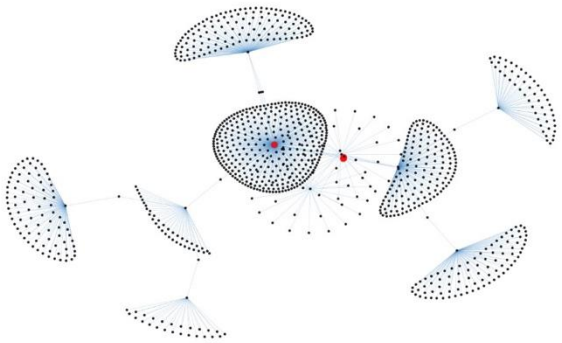
Appendix 2

Degree Centrality



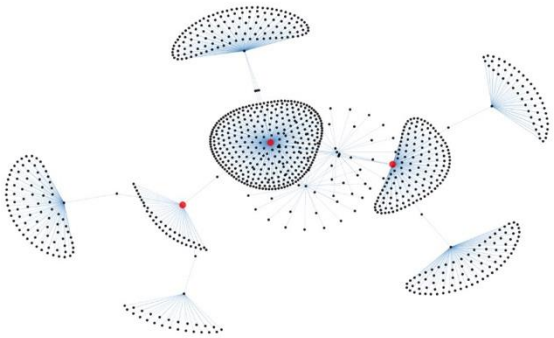
Top 3 members:
Giles Ward
Thomas Hulley
Nathan Hudson

Closness



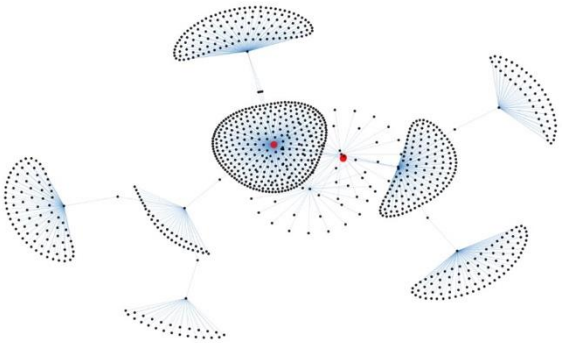
Top 3 members:
Craig McQuistion
William Etcetera
Nathan Hudson

Betweeness



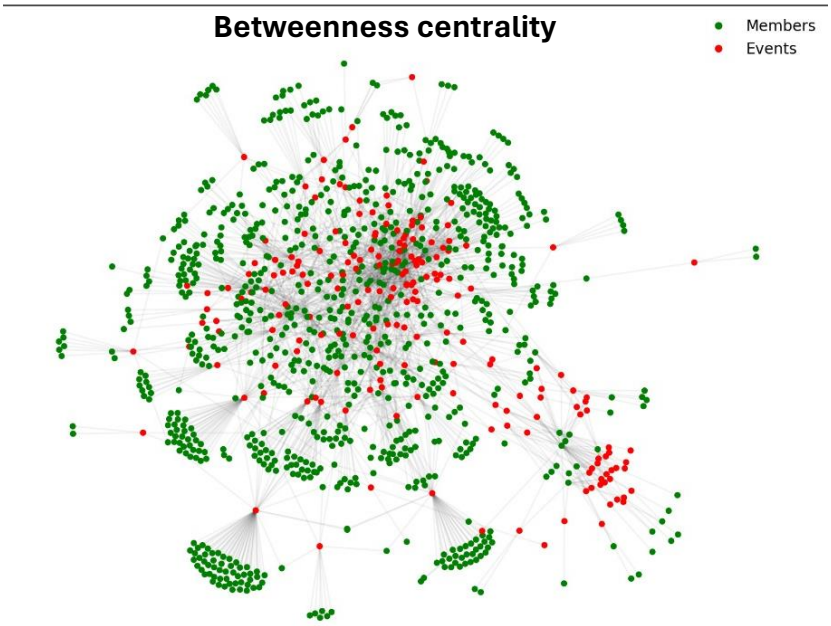
Top 3 members:
Jeffrey J
Thomas Hulley
Nathan Hudson

Eingenvector Centrality



Top 3 members:
Craig McQuistion
William Etcetera
Nathan Hudson

Appendix 3



Top 5 members:
Hassan
Michael Hicks
Cindy Price
Kim B
Allison C

Appendix 4

Here is the feature importance plot of the event attendance model.