Warehouse Optimization

1 Project Background

1.1 Business Background

1.1.1 Background

In the actual business of self-operated small and medium-sized warehousing, the order set strategy and picking route strategy in the warehouse have not been iterated for a long time. The intelligent group order function (building order set and order set) in the WMS rule setting has a low utilization rate, and The adoption rate of the picking route algorithm is relatively low, which leads to the long walking path of the current warehouse pickers, low picking efficiency, and increased personnel costs; based on the current situation of logistics self-operated warehousing business, an intelligent order collection algorithm is carried out in the warehouse (Phase 1) optimization.

1.1.2 How to understand the order set type

Order types are divided into single item (only 1 item), single item (only 1 item, multiple items are allowed), Duo Fei (multiple items, the picking position does not cross the logical area), and multiple (the product position after positioning crosses Logical area).

(1) An order set is all single-piece orders, it is a single-piece order set

(2) An order set is a single-item and single-product order, and there is at least one single-product order, it is a single-product order set

(3) An order set is a single-piece order, a single-product order, a multi-non-order, and at least one multi-non-order is a multi-non order set

(4) If an order set contains multiple orders, it is a multiple order set

1.1.3 Identifying old and new single-group policies

How do I know if I started with an old WMS group single policy or a new WMS group single policy.

(1) wms5_batchOrder_pageOrder_flag is not configured, or the configured value is not equal to 1 or 2, that is, the old WMS group single policy is used previously.

(2) wms5_batchOrder_pageOrder_flag is configured, and the configured value is equal to 1, or equal to 2, that is, the new WMS group single policy is used previously.

1.1.4 Single-parameter group configuration

(1) Set single parameter - wms5-taskassign

wms5_batchOrderPageOrderModeOrderCount	Maximum order number of order set (single piece)	Configure at least one of the two
wms5_batchOrderPageOrderModeTotalGoodsQty	Maximum number of sets per unit (per unit)	
wms5_batchOrderPageOrderModeOrderCountNoMerge	Maximum order number of order set (multi non)	
wms5_batchOrderPageOrderModeTotalGoodsQtyNoMerge	Maximum number of sets per unit (multi non)	
wms5_batchOrderPageOrderModeOrderCountMerge	Order set Maximum order number (multiple)	
wms5_batchOrderPageOrderModeTotalGoodsQtyMerge	Maximum number of sets per unit (multiple)	

(2) Task single parameter - wms5-taskAssign

wms5_batchOrderPageOrderModePageTotalVolume	Maximum volume of task single (single piece)	Configure at least one of the three
wms5_batchOrderPageOrderModePageTotalWeight	Maximum weight of order set (single piece)	
wms5_batchOrderPageOrderModePageTotalSKUNum	Maximum number of tasks per task (per task)	
wms5_batchOrderPageOrderModePageTotalVolumeNoMerge	Maximum volume of order set (multi non)	
wms5_batchOrderPageOrderModePageTotalWeightNoMerge	Maximum weight of order set (multi non)	
wms5_batchOrderPageOrderModePageTotalSKUNumNoMerge	Maximum number of tasks per task (multi-non)	

wms5_batchOrderPageOrderModePageTotalVolumeMerge	Maximum volume of single task (multiple)	
wms5_batchOrderPageOrderModePageTotalWeightMerge	Maximum weight of a single task (multiple)	
wms5_batchOrderPageOrderModePageTotalSKUNumMerge	Maximum number of tasks per task (Multiple)	

(3) Task single logical area parameter wms5-taskassign

If different logical areas use different picking containers need to configure parameters, general automated warehouse needs, otherwise you can not configure.

taskassign_logicArea_weight	Singleton - logical area task weight limit
taskassign_logicArea_volume	Singleton - logical area task volume limit
taskassign_logicArea_sku_num	Singleton - Maximum number of logical area tasks
taskassign_logicArea_weight_noMerge	Multi - non - logical zone mission weight limit
taskassign_logicArea_volume_noMerge	Multi-non - logical area task volume limit
taskassign_logicArea_sku_num_noMerge	Multi - non - logical area maximum number of tasks
taskassign_logicArea_weight_merge	Multiple - Logical zone mission weight limit
taskassign_logicArea_volume_merge	Multiple - Logical area task volume limits
taskassign_logicArea_sku_num_merge	Multi-pool - Maximum number of tasks in a logical area

(4) Set single parameter in explosive mode - wms5-taskAssign

wms5_batch_explosion_product_order_qty	Order set number in explosive mode

1.2 Library usiness sorting

1.2.1 Outline

(1) Research positions: Basic information: warehouse capacity, number of pickers, number of SKUs, number of pieces, and single quantity

