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Optimization Research on Single Task Pricing Scheme of Subcontracting Market Research under the Background of Mobile Internet

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Abstract: Taking pictures and making money is a self-service model of market research under the mobile internet. Users download APPs, register as APP members, and then take pictures from APPs for tasks (such as going to supermarkets to check the availability of certain items) to earn the fees set by APPs. This is a self-service crowdsourcing platform based on mobile Internet. Compared with the traditional market survey method, it can greatly save the investigation cost and effectively ensure the authenticity of survey data to shorten the survey cycle. Therefore, APP becomes the core of the platform operation, and the task pricing is its core element. If the price is unreasonable, some tasks will be ignored, which will lead to the failure of commodity inspection. In this paper, regression analysis, cluster analysis and cross analysis are used to analyze the relationships among pricing, membership density, task density, completion and membership credibility to effectively optimize the pricing model of photography problem.

1. Problem Analysis and Basic Idea

1.1 Problem Analysis.

In recent years, with the development of new technology and the popularity of intelligent terminals, crowdsourcing has become an efficient and inexpensive method of information collection. "taking pictures and making money" is also one of the crowdsourcing problems.

In this problem, if we want to finish the task well, reasonable pricing is the key. In the analysis of the data given, it is found that the low-priced (below 70 Yuan) tasks are distributed in the areas with high degree of member-intensive, with the lowest completion rate of 54.12%; the medium-priced (between 70 Yuan and 80 Yuan) tasks are distributed evenly, the distance between points is slightly larger, and the degree of completion is 74.73%; high-priced tasks (more than 80 Yuan) cluster in some specific locations and the distribution law is fuzzy. As the price is relatively high, the completion degree is also relatively high, reaching 82.5%.

It can be seen that price is an important factor in the degree of task completion. Price decision is a systematic process, which needs to take into account not only the geographical factors such as the location of the task, traffic, distance, but also the number of members of the scheduled task at the task point. It also needs to consider the psychological expectations of the price of the task represented by the creditworthiness values associated with the members.

1.2 Optimization Idea of Pricing Model.

Before analyzing the pricing problem of crowdsourcing problem, considering the factors that affect pricing are the density of membership distribution and task distribution, the calculation of density is the key. Then, using Stata software to do regression analysis, we can get the pricing law. Furthermore, Stata software was used to analyze the effects of price, population density and task density on task performance by regression analysis, cluster analysis and cross analysis, and to analyze the reasons why the task was not completed.

Whether the task is completed can be used as an indicator to check whether the pricing is reasonable. When the task is completed, it proves that the task is priced reasonably. Starting from the completed tasks, taking the density of members, the density of tasks and the psychological

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expectation of members to the price as explanatory variables, a new pricing model is obtained by multiple regression analysis with the price of completed tasks.

To reduce the heat of competition, it is a good way to reduce the price. After the task is packaged, the density decreases and the reduced density is substituted into the model to see if it can reduce the price.

At last, all data are analyzed and the corresponding data are classified and packaged. Using the model, the initial pricing is predicted, the pricing is dynamically optimized according to the actual completion degree, and finally the optimal state is achieved.

2. Model Hypothesis

1) Assuming that there are no extraordinary natural disasters or social events when members perform their tasks, the completion of the tasks is only affected by individual wishes.

2) Assuming that tasks which are at the same price are equally difficult and similar in content.

3) The members have no preference for content.

4) The distance between members to the task point is linear.

5) If the task is not completed, the reputation of the member will be impaired.

6) Assuming that members accept tasks, they will be completed.

3. Symbolic Agreement

P: price; m_1: Membership density (within 30 square kilometers); m_2: task density (within 10 square kilometers); a_i: the latitude of the ith point; bi: the longitude of the ith point; ℓ_{ai}: the latitudinal distance of the ith point; ℓ_{bi}: the longitude distance of the ith point; d: the linear distance between point and point; P^* : member's expected lowest price of the task; γ : reputation value; $r(e_i)$: preference error term; m_3: task density after packing.

4. Establishment and Solution of Model

4.1 Proposition of Basic Model.

In microeconomics, producer surplus equals the total profit of a product produced by a manufacturer plus the amount of compensation given to factor owners that exceed or fall below the minimum profit they require. When producer surplus exceeds zero, producers provide services. Similarly, members have a psychological minimum income requirement for a task. That is the lowest acceptable price P^*. When their producer surplus is greater than zero, they will accept the task.

$$P^* \le P$$

Members' minimum price for tasks is an important factor affecting whether members accept the tasks. To improve the completion rate of tasks, we should consider the members' psychological expected price for tasks when pricing.

