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iJAC International Journal of Advanced Corporate Learning

iJAC | eISSN: 1867-5565 | Vol. 19 No. 2 (2026) | OPEN ACCESS

https://doi.org/10.3991/ijac.v19i2.58861

TLIC PAPER

Using Artificial Intelligence and Social Network Analysis for Building Diverse and Balanced Corporate Teams

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ABSTRACT

Diverse and inclusive teams are increasingly recognized as critical drivers of innovation, productivity, and organizational resilience in corporate environments. However, forming balanced and effective teams remains a persistent challenge for human resource managers and project leaders. Traditional approaches—such as self-selection, managerial assignment, or random allocation—often fail to adequately account for the complex interplay of employees' skills, social ties, and organizational goals. To address this gap, we present a novel, AI-driven system that automates the formation of heterogeneous corporate teams by integrating genetic algorithms with social network analysis. The system enables managers to define project requirements, specify required skills, collect employees' self-assessments, and visualize workplace social networks through an intuitive interface. The hybrid algorithm optimizes three critical objectives simultaneously: maximizing skill diversity, enhancing workplace cohesion through social ties, and maintaining balanced team sizes. Using simulated organizational networks of varying scales, we demonstrate the system's reliability, robustness, and adaptability in producing inclusive and balanced teams. This approach has strong potential to reduce biases in team formation and empower organizations to align workforce composition with strategic objectives.

KEYWORDS

workforce diversity, team formation, corporate collaboration, genetic algorithms, social network analysis, artificial intelligence

1 INTRODUCTION

1.1 Background

Forming effective and balanced teams is a critical factor in driving innovation, productivity, and resilience in today's corporate environments. Organizations are increasingly relying on collaborative, cross-functional teams to deliver complex

Abdelhamid, S., Aly, M. (2026). Using Artificial Intelligence and Social Network Analysis for Building Diverse and Balanced Corporate Teams. *International Journal of Advanced Corporate Learning (iJAC)*, 19(2), pp. 22–33. https://doi.org/10.3991/ijac.v19i2.58861

This article is an expanded version of a paper presented at The Learning Ideas Conference, held in New York, NY, USA, June 11–13, 2025. Article submitted 2025-11-19. Revision uploaded 2026-03-19. Final acceptance 2026-03-23.

projects, respond to market shifts, and develop innovative solutions. Research consistently shows that diverse teams—consisting of individuals with varied skills, backgrounds, and perspectives—tend to outperform homogeneous groups in problem-solving, decision-making, and innovation. At the same time, ensuring team cohesion and balanced workloads is equally important for sustaining engagement and preventing interpersonal conflicts. Despite these benefits, constructing teams that achieve an optimal balance of skill diversity, workplace cohesion, and size distribution remains a persistent challenge for human resource managers and project leaders. Traditional approaches to team assignment are often limited in their effectiveness. These methods may unintentionally reinforce biases, silo employees with similar experiences, or overlook valuable connections across organizational networks. The problem becomes even more complex in large corporations or distributed organizations, where the number of potential team configurations grows exponentially, and decision-makers may lack clear visibility into employee skills and relationships.

1.2 Research motivation

The challenge of forming diverse and balanced teams in corporate contexts involves addressing multiple objectives simultaneously. Managers must ensure that teams bring together complementary skills, while also preserving social ties and employee satisfaction. For example, innovation projects may require combining employees from engineering, marketing, and operations, while still respecting existing collaboration patterns that reduce friction.

Bias in traditional team formation methods poses a further challenge. Manual assignments can unintentionally privilege familiar employees or reinforce organizational hierarchies, undermining fairness and innovation. Employee self-selection often leads to comfort-based groupings, which can limit diversity and hinder the emergence of new ideas. Random assignment to teams neglects skill alignment and workplace cohesion. These shortcomings highlight the need for a scalable, data-driven solution that can systematically optimize team composition in corporate environments.

1.3 Contributions

To address these challenges, we propose a novel system that leverages artificial intelligence to automate the formation of diverse teams in organizations. Our approach integrates genetic algorithms with social network analysis to generate team structures that maximize skill diversity, enhance workplace cohesion, and ensure balanced group sizes. Unlike traditional methods, our system provides managers with a scalable and transparent platform for aligning workforce composition with project requirements and diversity goals. Through simulation-based validation, we demonstrate the robustness of this approach and its applicability across a range of corporate scenarios, from small departments to large, multinational enterprises.