(2) In-store business

- The picker shall calculate and withdraw the goods according to storage space and number of pieces (library 0.115/0.02). The withdrawal standard is related to the difficulty of picking goods. So picking efficiency has a greater impact on wages.
    - Library tracked a task and picked up 65 slots in 30 minutes.
- The picking time of each warehouse varies greatly according to the size of the warehouse and the size of the logical area. The clothing warehouse is about 7~8 minutes, and the book warehouse is about 30 minutes.
- For small warehouses (warehouse 8 of clothing warehouse), one person participates in multiple links, and the improvement of picking efficiency can improve the rhythm and efficiency of the whole warehouse.
- There is ground pile on site, but it does not affect the efficiency of picking goods. Each pallet has a lane number in accordance with the code rules of the lane.
- Warehouse capacity is not the same, the number of orders differ greatly, the number of picking personnel difference is also large (pick goods people's flexibility is very big: pick goods fast).
- Multi logical area warehouse, many orders need to merge, a picking task will not cross the logical area, by a number of people in the merge area to complete the collection of single merges.
- Pickers can move across multiple logical zones, but tasks cannot cross zones.
- The task of picking goods does not stop, but the rhythm and workload will be adjusted through the proportion distribution of single products and multiple products to ensure the combination of work and rest.
- Replenishment has a separate process, and orders that need replenishment are not located and distributed temporarily.

(3) Pick up process

- Order filtering/task assignment
    - There is a single full-time staff for order screening and distribution.
    - Commonly used screening conditions: logical area, storage area, single product, multi-product, number of pieces, other category conditions.
    - If the order cannot be filtered out, it will be allocated through the normal order entry.
    - It will not allocate too many orders at a time, according to the actual number and efficiency of the current picking personnel in the warehouse, and according to the complexity of the task (single, multi-product) reasonable arrangement of task allocation.
    - After the order screening is completed, the task assignment is directly done. At this time, the task list has been generated in the system. At this time, the picker can click the task selection on PDA and receive a certain picking task.
- Picking tasks
    - Single picking task
    - Multidentate piking tasks
- Review/Pack

(4) In-warehouse WMS system: mainly completes the order screening on the task allocation page, and finally generates the order set to enter the queue

(5) Feedback problem: WMS screening process has many conditions, and the screening process is complex. We hope to provide a simpler operation interface

(6) Data analysis

(7) Algorithms optimize space and ideas

1.2.2 Research Note - August 26, 2021

(1) In case of mixed screening of single and multiple items, the algorithm will group single and multiple items together for on-site feedback. If the optimization point can meet the requirements of the site, it can carry out the operation of covering hundreds of sets of multiple items, and the coverage can be further improved. This optimization priority is higher than P0.

(2) The logic area and the site area of confluence don't want to happen, such as A orders LH01 and LH02 two logical area, B order LH02 and LH03 two logical area, these two orders not to put together, the current field can be solved by manual screening in the logic way temporarily, but after solving the problem, the body will obviously increase, At the same time, the coverage rate of 100 orders will also be further improved. Priority P1 can be carried out after completion of (1).

(3) There are many non-problems in storage areas 1 and 4 in the LOGICAL area of LH01, which can be manually operated by the first-line operation side and operated separately from 1 and 4.

2 Project Scheme

2.1 Collection single processing scheme

2.1.1 Algorithm objective and scheme

The problem was solved by multi-objective programming algorithm based on saving gain, aiming at the optimal number of tasks, total number of pickings, number of pickings, total number of pickings and cross number of pickings.

2.1.2 Constraints are considered in this algorithm

- A simple solution: consider order set upper limit, number of pieces upper limit, order set upper limit, number of pieces upper limit.

- A complex scheme: set the upper limit of the order number of order set and order set respectively for single order, multi-non-order, and multi-combination order. If there are multi-non-orders in the order set, it is considered as multi-non-order, and if there are multi-combination orders, it is considered as multi-combination order.
- Other constraints to consider.

2.1.3 Practical scope of the algorithm

Single piece, single product multi-piece, multi-non, multi-combination of single customer and large routine set single scene, not applicable to a single package and other production modes

2.1.4 Form of delivery

Provide jar package, and WMS to determine the call method, upload to JD private server, WMS through Maven reference. This approach is not good for monitoring run logs and relies on the deployment of WMS applications when deploying updates.

2.1.5 Deployment mode and Process

The application is created and deployed in the warehouse. It is troublesome to develop and maintain in this way. Some machines in the campus may have high CPU or memory usage and need to be added, but they can be running at any time.

2.1.6 Decoupling scheme

(1) On the basis of ungrouping order logic, disassemble packet order business and algorithm call business, and split the current JAR package form into RPC business form.
(2) All groups are called through the new interface.

2.2 Confluence order processing scheme

For the sake of simplicity, the following example only reflects the maximum order number of the order set, and other constraints will be considered in the code.
In an order pool, there are 50 orders of JH01+JH02, 60 orders of JH02+JH03 and 50 orders of JH01+JH02+JH03. Indicates that the order pool has.