Furthermore, for members with high credibility, the quota of tasks is high, and the chance of choosing high-priced tasks is great.

Therefore, in task selection, members with high credibility will have a greater chance of choosing tasks with high marginal utility and high price. Accordingly, members with high credibility will have a higher psychological expectation price for tasks.

On the contrary, for members with low credibility, they do not have much initiative in choosing tasks, so the psychological expectation price of tasks is low. Because reputation value has a positive correlation with psychological expectation price, it can replace psychological expectation price with reputation value.

$$\gamma = kP^*$$

At the same time, whether the task is completed can be regarded as a reasonable criterion for the task pricing. Assuming that the task is priced reasonably, the task will be completed. Therefore, it is of great significance to establish the new model by analyzing the price information of the completed tasks. Based on the previous analysis, the pricing is related to the task density and the reputation value.

$$P = \rho\left(\beta_2 m_2 + \beta_3 \gamma\right) + \left(1-\rho\right) r\left(e\right)$$

When $m_1 \rangle 0$, we have $\rho = 1$; when $m_1 = 0$, we have $\rho = 0$.

In the previous hypothesis, each member does not have any special preference for the task content of the same value within a certain geographical range (30km), but in the process of analyzing the data, it is found that there is a situation in which the density of members within 30km is 0 but the task is still completed. This paper assumes that in this case, the task will be performed. Participants prefer the content of the task, and the psychological price is determined entirely by preference. Therefore, a new variable $r(e)$ representing preference error value is introduced. We consider that P^* is totally determined by $r(e)$ and can impact on P.

4.2 Data Processing.

Based on the previous statement, when the task is completed and the pricing proves reasonable, the pricing of each completed task in Annex I satisfies the following formula:

$$P_i^* \le P_i = \rho\left(\beta_2 m_{2i} + \beta_3 \gamma_i\right) + \left(1-\rho\right) r\left(e_i\right)$$

Therefore, it is necessary to analyze the membership density, task density and average reputation value of the completed tasks.

The next step is to get the average credit value of the members within a radius of 30 km.

Through statistical analysis and calculation, this group obtained the average reputation value of each type of membership density, and carried out multiple regression analysis. After multiple regression tests, the author found that the fitting degree was higher after $m_2^{\,2}$ inclusion. The results are shown as follows:

Table 1

.reg	Task pricing	Task density	Task density 2	Average credibility of members	robust		
Linear regression							
					Number of obs =		470
					F(3, 466) =		46.27
					Prob>F =		0.0000
					R-squared =		0.2033
					Root MSE =		4.238
Task pricing	Coef.	Robust Std.Err.	t	P>| t |	[95% Conf. Interval]		
Task density	-0.1556625	0.0247525	-6.29	0.000	-0.2043028	-0.1070222	
Task density 2	0.0007873	0.0002179	3.61	0.000	0.0003591	0.0012154	
Average credibility of members	0.0037184	0.001567	2.37	0.018	0.0006391	0.0067977	
_cons	73.5699	0.5161468	142.54	0.000	72.55564	74.58416	

Accordingly, the pricing model is:

$$P = \rho\left(-0.2556625m_2 + 0.0007873m_2{}^2 + 0.0037184\gamma + 73.5699\right) + \left(1-\rho\right)r\left(e\right)$$

When $m_1 \rangle 0$, we have $\rho = 1$; when $m_1 = 0$, we have $\rho = 0$.

5. Conclusion

In reality, people will scramble for tasks in areas with high mission density. In order to reduce people's enthusiasm for the task, we can reduce the price of the task, which can play a very good role.

When the average reputation value remains unchanged, P can be regarded as a quadratic function of m_2 as a dependent variable with parabola going upwards.

When the task density is too high and is on the right side of the density axis, it is necessary to reduce the density to reduce the price. The model can also deal with the problem that when the task density is too low. It needs to raise the price to achieve the goal of improving the task completion rate.

When the task density is high, the task is packaged, and several small tasks can be combined into a large task, so the task density becomes a smaller m_3.

The total income that members receive when they pack their tasks is:

$$P_n = \sum_{i=1}^{n} \rho\left(-0.2556625m_{2i} + 0.0007873m_{2i}{}^2 + 0.0037184\gamma_i + 73.5699\right) + \left(1-\rho\right)r\left(e\right)$$

He received less total income than he accepted these tasks alone. In this case, the model can play a good role in reducing the heat of people's choice.

The model is established based on the premise of $P^* \le P$. The above pricing scheme can not only guarantee the task to be done, but also can reduce prices and costs, and achieve more efficient task completion.

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