2 RELATED LITERATURE

Diversity in corporate teams has been associated with numerous benefits, chiefly enhanced creativity and innovation. Vedres and Vásárhelyi emphasize that an inclusive work environment—where team members feel both diverse and

valued—can unlock significant creative potential [1]. Their findings corroborate the assertion that inclusion should not focus solely on demographic differences but must also include practices that integrate diverse individuals into cohesive units. The integration of diverse perspectives within teams leads to richer brainstorming sessions and a broader array of solutions to complex [1][2][3]. Trust, as a core element of team dynamics, also plays a pivotal role in effective knowledge sharing within diverse teams. García-Sánchez et al. demonstrate that teams characterized by strong social ties generate higher levels of trust, which, in turn, facilitates knowledge sharing and collaboration [4]. The significance of social networks within corporate teams is further evidenced by the findings of Sahoo et al., who argue that strong embeddedness within teams can reduce turnover intentions and bolster overall performance, especially when members have genuine interpersonal connections beyond mere work collaboration [5]. Furthermore, Bernstein and Turban emphasize that contemporary workplaces are increasingly designed to promote collaboration through open spaces, which facilitate social interactions [6]. Such environments, enhanced by digital tools, encourage ongoing dialogue and the exchange of ideas, thereby reinforcing social ties within teams. Digital platforms also offer unique ways for leaders to foster team cohesion among diverse team members. Research by Reddy et al. highlights the significance of social ties not only in supporting day-to-day operations but also in enhancing job performance and promoting sustainable practices within organizations [7]. Moreover, organizations should be mindful of the recruitment and team-building processes that foster diversity while ensuring that team members display complementary competencies. Additionally, social network analysis (SNA) has emerged as a potent tool for understanding and optimizing team dynamics [8]. Through SNA, organizations can visualize how social ties influence teamwork and identify areas for improvement in interpersonal connections. Valente et al. present compelling evidence on the utility of SNA in uncovering patterns that enhance program implementation [9]. Nevertheless, organizations must also navigate the potential for negative perceptions and cliques that can arise in diverse teams. Vahtera et al. unpack how differing social identities can lead to fragmentation within teams, particularly in global settings [10].

The literature emphasizes the importance of promoting diverse teams, cultivating trust, and actively managing team dynamics through the effective use of technology and leadership. Organizations that embrace these principles not only benefit from the rich tapestry of perspectives available through diversity but also effectively harness these strengths into actionable business value.

3 SYSTEM ARCHITECTURE

The proposed system is designed as a scalable, user-friendly platform that helps organizations assemble diverse and balanced teams. It integrates employee data, project requirements, and workplace relationships into an intelligent decision-support framework. The architecture consists of four key components: the Manager Interface, the Employee Interface, the Backend System, and the Output & Visualization Module.

3.1 Manager interface

Human resource managers or project leaders interact with the system through an intuitive dashboard. Using this interface, managers can create new projects by

specifying the project title, description, and required skills (see Figure 1). They can also define the desired number of teams and review collected employee inputs, including self-assessments of skills and collaboration preferences as shown in Figure 2. Additionally, the interface provides network visualizations of workplace relationships, enabling managers to better understand inter-employee connections and potential collaboration dynamics before finalizing teams. This transparency enables informed decision-making that aligns with organizational and DEI objectives.