Note:

- Set single saturation = Max (set single/Max order, set single/Max order)

2.2.1 If multiple orders form an order set and form two sets of orders relative to each other, and the number of tasks does not decrease, it cannot form an order set [reduce confluence].

Case 1: The current order pool has 80 singleton orders, 40 of which are in logical area JH01 and 40 in logical area JH02. If a collection list is formed, it needs to be logically divided into two tasks. If there is one order set in JH01 area and one order set in JH02 area, there are also two tasks with the same number of tasks. Therefore, 40 orders of JH01 are required to form an order set, and 40 order sets of JH02 are required to form an order set.
Case 2: There are 4 orders, 2 orders of JH01 + JH02 and 2 orders of JH03+YXP. If these 4 orders form an order set, there are 4 tasks; If two orders of JH01 + JH02 form an order set, and two orders of JH03+YXP form an order set, they are also four tasks, so two order sets need to be formed.
Case 3: There are 4 orders, 2 orders of JH01 + JH02 and 2 orders of JH02+JH03. These 4 orders form an order set with 3 tasks; If it is divided into 2 sets, there are 4 tasks, and the number of tasks is reduced by 1, which can form a set list.
Case 4: There are 4 orders, JH01, JH02, JH03 in order 1 logical area, JH01, JH02 in order 2 logical area, JH03 in order 3 logical area, JH02, JH03 in order 4 logical area. If 4 orders form an order set, there will be 3 tasks. If divided into multiple order sets, there will be more than 3 tasks. So, 4 orders are integrated into an order set.
Case 5: JH01+ JH02+ JH03 order number =1, JH01+ JH02+ YXP order number =1, JH01+ JH02 order number =2, Logical area JH01+JH03+YXP, order number =1, logical area JH01+JH03, order number =2, logical area JH01+ YXP, order number =6, logical area

JH02+JH03, order number =2, logical area JH03+YXP, order number =1, if an order set is formed, a total of 4 tasks, If the singular number of sets is greater than 1, the number of tasks will be greater than 4, and an order set is formed.

2.2.2 Orders in the same logical area form an order set preferentially.

Case 1: In an order pool, there are 50 orders of JH01+JH02, 60 orders of JH02+JH03, and 50 orders of JH01+JH02+JH03. If 3 order sets are generated, 40 of 50 orders of JH01+JH02 are selected to generate an order set. Select 40 out of 60 orders of JH02+JH03 to generate 1 order set and select 40 out of 50 order sets of JH01+JH02+JH03 to generate 1 order set.

Case 2: In an order pool, there are 60 orders in JH01+JH02 logical area and 30 orders in JH01+JH02 logical area, 2 order sets need to be generated. Select 40 orders from 60 orders in JH01+JH02 logical area to generate 1 order set. Select 30 orders from JH01+JH02+JH03 logical area and 10 orders from JH01+JH02 to form an order set.

2.2.3 When the collection single energy group is full, the order with less logical area takes precedence in the grouping order

Case 1: JH01 has 10 orders, JH02 has 100 orders, and JH01+JH02 has 50 orders. If 1 order set needs to be returned, 40 orders from 100 orders in JH02 area should be selected preferentially. If 2 sets of orders need to be returned, 80 sets of 100 orders of JH02 should be selected to form 2 sets of orders. To return 3 order sets, select 2 order sets from the JH02 logical area and 40 order groups from the 50 orders of JH01+JH02.

[Note: After 2 order sets are sent out from JH02 area, there are 20 remaining orders in JH02 area and 50 remaining orders in JH01+JH02 area. According to the principle of giving priority to one order set in the same logical area, group one order set from JH01+JH02 area.]

2.2.4 When the order set reaches a certain saturation >=0.8 (preferably set in master) and the logical area must be added, there is no need to add the order to the order set.

Case 1: There are 36 orders of JH01+JH02, 10 orders of JH01+JH02+JH03, and 1 order set is needed. After 36 orders of JH01+JH02 generate an order set, the saturation is at least 36/40=0.9>=0.8, and there is no need to add orders of JH01+JH02+JH03. (26 orders for JH01+JH02, 10 orders for JH01+JH02+JH03, 1 order set is required.)

2.2.5 Beijing Library No. 1, JH01 logic area, order plan of Zone 1 and zone 4

(1) The discriminant scheme of zone 1 and zone 4 does not distinguish zone 1 and Zone 4. However, if the sequential difference between the two roadways is 1500 or more, it is considered to span zone 1 and Zone 4.

(2) Priority grouping of orders that do not cross zone 1 and zone 4.

Example: 50 orders in zone 1, 60 orders in Zone 4, 100 orders across zone 1 and zone 4. If an order set is needed, an order set is formed from block 1 or block 4. If two sets of orders are needed, one order set is assembled from block 1 and one order set is assembled from block 4. If 3 order sets need to be grouped, 40 will be selected from orders across zone 1 and zone 4, and 1 order set will be grouped.

