Centre for
Data Analytics

Insight

MeetupNet Dublin: Discovering Communities in Dublin's Meetup Network

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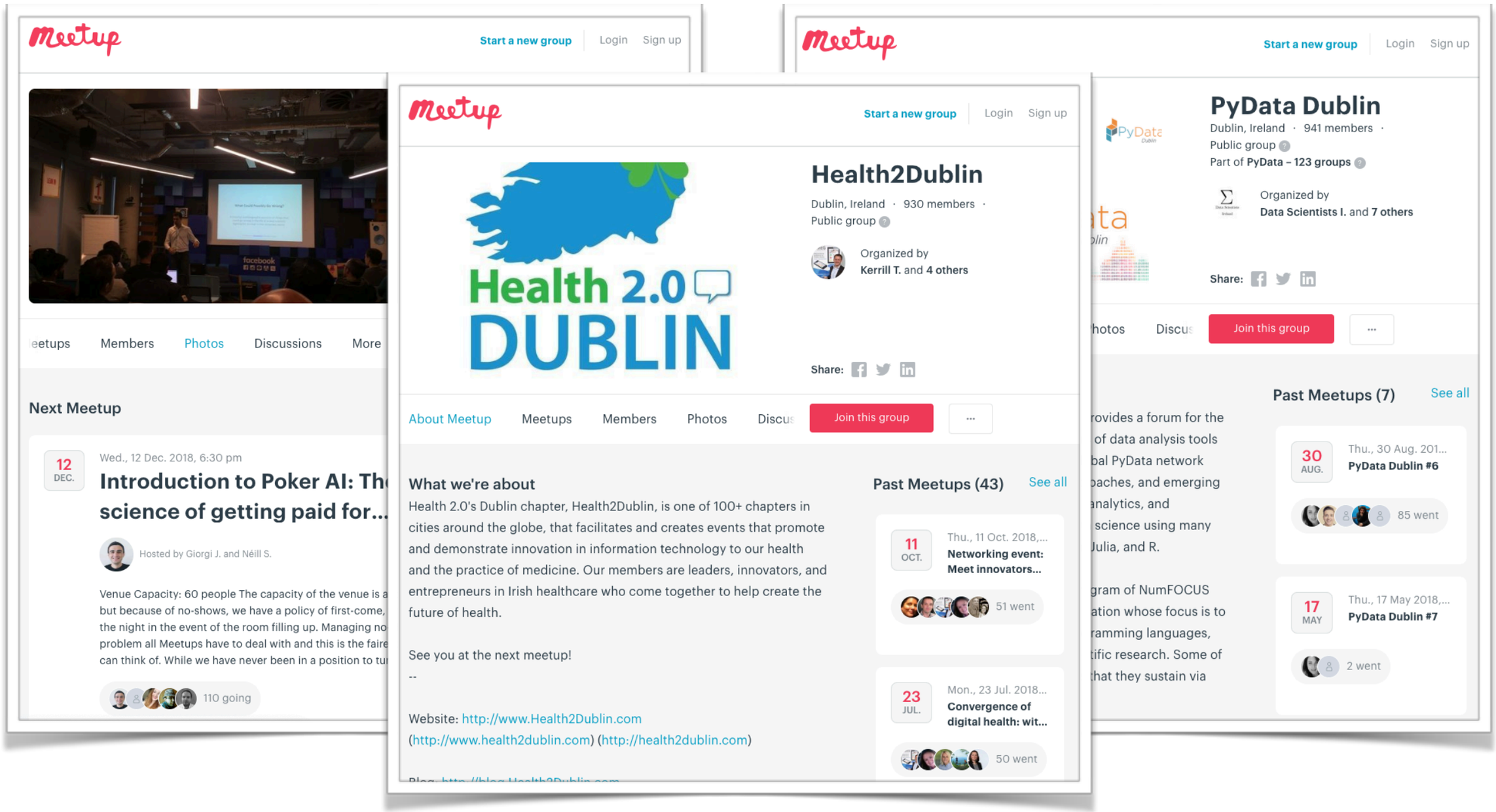
DCU NUI Galway OÉ Gaillimh UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh UCD DUBLIN sfi Science Foundation Ireland