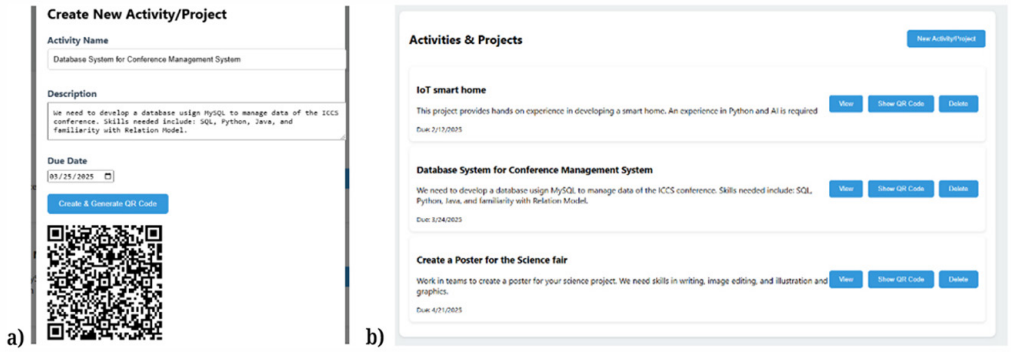

Fig. 1. (a) Managers can create activities by providing an activity title and description and generating and sharing the link for the activity with staff. (b) The activity dashboard allows managers to view and manage their activities

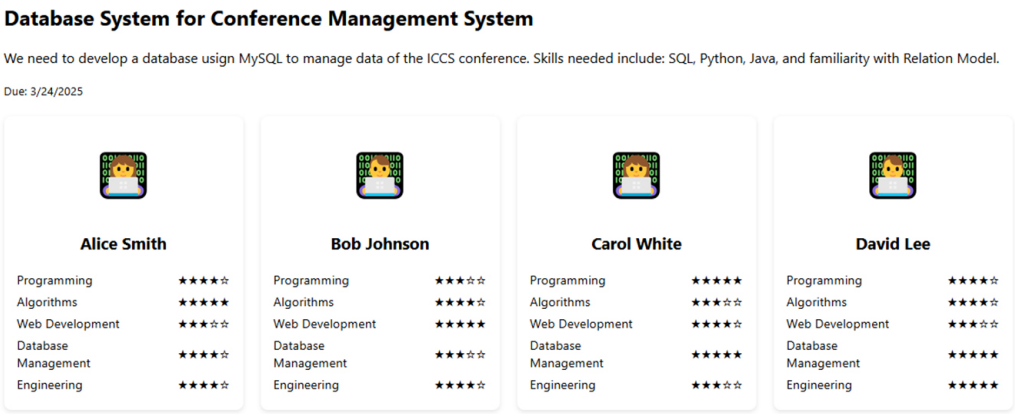

Fig. 2. Managers review employees' responses, including self-ratings of skills and peer preferences

3.2 Backend system

The backend system processes employee data and constructs a weighted organizational network. In this graph, nodes represent employees, and edges represent workplace connections weighted by the strength of collaboration or preference. This network serves as the foundation for the hybrid team formation algorithm. The backend integrates two complementary approaches: a) Community Detection, a modularity-based method that identifies clusters of employees with strong existing connections, forming an initial grouping that reflects workplace cohesion, and b) Genetic Optimization: A genetic algorithm refines these initial groupings by optimizing three objectives simultaneously: Skill Diversity – measured as the entropy of aggregated skills within each team, Workplace Cohesion – based on the average strength of collaboration ties within a team, and Team Size

Balance – ensuring equitable distribution of employees across teams to prevent bottlenecks or resource imbalances.

3.3 Output and visualization

The system outputs optimized team assignments along with performance indicators for each objective (e.g., skill diversity index, cohesion score, and size distribution). These results are presented through interactive visualizations of the organizational network (see Figure 3), allowing managers to explore how teams were formed and evaluate trade-offs between diversity and cohesion. The output includes metrics such as skill diversity, social closeness, and group size, offering insights into how teams were formed, as shown in Figure 4. Final team assignments can be exported for integration with HR systems or project management platforms.