(3) When the order set reaches a certain degree of saturation, temporarily >=0.8, and must span zone 1 and zone 4, orders can no longer be added to the order set.

Case: there are 35 orders in zone 1, 39 orders in zone 4, and 10 orders across zone 1 and zone 4. If 2 order sets are needed, select an order set for 35 orders in zone 1, and select an order set for 39 orders in zone 4. There is no need to continue to add orders across zone 1 and zone 4, making an order set for 40 orders.

(4) The order in zone 1 should be grouped with the order in zone 1, the order in zone 4 should be grouped with the order in zone 4, the order across zone 1 and zone 4 should be grouped with the order across zone 1 and zone 4. If the saturation cannot reach 0.8, the order will be mixed with each other.

Case: there are 25 orders in zone 4 and 50 orders across zone 1 and 4. If 2 order sets are needed, select 40 groups from the orders across zone 1 and 4 for an order set, and 25 orders in zone 4 for an order set, which is not enough to form a saturated order set. The remaining 10 orders across zones 1 and 4 need to be added.

2.3 Separation parameters of single and multiple parts

2.3.1 Requirement Background

Under the condition of single particle size, the site needs to realize the single function of unassembling and assembling a single product or multiple pieces of a single product to improve the set single saturation. Based on this requirement and considering the support of subsequent intelligent group single business type, the function adopts existing WMS parameters and usage logic, and uses taskAssignStrategy_subgroup and taskAssignStrategy_singlegoods as the split single and multiple pieces. Single product and multi-product function. This function will replace wms5_split_single_multi. The business side reports that this method increases the learning cost on site and needs to be replanned.

2.3.2 Scope of requirements

Based on wms5_split_single_multi, it can realize the function of separating and grouping single item and multi-item, multi-non and multi-combination, and wms5_option_singleproduct_singlesku to judge single item and multi-item logically. Then, based on two parameters, the combination mode of single item and single item is realized.

- wms5_definition_singleproduct_singlesku must be modified

2.3.3 Function - Implementation rules

wms5_split_single_multi = 0, single item single, single item multiple, multi-non and multi-combination can be realized
wms5_split_single_multi = 1, the grouping list of single item, multi-item, multi-non-item and multi-combination and disassembly can be realized
wms5_split_single_multi = 1, single item single or multiple items are single items, and multi-non-items and multi-items are combined for multi-items.
wms5_split_single_multi = 0 (default value) or not configured, a single item is a single item. If the value is multi-item, multi-non-item, or multi-item.

2.4 Separation from logical storage area

2.4.1 background

Some warehouses try to reduce the number of logical areas in order to avoid confluence tasks. For example, the no. 1 library of Chengdu Yayi Book and Audio warehouse has a two-layer structure, but it is not divided into two logical areas. When grouping orders, there is no information about the storage floors in the background, so the orders of the second floor cannot be divided into different order sets. The warehouse is required to give some configuration data, which is used to represent multiple separated areas. The background algorithm tries to put the orders in the same area into a collection list.

2.4.2 Configuration Description

You can add a dictionary to describe the storage areas that need to be as separate as possible. For example, a warehouse has three logical extents containing the following storage information:
JH01: 1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 1L 1M 1N 1O 1P
JH02: 2A 2B 2C 2D 2E 2F 2G 2H 2I 2J 2K 2L 2M 2N 2O 2P
JH03: 3A 3B 3C 3D 3E 3F 3G 3H 3I 3J 3K 3L 3M 3N 3O 3P

