Technical Appendix

Submitted for Blind Review

Guild Health Dimensions

Table 1 shows the corresponding table of guild health dimensions and specific indicators.

Table 1: Guild health dimensions.

Dimension	Indicators
Communication	Average number of guild chat messages
Ability	Average total scores of guild members
Resource	Average amount of guild funds
Activity	Average number of guild members online
Leadership	Average total score of guild leaders

Algorithm

Algorithm 1 shows the technical details of our experiment. Using 7-day historical data to predict future guild health is mainly due to the following reasons. According to previous statistics, this length is in line with most users' game or activity rules. In the real game scene, many indicators are week-based, such as the guild ranking, guild activities and membership. One week is an update cycle. Therefore, we use the historical data of seven days to predict the future health status, which is of great value to the reality. Besides, our model is versatile and can be used for shorter or longer term prediction based on specific scenarios, with data permitting.

Algorithm 1: The Algorithm of SAMLA

Input: Players attributes U; guild features X; relationships among Players G^r;
Output: Parameters Θ_r in graph learning module, Θ_a in attribute update module

Random initialize model parameters Θ
$t = 1$, $days = 7$
while not converged **do**
  Sample a batch of training data
  for $t = 1$ to $days$ **do**
    Calculate the guild's portrait $e^{W}_{p_{i,t}}$
    for $r \in \{trade, friend, team, chat\}$ **do**
      Calculate the guild's relation representation $e^{r}_{p_{i,t}}$
    end for
    Calculate the guild's representation $e_{p_{i,t}}$ at t
  end for
  Get the unified representation of the guild $e^{H}_{p_i}$ within days
  Get embeddings of five dimensions $e^{dim}_{p_i}$ and predict $\hat{y}_{i,dim}$
  Get embeddings of guild's stability $e^{stability}_{p_i}$ and predict $\hat{y}_{i,stability}$
  Update the parameters
end while
return Parameters Θ

Details of Dataset.

Table 2 shows the details of our data set. We promise to publish sample dataset after acceptance to ensure the usability of the algorithm.

Parameter Settings

Our SAMLA model is implemented in Pytorch, and all embeddings' size are fixed to 64, except for the necessary concatenation part. For all latent embedding based models, we initialize the embedding matrix with the mean value of 0 and the standard variance of 0.01. For these gradient descent-based methods, we use the Adam with the initial learning rate of 0.00001 to optimize the model. In our proposed SAMLA model, we set the size of the training batch to 32 and the loss functions are as mentioned in Section 3.6. In hyper-parameter settings, similar to many graph-based frameworks (Wu et al. 2020) and sequential model (Vaswani et al. 2017), we use hyper-parameter search to set the number of GCN Layers L in $\{1, 2, 3, 4\}$ and Encoder Layers E in $\{1, 2, 3, 4\}$. We would analyze their impact in the experiments. The time window size is 1 week, i.e., we use the guild characteristics of one week to predict the average health of the guild in the next week. In addition, we randomly select 80% of the data as the training set and 20% of the data as the test set.

References

Vaswani, A.; Shazeer, N.; Parmar, N.; Uszkoreit, J.; Jones, L.; Gomez, A. N.; Kaiser, L.; and Polosukhin, I. 2017. Attention is all you need. *arXiv preprint arXiv:1706.03762*.

Wu, L.; Yang, Y.; Zhang, K.; Hong, R.; Fu, Y.; and Wang, M. 2020. Joint item recommendation and attribute infer-

Table 2: Detailed Log Information of A Guild

Object	Field	Description	DataType
Player	id	player's id	hash code
	guild_id	player's guild	hash code
	class	player's role	category
	grade	player's level	category
	score	player's 8 attribute values	List-float
	gender	player's gender	category
	vip	whether a vip	category
Guild	guild_id	guild id	hash code
	type	guild type	category
	level	guild's level	category
	leader	leader id	hash code
	scale	guild's number of members	category
	chat	guild's number of messages	int
	resor	guild's funds amount	int
	online	online number of members	int
	building	guild's building name/level	dict
	join	number of join	int
	leave	number of leave	int
Relation	start	start node's id (player)	hash code
	ends	end node's id (player)	hash code
	type	types of relationships	category
	weight	frequency of relationships	float
Other	ts	logging time	timestamp
	date	logging date	timestamp

ence: An adaptive graph convolutional network approach. In *Proceedings of the 43rd International ACM SIGIR Conference on Research and Development in Information Retrieval*, 679–688.