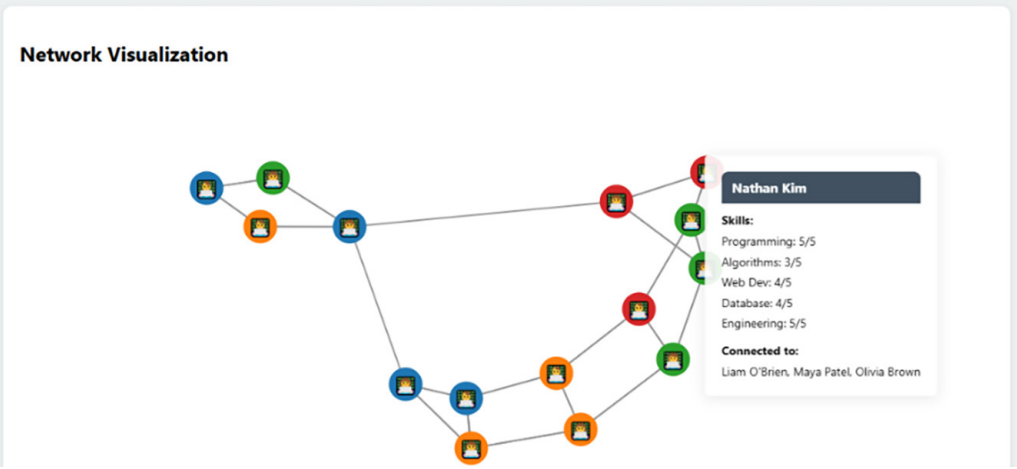

Fig. 3. Employees' social network visualization. Managers can view each member's profile

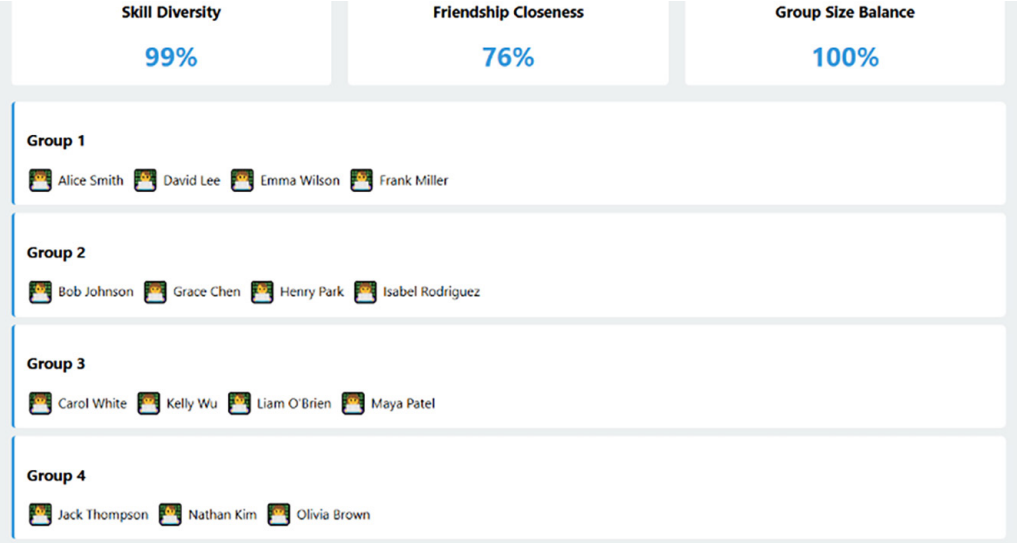

Fig. 4. Generated teams with indicators of skill diversity, social closeness, and size balance

3.4 Employee interface

Employees interact with the system through a simple and accessible platform, see Figure 5. Upon receiving a project link or access code, employees self-assess their skill levels using a Likert-scale format (e.g., 1–5) across dimensions relevant to the project. They may also indicate colleagues with whom they prefer to collaborate, reflecting trust, past successful collaborations, or mentorship relationships. By capturing both skills and social ties, the system ensures that employees' voices and preferences are integrated into the team formation process, promoting fairness and satisfaction.

4 DATA COLLECTION

To evaluate the proposed system, synthetic datasets were generated to simulate diverse organizational scenarios. These datasets replicate real-world workplaces by modeling employee skills, collaboration patterns, and preferences. The synthetic approach allows us to test the system's scalability and robustness under different organizational sizes and structures. Each node in the dataset represents an employee and is assigned a multi-dimensional skill vector. These vectors capture proficiency across a range of competencies or skills relevant to organizational projects. For evaluation purposes, skills were randomly generated on a scale between 0 and 1.