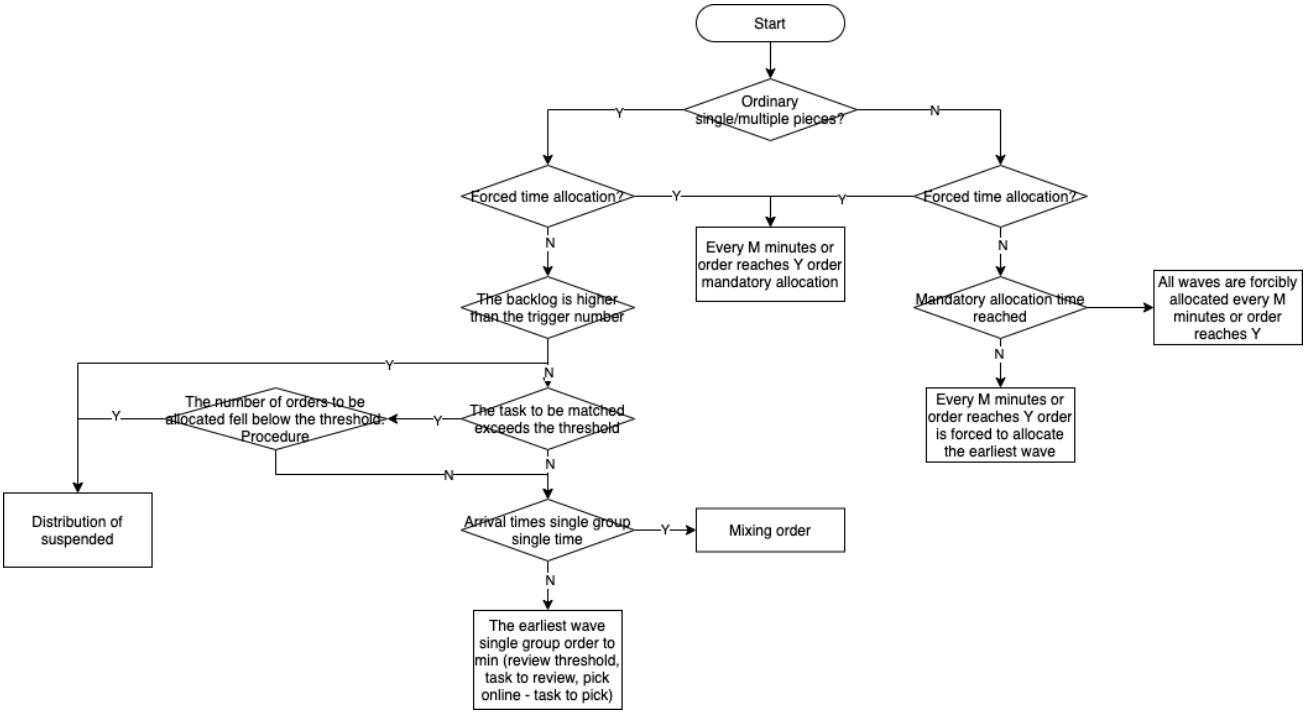
Case1: JH01 logical area [1A 1B 1C 1D 1E 1F 1G] storage area and [1H 1I 1J 1K 1L 1M 1N 1O 1P] storage area are far apart, it is hoped to separate the group as far as possible. JH01:1A 1B 1C 1D 1E 1F 1G# 1H 1I 1J 1K 1L 1M 1N 1O 1P.
Case2: JH01 logic area [1A 1B 1C 1D 1E] storage area and [1F 1G 1H 1I 1J 1K] storage area and [1L 1M 1N 1O 1P] storage area, the three parts are far apart, it is hoped to separate the group as far as possible. JH01:1A 1B 1C 1D 1E #1F 1G 1H 1I 1J 1K #1L 1M 1N 1O 1P.

Case3: JH01 logical area [1A 1B 1C 1D 1E 1F 1G] storage area and [1H 1I 1J 1K 1L 1M 1N 1O 1P] storage area are far apart, it is hoped to separate the group as far as possible. In addition, the JH03 logical area [3A 3B 3C 3D 3E] storage area and [3F 3G 3H 3I 3J 3K 3L 3M 3N 3O 3P] storage area are also far away from each other, so we hope to separate them. JH01:1A 1B 1C 1D 1E 1F 1G #1H 1I 1J 1K #1L 1M 1N 1O 1P JH03:3A 3B 3C 3D 3E # 3F 3G 3H 3I 3J 3K 3L 3M 3N 3O 3P.

Note:

- When grouping multiple storage areas in a logical area for separate picking, try to group the storage areas according to the picking order.
- For example, the order of picking is [1A 1B 1C 1D 1E 1F 1G 1H 1I 1J 1K 1L 1M 1N 1O 1P]. A poor grouping [1A 1B 1G 1H 1I 1J # 1C 1D 1E 1F 1K 1L 1M 1N 1O 1P] Here the first group [1A 1B] and the following [1C] storage area are not in this group, but [1G 1H 1I 1J] is in this group.