Introduction

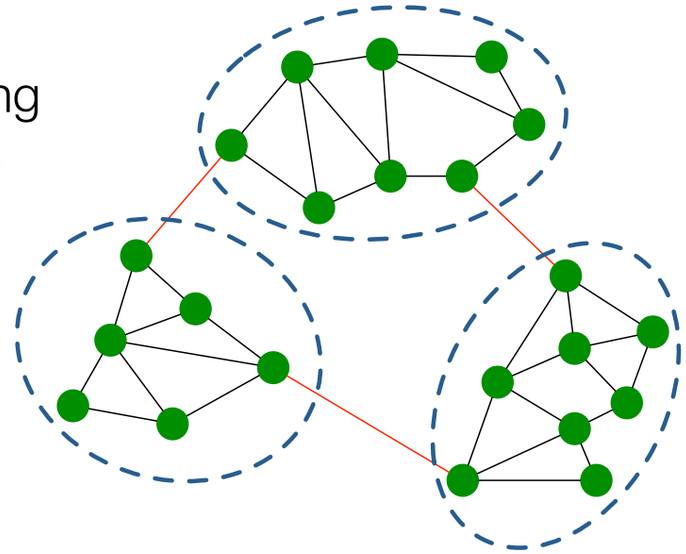
- Meetup.com is a worldwide online platform to organise gatherings and events, covering a diverse range of topics.

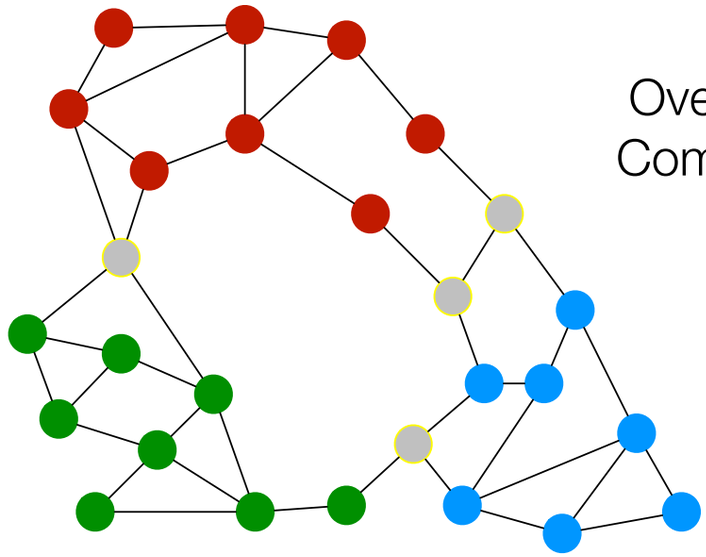


Introduction

- The co-attendance of members at common meetups implicitly creates a network of participation on the platform.
- A common question in network analysis - does community structure exist in the network? Do we see groups of nodes forming dense, highly-connected clusters?

Non-overlapping Communities





Overlapping Communities

Key research question: Do distinct thematically-coherent communities exist within Dublin's Meetup ecosphere?

Data Collection

- The Meetup.com API provides open access to meetup and user data in JSON format.
- In September 2018 data for all 1,482 Dublin-based public meetups was retrieved.
- Data includes meetup metadata, descriptive text, and user membership lists.
- The focus of our analysis is on meetup groups, rather than on individuals. Detailed user information was discarded.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      "rating": 4.67,
      "description": "<p>This is a meetup for all who are interested in
      data science and applied statistics.</p>
      <p>We'll cover:<br>- Statistics<br>- Machine Learning<br>-
      Analytics<br>Major languages used include SQL, R &amp;amp; Python,
      but we're always open to new tools.</p>",
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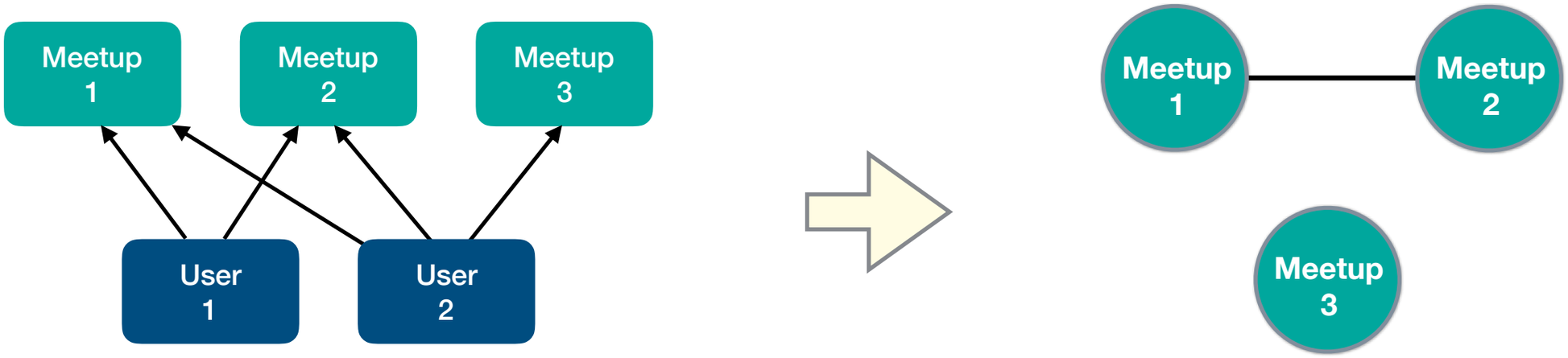
Network Construction