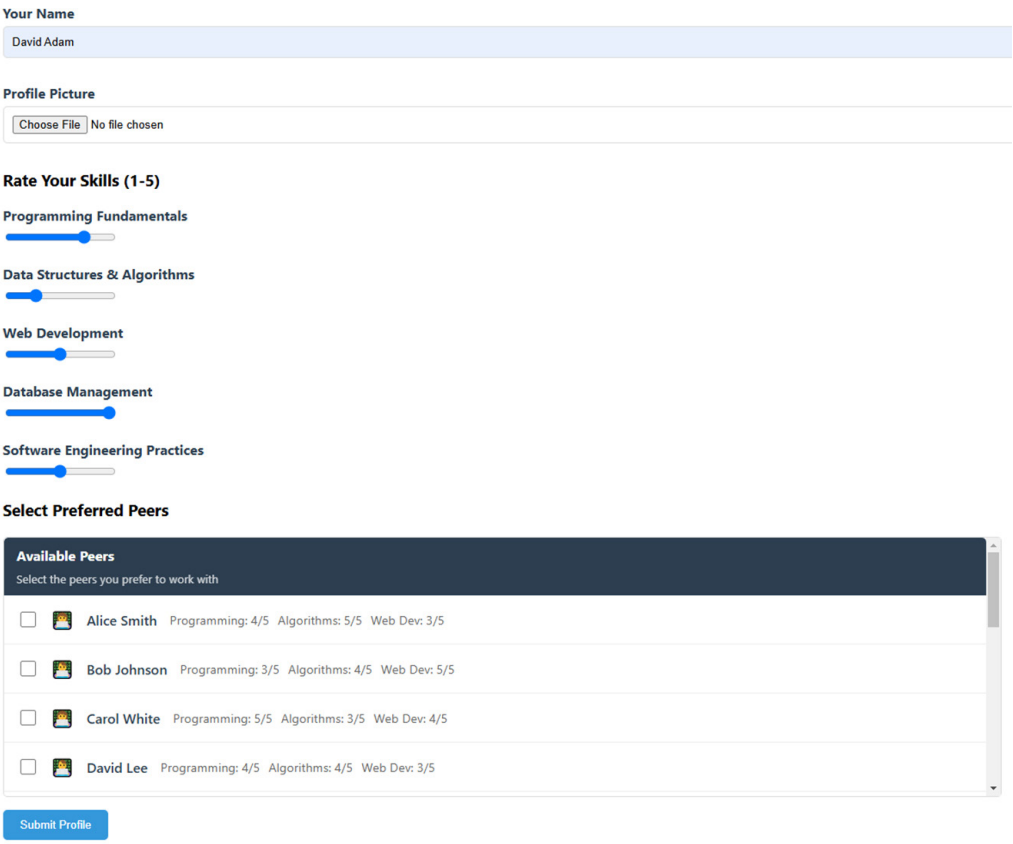

Fig. 5. Employees respond to the managers' "activity create requests," rate themselves on the relevant skills, and select peers to work with

Connections between employees are modeled as edges in a weighted graph. Each edge weight reflects the strength of a workplace relationship, such as

prior collaboration, mentorship ties, or peer endorsements. Weights range between 0 and 1, where higher values indicate closer or more effective collaboration. By incorporating these ties, the system accounts for the importance of workplace cohesion and social capital in forming effective teams. Employees may also specify colleagues with whom they prefer to collaborate. These preferences are mapped to network edges and influence the optimization process, ensuring that employee voice and trust relationships are integrated into team assembly. By balancing preferences with organizational needs, the system fosters inclusivity while avoiding insular or clique-based groupings.

5 HYBRID ALGORITHM DESIGN

The hybrid algorithm for corporate team formation integrates community detection and genetic optimization to address the multi-objective nature of assembling diverse and balanced teams in organizations, see Figure 6. The approach ensures that project teams are not only heterogeneous in skills but also socially cohesive and equitably sized, aligning with both performance and diversity, equity, and inclusion (DEI) objectives.

5.1 Phase 1: Community detection

The first step applies a modularity-based community detection method (Louvain algorithm) to identify clusters of employees with strong existing workplace connections. These clusters serve as the initial team configurations. By respecting pre-existing collaboration ties, the algorithm reduces the likelihood of interpersonal conflict and leverages social capital within the organization. This step provides a structured starting point for the optimization process, ensuring that the genetic algorithm operates on socially meaningful groupings.