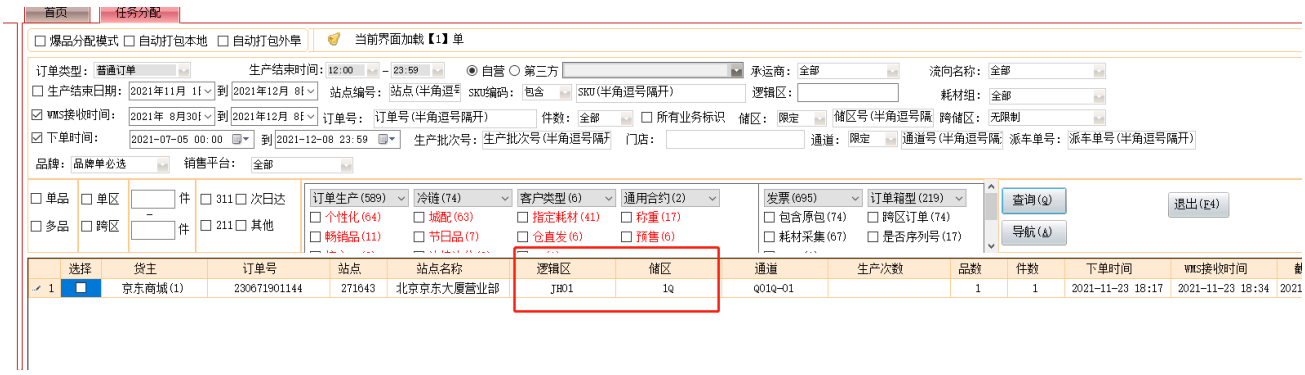
2.5 Automatic ordering flowchart



2.6 Positioning Policies

2.6.1. Business Background

At present, all orders accepted by WMS task assignment interface are directly sent down based on OFC system, received and positioned by WMS, and then warehouse workers assign tasks to them. The task allocation set unit in the database is based on the strategy of building the set unit after WMS has completed the location positioning.



2.6.2 Business status and problems/pain points

The current positioning strategy is based on storing clear minimum principle, based on the principles of positioning, will not necessarily make for picking and solves the order picking optimal, so hope to form a set list before design a variety of positioning strategy, in order to optimize the collection of single construction quality, so as to shorten the picking workers picking tour, and improve the picking efficiency.

2.6.3 Business objectives and scope

(1) To solve the positioning strategy problem of ordinary orders in self-operated small and medium-sized warehouse, different positioning strategies can be developed for different categories.
(2) Optimize the positioning logic, optimize the setting effect of the order set, improve the efficiency of picking goods.

2.6.4 Business Scenario

(1) For example, category, wave number and commodity type are taken as the judgment conditions, and the minimum storage clearing principle, maximum SKU storage principle, or other dynamic positioning principles can be determined according to different scenarios.
(2) Change the positioning strategy without affecting the sorter and picker's system motion perception.

2.6.5 Description of Requirements

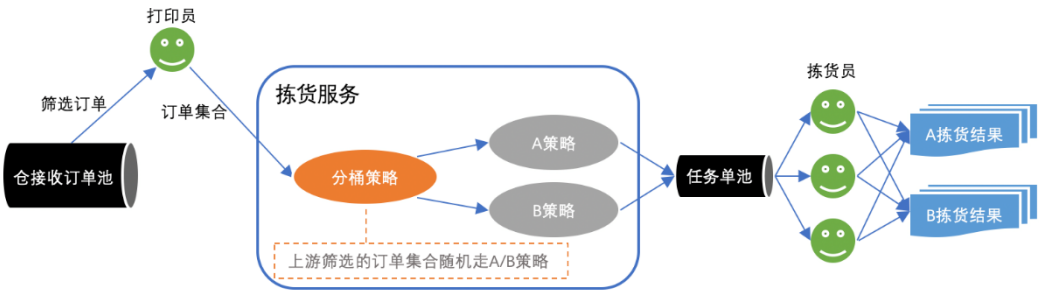
(1) Transformation of positioning strategy: for example, category, wave number, commodity type, etc., are taken as judgment conditions, and the principle of minimum storage clearing, maximum SKU storage, or other dynamic positioning principles can be determined according to different scenarios.
(2) Transformation of the minimum storage principle: when OFC orders are placed to preoccupy the storage inventory in WMS, the optimal storage position is determined dynamically (no need to consider the minimum storage principle) before the assembly order is formed, and the positioning is stopped until the warehouse distributes tasks.
(3) Dynamic positioning: after WMS assembles the order set, and before the picker gets it, if a new strategy determines a better positioning location, the order set can be dynamically disassembled and repositioned for construction.

2.7 AB Test scheme

2.7.1 Bucket Sharing Scheme

In the actual picking business, the logic of bucket division is realized. For the upstream order pool screened by the distributor as A batch, A/B algorithm is randomly selected to calculate the order set. The testing process and results can be insensitive to the site and do not affect the production process.

- Policy A: the old WMS sets A single policy.
- Policy B: new set single algorithm policy.