- Key question in network analysis - what is the appropriate representation for our data?
- Rather than constructing a large bipartite network of meetup groups and users, we construct a meetup co-membership network.
- **Core idea:** Each node represents a meetup. An edge exists between a pair of meetups if they share two or more members in common.



Original meetup membership data

Meetup co-membership network

Network Construction

- Each edge has a corresponding weight, indicating the strength of the association between two nodes.
- We calculate each edge weight between a pair of meetups using the Jaccard set overlap:

$$w_{ij} = \frac{|M_i \cap M_j|}{|M_i \cup M_j|}$$

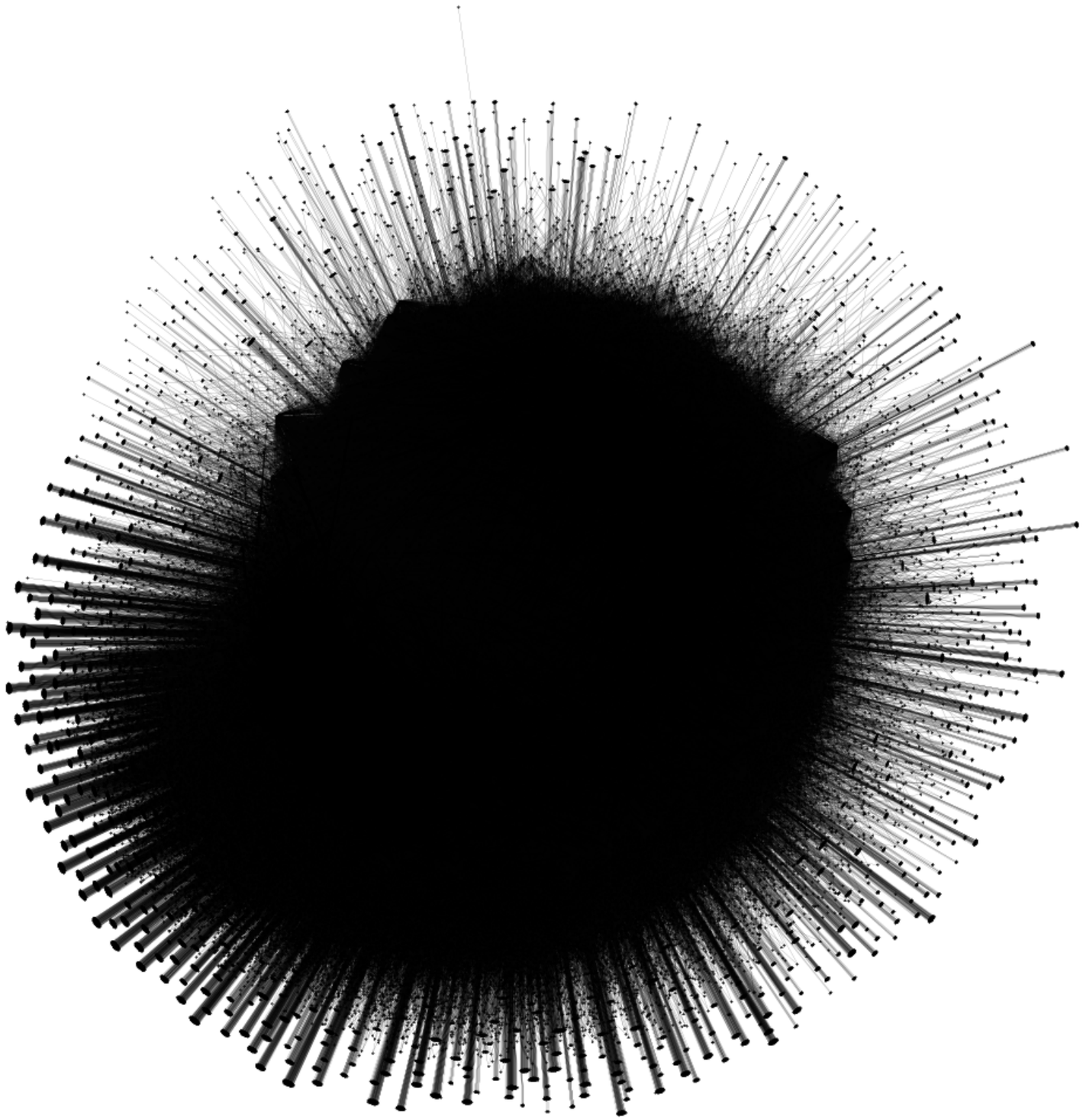
i.e. $\dfrac{\text{size of intersection of memberships}}{\text{size of union of memberships}}$