5.2 Phase 2: Genetic optimization

Building on the community detection results, the genetic algorithm refines team compositions to optimize three critical objectives simultaneously: a) Skill Diversity – Measured using the entropy of aggregated skill vectors within each team. A higher entropy value indicates broader skill coverage, which is particularly valuable for cross-functional corporate projects requiring complementary expertise. b) Workplace Cohesion – Assessed by averaging the weights of intra-team edges, which reflect collaboration history or employee preferences. Teams with stronger social ties are expected to communicate more effectively, reducing project risks associated with misalignment or conflict, and c) Balanced Team Sizes – A penalty function is applied to teams that deviate from the target size. This ensures workload equity across the organization and prevents inefficiencies caused by under- or over-staffed teams.

Each chromosome encodes a potential team assignment, with employees mapped to team identifiers. The genetic algorithm evaluates each chromosome using a composite fitness function that combines the three objectives into a single score.

The algorithm employs three genetic operators to enhance the population of solutions. Tournament selection, which favors high-performing chromosomes for reproduction. Crossover: A two-point crossover mechanism exchanges team assignments between parent chromosomes, generating new candidate solutions.

Mutation: Uniform mutation introduces diversity by reassigning employees to different teams, helping the algorithm escape local optima. Through repeated iterations of selection, crossover, and mutation, the algorithm converges toward an optimal or near-optimal team configuration. The process balances exploration (searching broadly across possible solutions) and exploitation (refining promising solutions), producing team assignments that satisfy diversity, cohesion, and size balance criteria.

6 RESULTS AND FINDINGS

The algorithm was evaluated across three key metrics: group size balance, social or friendship closeness, and skill diversity. The findings are discussed for synthetic networks of varying sizes (20, 50, and 100 nodes) and multiple instances to assess the algorithm's robustness, scalability, and effectiveness.

```
Input: G = (V, E): Social network graph
       S: Skill vectors for each employee
       k: Desired number of groups

Output: G_k = {G_1, G_2, ..., G_k}: Partitioned employee groups

Initialisation:
    Perform community detection on G to obtain initial group assignments G_k^(0)
    Encode initial assignments as chromosome c^(0)

Process:
1: Initialise population P with chromosome c^(0) and random chromosomes
2: for t = 1 to T (max generations) do
3:     Evaluate fitness F(c) for all chromosomes in P
4:     Select parent chromosomes using tournament selection
5:     Perform crossover to generate offspring
6:     Apply mutation to offspring with probability p_mut
7:     Replace least-fit individuals in P with offspring
8: end for

Final Step:
9: Return best chromosome c* representing the optimized groups G_k
```

Fig. 6. The hybrid algorithm for team formation

6.1 Skill diversity

Skill diversity, measured using entropy, evaluates the heterogeneity of skills within each team. The results demonstrate the effectiveness of the proposed algorithm in maintaining consistently high levels of skill diversity across groups and instances. Figure 7 illustrates the skill diversity across clusters for different network sizes (20, 50, and 100 nodes) and multiple instances (1 through 5). For all network sizes and instances, the skill diversity values are uniform within each group across the same instance.

This indicates that the algorithm successfully optimizes group compositions to achieve balanced skill diversity, ensuring that no group is overly homogeneous or excessively diverse. In larger networks (e.g., size 100), where the pool of skills is more diverse, the algorithm maintains balance, reflecting its robustness in handling increased complexity.

6.2 Friendship and social closeness

The presented graph in Figure 8 illustrates the distribution of friendship closeness across clusters for different network sizes (20, 50, and 100 nodes) and multiple instances (1 through 5). Closeness, measured as the average edge weight within each group, reflects the social ties among team members. The results highlight how the proposed algorithm balances this metric across varying network conditions. For smaller networks, such as those with 20 nodes, closeness varies noticeably between groups within the same instance. This variability suggests that achieving uniformity in social ties is more challenging in smaller networks, likely due to the limited number of nodes and edges.