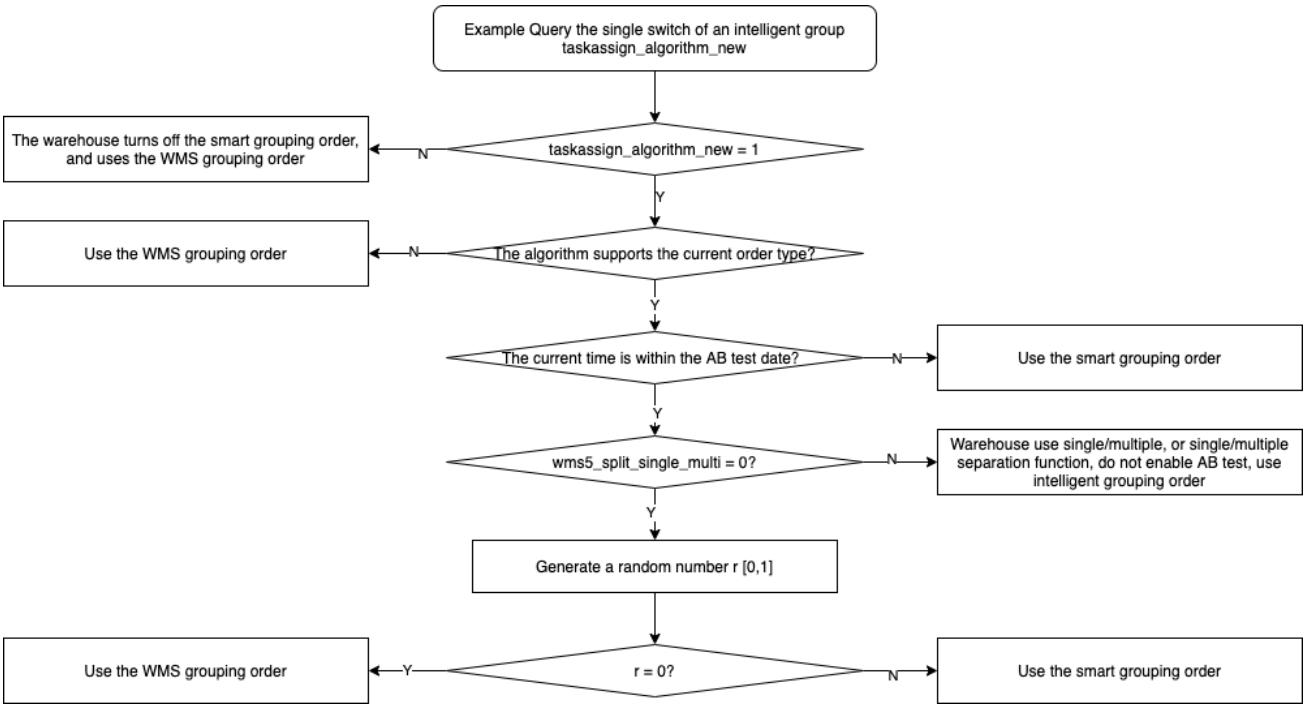


2.7.2 Evaluation plan

For A week of continuous testing, orders screened at A time were taken as A group of inputs, and A/B strategy was randomly selected.

Finally, the picking time of each piece of A/B strategy output order set was compared downstream.

AB Solution Flow



2.7.3 AB test real-time monitoring dashboard

In order to achieve a quick response to AB's on-site abnormal problems, the real-time monitoring scheme is planned to obtain the status and anomalies of the background in real time, so that operation and maintenance students can timely respond based on the monitoring results.

Demand	Brief Description
Alg (B policy) identifies the real-time cumulative single quantity	Monitors the real-time cumulative single volume of policy B
WMS (Policy A) identifies the real-time cumulative single quantity	Monitors the real-time cumulative single volume of policy A
Alg (B policy) identifies the real-time order pool	Monitor the real-time order pool of policy B
WMS (Policy A) identifies the real-time order pool	Monitor the real-time order pool of policy A

2.7.4 Functions

No.	Functions	Brief description
1	Filter box	The search can be based on the name of the online warehouse + [all], 2~7 will change according to the screening conditions.
2	List that has not been updated for less than 1 day	Display only the current day, and the unupdated duration field is less than 24 hours, and in descending order according to the unupdated duration. All: Displays the total information of all positions. Warehouse name: Displays the warehouse information corresponding to the warehouse name.
3	List that has not been updated for more than one day	Only the positions whose unupdated duration is less than 24 hours are displayed, in descending order according to the unupdated duration. All: Displays the total information of all positions. Warehouse name: Displays the warehouse information corresponding to the warehouse name.
4	The policy currently	On the current day, the real-time cumulative single volume of the corresponding policy up to the current date.

	accumulates a single quantity	All: Displays the total information of all positions. Warehouse name: Displays the warehouse information corresponding to the warehouse name.
5	Policy Indicates the number of current traffic streams	On the current day, the number of real-time shunts by the corresponding policy to the current day All: Displays the total information of all positions. Warehouse name: Displays the warehouse information corresponding to the warehouse name.
6	Policy current order pool	On that day, the corresponding policy is up to the current order pool size. All: Displays the total information of all positions. Warehouse name: Displays the warehouse information corresponding to the warehouse name.
7	Policy Indicates the current trend of single traffic and shunting times	On that day, A/B strategy up to the current real-time single volume and number of streams trend. All: Displays the total information of all positions. Warehouse name: Displays the warehouse information corresponding to the warehouse name.