M_i: members of group *i*

M_j: members of group *j*

Network Construction

- The resulting meetup network contains 1,482 nodes, connected by 1,416,326 weighted edges.
- Visualisation using Gephi (www.gephi.org) indicates the complexity and density of the network.



Finding Communities

- We apply an overlapping community finding approach to the co-membership network, which allows each meetup to potentially belong to multiple communities.
- We use the weighted variant of the popular probabilistic OSLOM algorithm (Lancichinetti et al, 2011).
- We experimented with a range of values for the OSLOM resolution parameter, which controls community size. The default value (0.1) provided a balance between number of communities and their size.
- On completion, we filtered communities containing < 5 nodes, which do not represent significant groupings of meetups.

➡ **Output:** 26 communities, ranging in size from 17 to 216 meetups. Mean size of size was 65 meetups.

Labelling Communities

- From the Meetup.com API we collected textual descriptive meetup metadata. These can be used to produce human-interpretable labels for each community.

Short name field

Dublin Data Science

Dublin, Ireland · 2,329 members · Public group

What we're about

This is a meetup for all who are interested in data science and applied statistics.

We'll cover:
- Statistics
- Machine Learning
- Analytics

Major languages used include SQL, R & Python, but we're always open to new tools.

Long description field

Tag Rugby Ireland

Dublin, Ireland · 599 members · Public group

What we're about

Tag is a brilliant Mixed Social Sport, suitable for all shapes, sizes, ages and sporting abilities, where guys and girls play together in a competitive environment. It's a fantastic opportunity to meet new people, expand your social circle while getting fit and having a Social drink afterwards You don't need any rugby experience as the game is all about running and passing where agility, speed and hand-eye co-ordination are the key skills. It is a soft contact sport, similar to basketball - so intentional impact, diving tackles and deliberate contact are forbidden and strictly penalised by our officials.

Flamenco Dubliners

Dublin, Ireland · 388 members · Public group

What we're about

Flamenco for beginner and intermediate levels. You don't need to bring anything special. Just wanting to learn and enjoy! Come and join us! Every Tuesday for beginners at YMCA Gym (Aungier Street) and Wednesday for intermediate level at Raw Gym (Richmond Street).

Hope to see you there clapping and tapping!