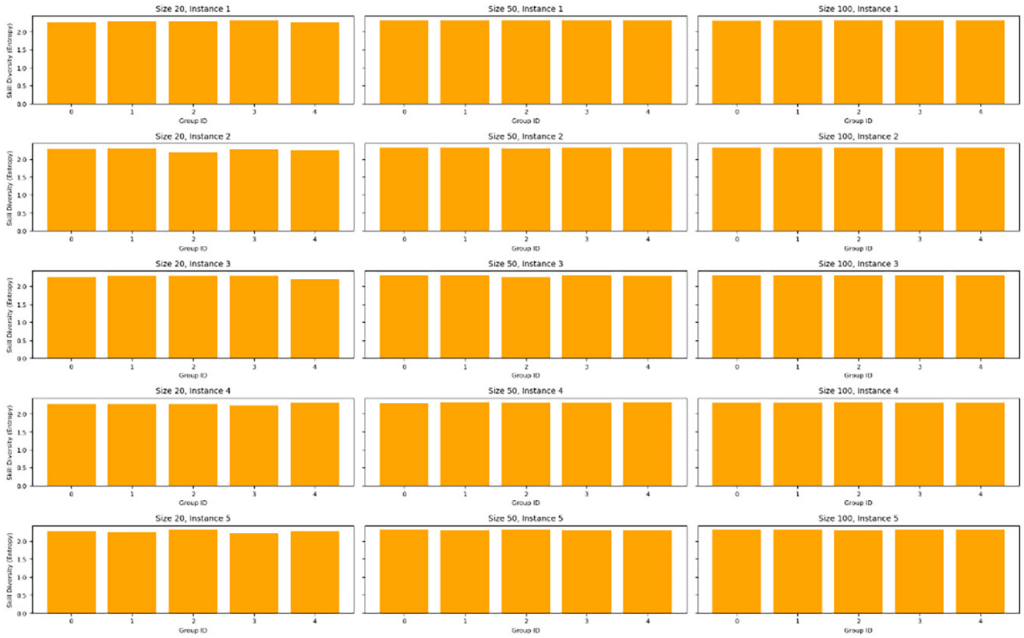

Fig. 7. Skill diversity across teams in various employee networks

Certain groups exhibit significantly higher friendship closeness than others, indicating that strong social ties are concentrated within specific clusters. For larger networks, particularly those with 100 nodes, the algorithm produces more uniform friendship closeness across groups. This uniformity reflects the algorithm's capability to distribute social ties more evenly when a larger pool of nodes and connections is available. The improved balance for larger networks demonstrates the algorithm's scalability, making it particularly suited for large-scale educational contexts such as MOOCs.

The trend toward uniformity in larger networks suggests that the algorithm benefits from greater network density and diversity of connections. This is particularly advantageous in fostering equitable collaboration opportunities, as employees in larger networks are less likely to experience disparities in social support within their teams.

6.3 Group size balance

The results presented in Figure 9 highlight the effectiveness of the proposed algorithm in achieving balanced group sizes across various networks. The algorithm demonstrates near-perfect group size distribution for networks of different sizes (20, 50, and 100 nodes) across multiple instances. The algorithm's scalability is evident from its consistent performance across networks of varying sizes.

