



Optimization adjustment of human resources based on dynamic heterogeneous network

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HIGHLIGHTS

- The adjustment of human resource is abstracted as a dynamic heterogeneous network.
- The heterogeneous network includes personal network, job network and matching network.
- Monte Carlo method is used to simulate the change of intimacy and loyalty.
- The optimization process contains transformation, churn simulation and assignment.

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ABSTRACT

The human resources network, involves enterprise social networks and job networks, can be abstracted as heterogeneous networks or multi-layers networks. Adjusting the position assignments to maximize employee productivity and minimize the company's cost is the goal of organization optimization. Taking the churn and interaction among the staff into account, this paper puts forward a dynamic optimization model for human resource adjustment, which is based on heterogeneous network, to describe the influence among individuals who are in personal relationship or professional relationship. More specifically, intimacy and loyalty are constructed to form the basis of churn rate, which indicate the influence of the personal and professional relationship respectively. With the operation of the organization, the change of intimacy and loyalty leads to the churn process, which are simulated with Monte Carlo method in a dynamic process among the heterogeneous network. After churning, an optimal strategy of recruitment and position adjustment is obtained using the Genetic Algorithm. In general, the human resource optimization process consists three periodic parts: loyalty and intimacy transformation, staff churn simulation and position assignment. Finally, a case study of an organization with 370 employee positions is carried out to demonstrate the whole process.

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1. Introduction

In recent years, human resource management plays a crucial role in every company's operation. It can not only increase the employees work efficiency and job satisfaction, but also decrease the management cost. As a result, companies from all over the world have been urged to adopt a variety of performance-enhancing or progressive human resource (HR) management practices to improve their competitiveness in the global market [1,2].

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In order to pursue a higher salary and satisfy their career development, many people will leave for other jobs and the resulting turbulence is collectively termed organizational “churn”. Managing the fluid network of human resource within an organization and understanding organizational churn plays a crucial role in business [3]. J Welch said that the lack of emotional bond between employees and their boss is the main reason for resignation [4]. G Gregory found that the simplest reason of an employee’s resignation is that the company failed to keep him [5]. More specifically, employees leave because of low salary and conflict with coworkers. R Martin concluded the reasons, including the lack of enthusiasm for their work and opportunities for development within the company [6]. To sum up, the reason for their resignation can be attributed to their own reasons and the influence of others.

With the rapid development of social networks, the relationships among employees become closer and some employees leave the company just following their friends. In other words, the dynamic and instability of the employment are growing, which brings trouble to the normal operation of the enterprise. Therefore, in order to ensure the normal operation of the company, recruitment of staff and the training for new employees (including the newly recruited staff and the old staff adjusted to a new position) significantly increase the operation cost of the company. Management, an important content in an enterprise, can be used to decrease the operation cost and increase the company’s earnings [7]. So, the aim of the article is to obtain the optimal recruitment and adjustment scheme of the human resource management with minimal cost in the company’s reasonable operation.

Human resource management is a complex process that involves many subjective and unpredictable, non-quantifiable factors. Assuming that each employee has an initial loyalty to the company, and there is a certain emotional basis among colleagues. With the leaving of staff, how to recruit new employees and how to adjust the positions of old staff can minimize the cost and also ensure the normal operation of the company is the content of our research. Generally, our research topic is the employee-position adjustment problem. The employee-position adjustment problem is a complex management problem that is concerned with recruiting new employees and adjusting the original employees positions based on using minimal cost. In any company, with the increasing competition of superior talents, many experienced employees churn and the original organizational structure is interrupted. Thus, a large amount of money will be used in recruiting new persons and training new or old employees to fit their new positions. In addition, the churn of employees brings loss in productivity, which is transferred to indirect cost and considered in the optimizing process.

In this work, we first abstract employees and the relationship among them to construct a personal network and then establish a professional network using the organizational structure. When introducing the bipartite network of employees and positions, we put forward an integrated network based on the heterogeneous networks to illustrate the inner and interactive information of employees. The main contribution of this work is considering the changes of employees’ loyalty to a company and using a simulation method to display the whole process as time goes by. Furthermore, a GA is used to solve the optimization of employee-position adjustment problem. Finally, through optimizing the adjustment of the employees and positions, the loyalty of all employees will update and drive the staff churn simulation. Obviously, the adjustment of human resource is a dynamic cyclical process and once given a terminal time, an optimal adjustment scheme will be obtained.

The structure of this paper is organized as follows. Section 2 describes the human resource network model, which is the premise for churn and recruitment simulation. Section 3 elaborates the churn simulation in the human resource process and proposes a genetic algorithm to optimize the assignment of human resource. Section 4 provides a case to illustrate the application of our model. Conclusions are drawn in Section 5.

2. Human resource dynamic optimal model based on heterogeneous network

The system of human resource contains many factors, such as people, position, the matching between people and position, the relationship among people, the relationship among position, factors influencing their relationship and so on. Traditional, the network model was used to describe the human resource system because it takes the interaction of individuals into account. However, the homogeneous network model cannot distinguish the different characteristic of nodes and edges. For example, employees and job positions are two kinds of nodes in the network but they are treated as the same kind of node. Hence, to better illustrate the human resource system, the heterogeneous network [8], which contains more than two kinds of nodes and edges, are introduced. The definition of heterogeneous network is given in Definition 1.

Definition 1 (Heterogeneous Network). A heterogeneous network can be represented as $G = (V, E)$, where V denotes the set of nodes and E represents the set of links between the nodes in V . A node type mapping function is defined as $\phi : V \rightarrow V_{type}$ and a link type mapping function is defined as $\phi : E \rightarrow E_{type}$. If a network contains more than one node types $|V_{type}| > 1$ or link $|E_{type}| > 1$, this kind of network is called a heterogeneous network.

By analyzing the elements in human resource system, the heterogeneous network is made up of three sub networks: the personal network, the profession network and the bipartite network.

2.1. The personal network among employees

In the human resource system, the relationship between people can be friendship, leadership or others. In the personal network, we just consider the friendship among people, or private friendship, which does not relate to the business. Therefore, there is only one kind of nodes and edges, which is employee and the friend relationship in the personal network.

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