Labelling Communities

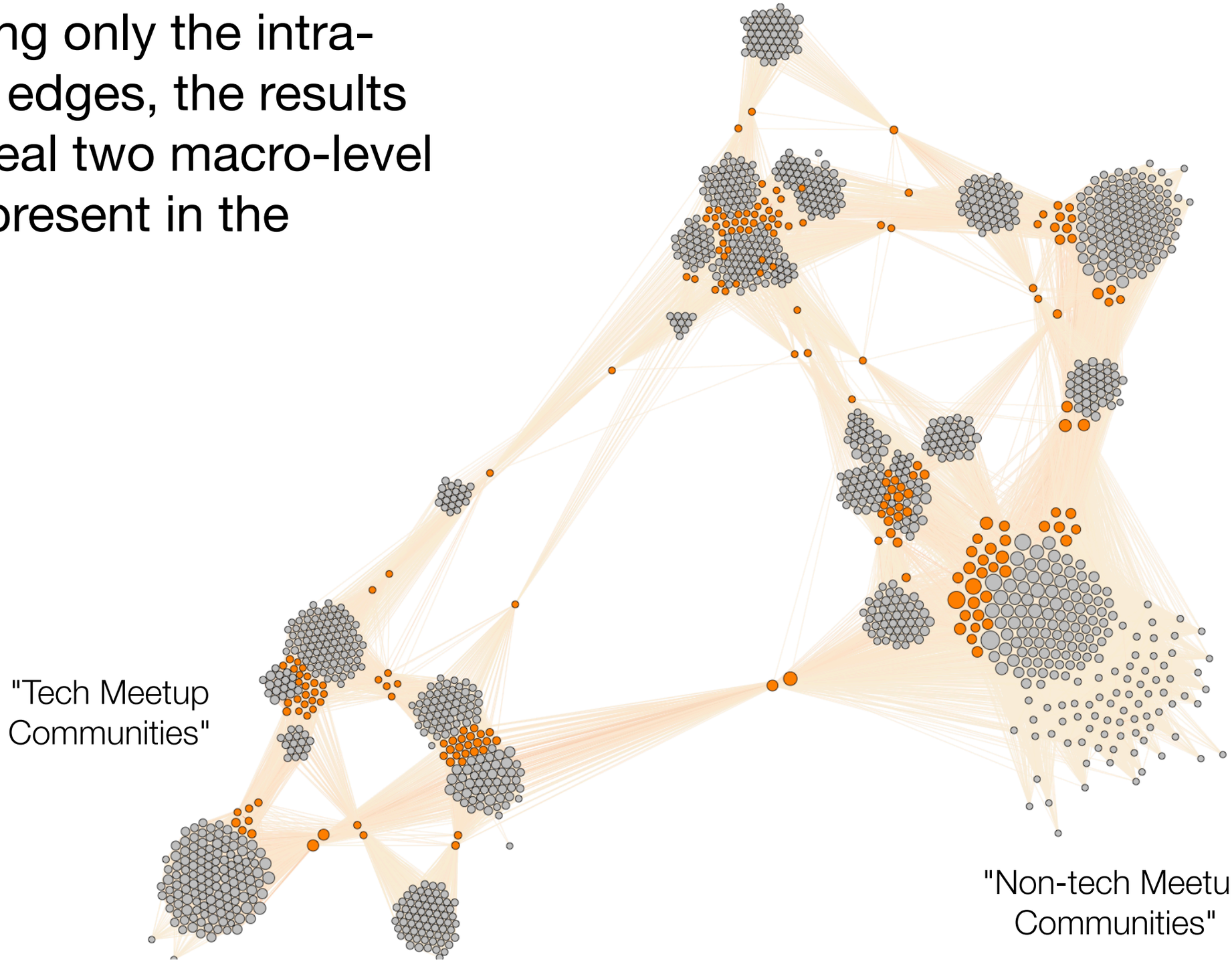
- We developed a custom approach for labelling each community based on the short name field and the longer description field associated with each meetup assigned to that community.
- Generate name labels for communities as follows:
  1. For each meetup name field, extract all alphanumeric terms.
  2. Construct a TF-IDF weighted meetup-term matrix **A**.
  3. For each community *C*:
     a) From **A**, compute mean vector of the rows corresponding to the meetups which have been assigned to *C*.
     b) Rank values in the mean vector in descending order. Select the top *t* terms to create a name label.
- Applied an analogous approach to generate description labels for communities from meetup long description fields.

Summary of Largest Communities

Id	Size	Name Label	Description Label
5	216	hiking, international, wicklow, friends, yoga, book, culture, adventure, language, travel	fun, members, friends, time, hikes, free, social, friendly, looking, food
4	148	meditation, yoga, healing, spiritual, heart, sound, empowerment, soul, life, positive	healing, life, meditation, experience, self, energy, practice, spiritual, mind, mindfulness
7	137	data, user, science, tech, engineering, big, cloud, users, things, learning	data, programming, developers, community, code, science, software, technology, technologies, learn
17	118	user, tech, security, cloud, sharepoint, technology, game, software, data, crypto	data, learn, share, learning, developers, cloud, community, security, technology, software
14	84	business, digital, marketing, startup, entrepreneurs, network, job, professionals, innovation, market	business, marketing, digital, entrepreneurs, startup, market, network, owners, sales, job
22	80	yoga, meditation, workshop, stress, dun, laoghaire, camino, running, dance, therapy	yoga, life, body, meditation, class, health, classes, practice, energy, mind
3	78	startup, entrepreneurs, digital, lean, business, marketing, agile, growth, product, innovation	business, entrepreneurs, marketing, startup, networking, digital, lean, product, community, innovation
25	77	yoga, health, happiness, meditation, vegan, prayer, empowerment, circle, centre, self	yoga, life, meditation, help, support, healing, learn, world, health, work
10	71	user, mysql, traders, developers, tech, js, product, data, sprint, net	learn, product, developers, mysql, share, community, meetups, professionals, technologies, engineers
18	63	music, singles, rock, social, travel, south, international, fans, electronic, 30s	music, night, friends, fun, singles, rock, singing, love, members, sing
8	61	yoga, meditation, health, healing, classes, relaxation, self, body, light, sound	yoga, meditation, body, classes, life, mind, healing, health, practice, nature
21	54	empowerment, self, book, support, health, workshop, eating, therapy, life, development	life, world, diet, work, feel, learn, share, spiritual, ideas, find
15	53	circle, things, drinks, city, fun, hike, ladies, social, friends, book	drinks, friends, women, fun, book, food, wants, single, cinema, dinner
16	53	dance, dancing, yoga, classes, movement, salsa, fitness, class, set, handstand	dance, classes, dancing, fun, fitness, workout, 8pm, levels, class, movement
26	53	soul, prayer, network, life, healing, workshop, empowerment, biodanza, centre, body	life, god, healing, faith, spiritual, love, evening, work, reiki, chat