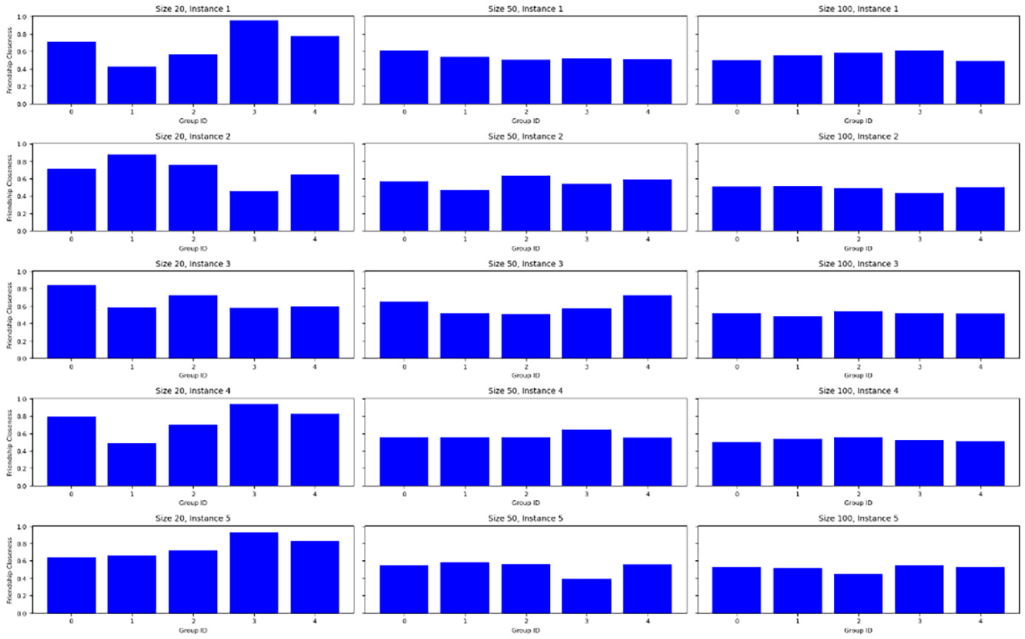

Fig. 8. Friendship closeness across teams for different student networks

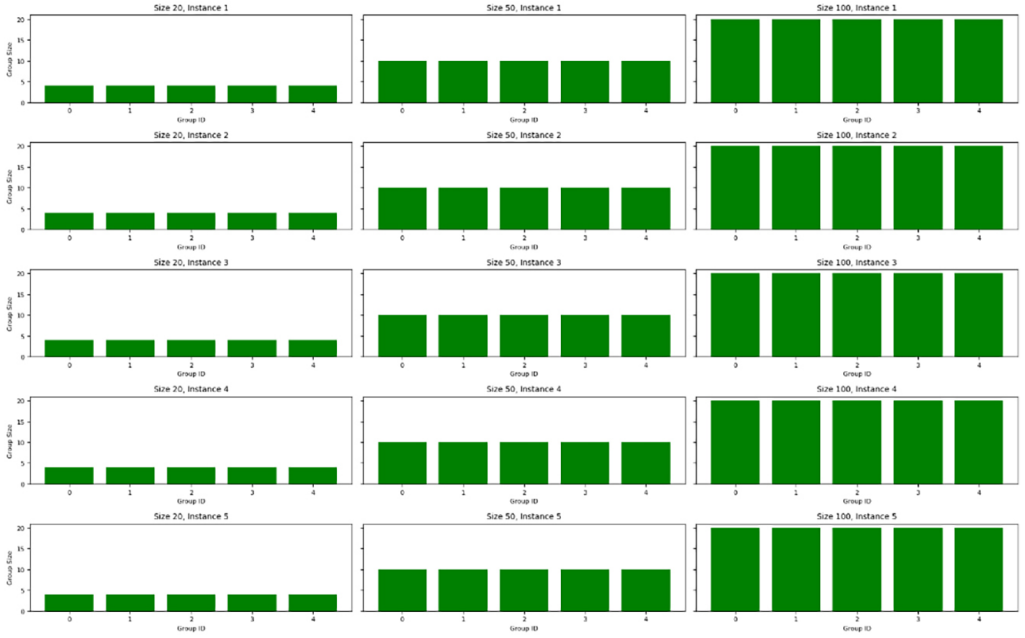

Fig. 9. Team sizes are nearly identical in different student networks

7 CONCLUSION AND FUTURE WORK

This paper introduced a hybrid system for forming diverse and balanced corporate teams using social network analysis and genetic optimization. By optimizing skill diversity, workplace cohesion, and team size balance, the system provides a scalable, data-driven alternative to traditional team formation methods. Simulated organizational networks demonstrated the system's robustness across various network sizes, including small, medium, and large. Future work will validate the system with real corporate data, integrate behavioral and personality attributes, and explore adaptive team reconfiguration as projects evolve. Expanding to enterprise HR platforms and addressing global, cross-cultural teams will further increase its relevance. These extensions position the system as a practical tool for building inclusive, high-performing teams in modern organizations.

8 ACKNOWLEDGMENTS

This work was supported in part by the Commonwealth Cyber Initiative, an investment in the advancement of cyber R&D, innovation, and workforce development. For more information about CCI, visit https://cyberinitiative.org/.

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