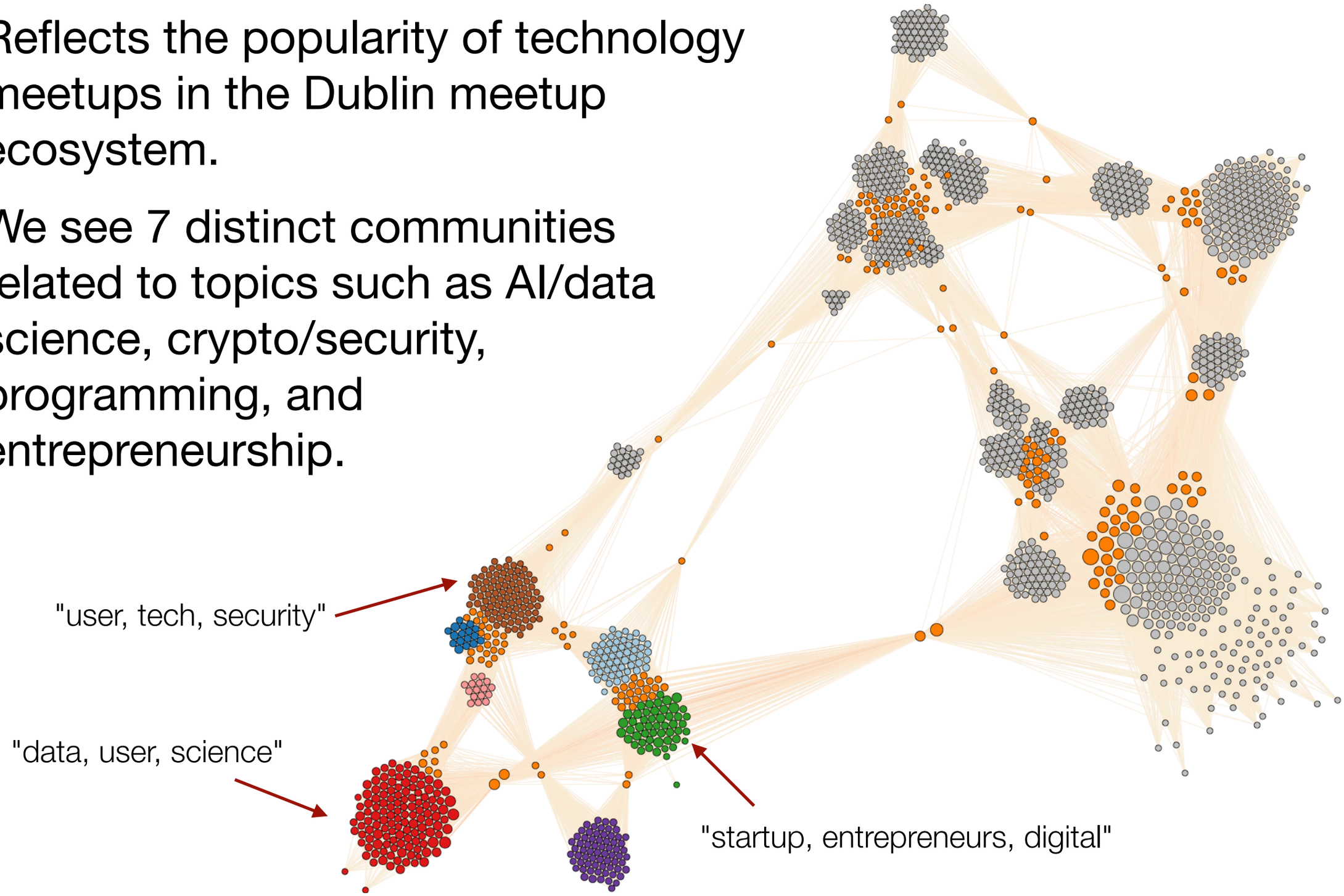
Macro-Level Structure

- By visualising only the intra-community edges, the results broadly reveal two macro-level structures present in the network.



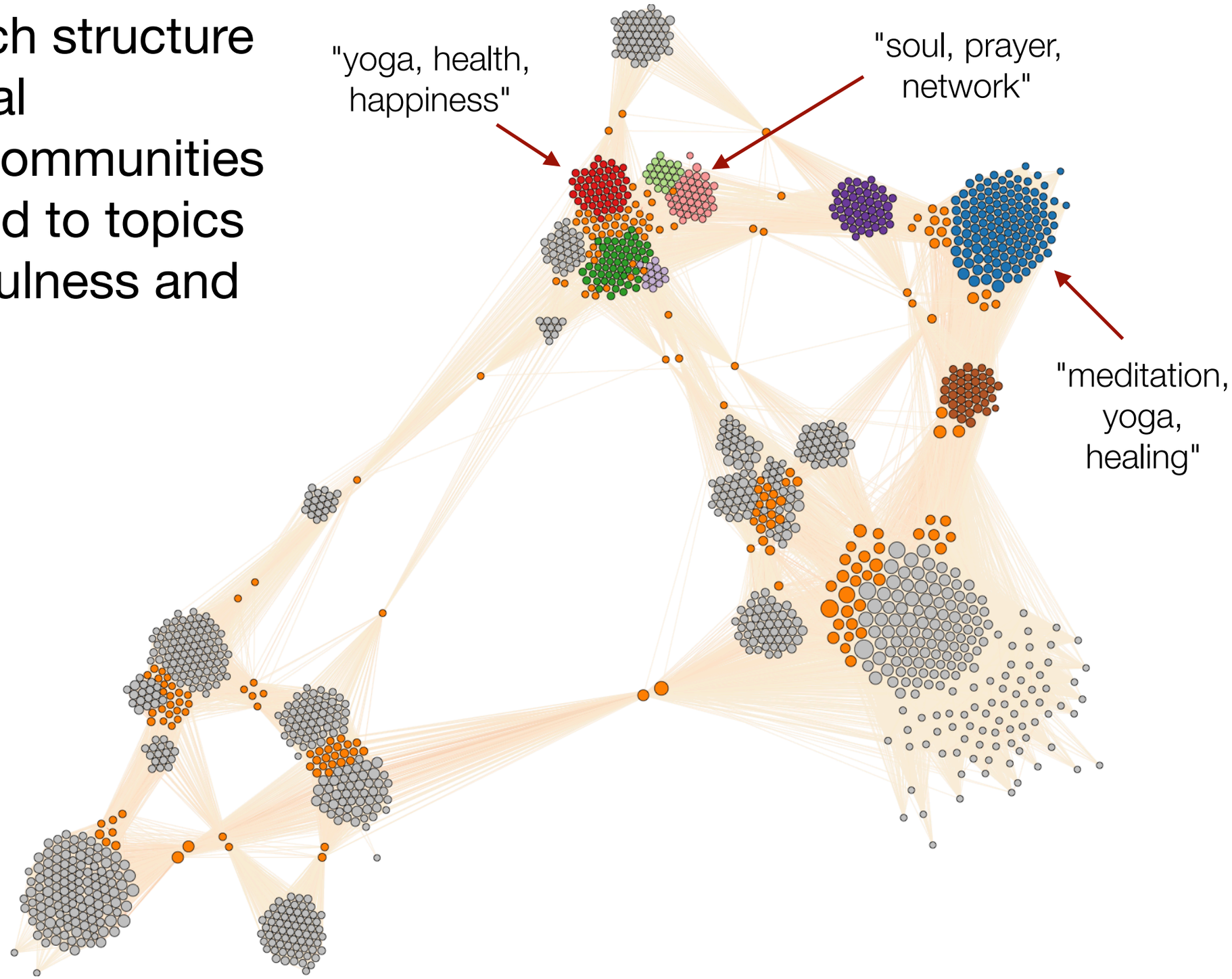
Tech Meetup Communities

- Reflects the popularity of technology meetups in the Dublin meetup ecosystem.
- We see 7 distinct communities related to topics such as AI/data science, crypto/security, programming, and entrepreneurship.



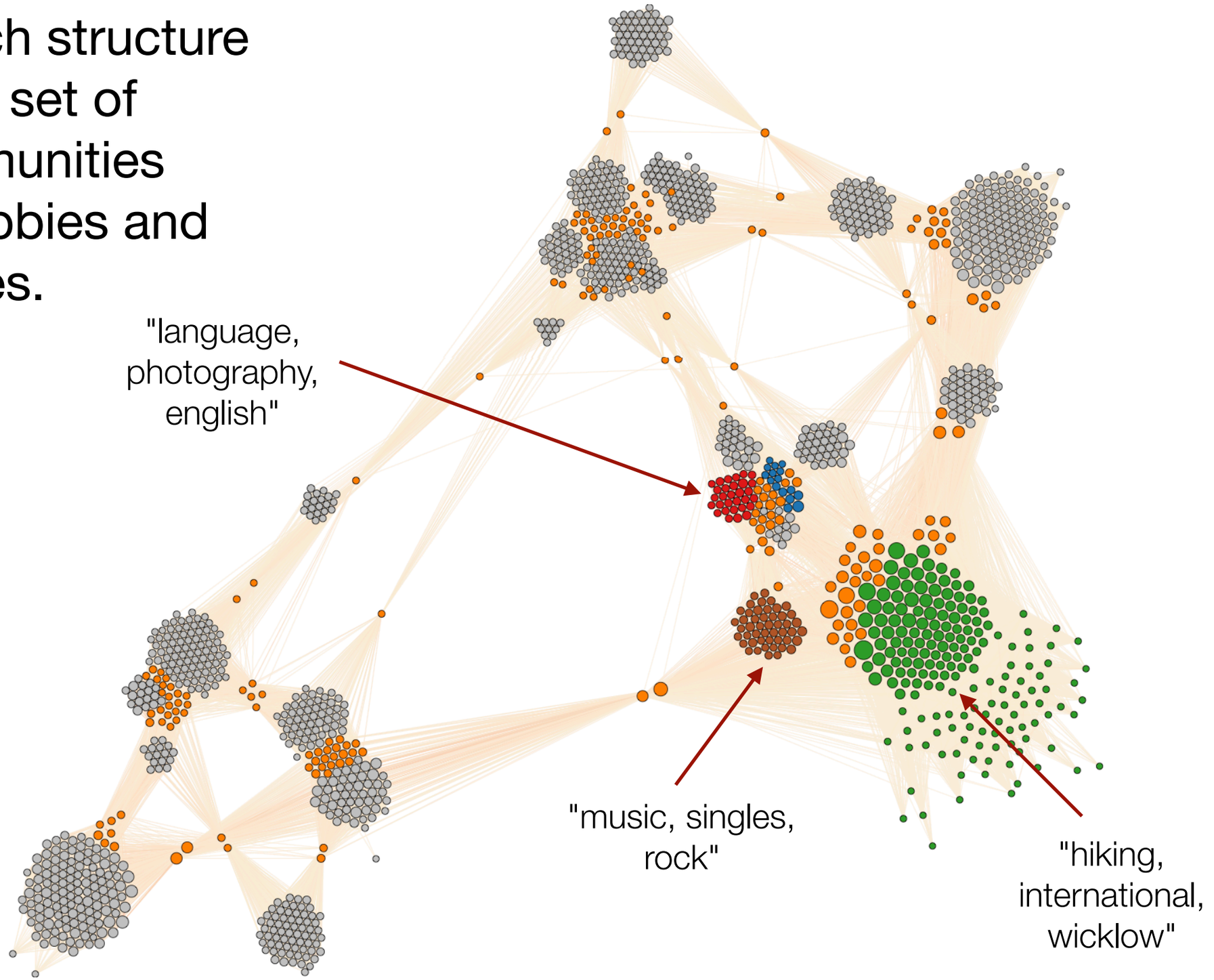
Non-Tech Meetup Communities

- In the non-tech structure we see several overlapping communities broadly related to topics around mindfulness and well-being.



Non-Tech Meetup Communities

- In the non-tech structure we also see a set of meetup communities relating to hobbies and social activities.



Conclusions and Future Work

- We have demonstrated the use of network analysis and community finding to reveal the presence of thematically-coherent communities within Dublin's Meetup.com ecosphere.
- By applying text analysis procedures to descriptive meetup metadata, we can summarise the topics associated with each community.
- As future work we plan to develop a framework to support the exploration of the underlying Meetup.com communities for other geographic locations.
- Current analysis could be extended to incorporate additional layers of metadata into the network construction process (e.g. meetup attendance information).

Code and Data

https://github.com/phoxis/MeetupNetDublin

Interactive Visualisation

https://draig.ucd.ie/MeetupNetDublinInteractive

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