3 Data Analysis

3.1 Sampling analysis

3.1.1 Current Caliber:

- Delete the business types tha.t are not supported by the algorithm.
- Such as: bulk, internal distribution, warehouse counter shelf, abnormity, platform logic area, etc.
- Eliminate the number of picked goods is more than 200, eliminate the single volume less than 1000 warehouse.
- Scope: Formal (dispatched + labor contract) picker

3.1.2 Analysis results under different conditions

- Effect: -0.93% Number of positions: 194 Double 11(effect: -0.74%, number of positions: 82)
- Hold orders greater than 0: Effect: -0.95% Number of positions: 178 Double 11(Effect: -0.62%, number of positions: 72)
- Hold orders greater than 5: Effect: -2.84 Number of positions: 129 Remove double 11(Effect: -1.77%, number of positions: 54)
- Hold orders greater than 10: Effect: -3.55 Number of positions: 110 Double 11(Effect: -1.95%, number of positions: 48)
- Hold orders greater than 15: Effect: -3.9% Number of positions: 93 Double 11(Effect: -2.14%, number of positions: 43)
- Hold orders more than 20: Effect: -4.11% Number of positions: 78 Double 11(effect: -14.5%, number of positions: 23)
- Hold orders greater than 30: Effect: -4.43% Number of positions: 51 Eliminate double 11(Effect: -13.8%, number of positions: 18)
- Hold order more than 40: effect: -5.78% Number of positions: 32

National warehouse: dev_store_temp_all

Sample bin 93 contains orders greater than 10: dev_store_temp

Number of official Pickers dev.dev_store_ord_all (dev_store_ord + dev_people_detail)

Warehouse ID, people, ERP, age, total picking time, average task volume, average order volume,93 warehouse marked dev_people_detail

3.2 Pearson correlation coefficient corR correlation analysis of picking efficiency

3.2.1 Relationship between picking time and each parameter

[10]:

	jianjun	dds	cqs	cws	SKU	xds	kxds	ddj	jhddds
jianjun	1.000000	-0.157244	0.181637	-0.061814	-0.063578	0.022898	0.159661	-0.075941	-0.044550
dds	-0.157244	1.000000	0.070253	0.438534	0.447044	0.281607	0.036395	-0.176794	0.916414
cqs	0.181637	0.070253	1.000000	0.561734	0.553078	0.749615	0.415391	0.179216	0.118720
cws	-0.061814	0.438534	0.561734	1.000000	0.995834	0.920592	0.269736	0.152277	0.375360
SKU	-0.063578	0.447044	0.553078	0.995834	1.000000	0.911390	0.266302	0.148624	0.383621
xds	0.022898	0.281607	0.749615	0.920592	0.911390	1.000000	0.355639	0.188876	0.253558
kxds	0.159661	0.036395	0.415391	0.269736	0.266302	0.355639	1.000000	0.069848	0.092859
ddj	-0.075941	-0.176794	0.179216	0.152277	0.148624	0.188876	0.069848	1.000000	-0.219351
jhddds	-0.044550	0.916414	0.118720	0.375360	0.383621	0.253558	0.092859	-0.219351	1.000000

- Jianjun: The pickup time per piece
- dds: Order number -0.15
- cqs: number of storage areas 0.18
- cws: storage digit -0.06
- SKU: Number of SKUs -0.06
- XDS: number of tunnels 0.02
- KXDS: number of cross-roadway 0.15
- ddj: Single piece multiple pieces -0.07
- jhddds: Order set number -0.04

Conclusion:

- The average picking time and order number, number of storage areas, number of storage, number of SKU, number of tunnels, number of cross tunnels, number of single and multiple pieces, and order number of set single are weakly correlated

3.2.3 Relationship between picking time and various parameters

]:

	jhsj	spjs	dds	cqs	cws	SKU	xds	kxds	ddj	jhddds
jhsj	1.000000	0.223183	0.116938	0.466356	0.424330	0.419480	0.472683	0.252159	0.132618	0.148540
spjs	0.223183	1.000000	0.469870	0.243166	0.628536	0.625799	0.519639	0.096153	0.212694	0.371855
dds	0.116938	0.469870	1.000000	0.070253	0.438534	0.447044	0.281607	0.036395	-0.176794	0.916414
cqs	0.466356	0.243166	0.070253	1.000000	0.561734	0.553078	0.749615	0.415391	0.179216	0.118720
cws	0.424330	0.628536	0.438534	0.561734	1.000000	0.995834	0.920592	0.269736	0.152277	0.375360
SKU	0.419480	0.625799	0.447044	0.553078	0.995834	1.000000	0.911390	0.266302	0.148624	0.383621
xds	0.472683	0.519639	0.281607	0.749615	0.920592	0.911390	1.000000	0.355639	0.188876	0.253558
kxds	0.252159	0.096153	0.036395	0.415391	0.269736	0.266302	0.355639	1.000000	0.069848	0.092859
ddj	0.132618	0.212694	-0.176794	0.179216	0.152277	0.148624	0.188876	0.069848	1.000000	-0.219351
jhddds	0.148540	0.371855	0.916414	0.118720	0.375360	0.383621	0.253558	0.092859	-0.219351	1.000000

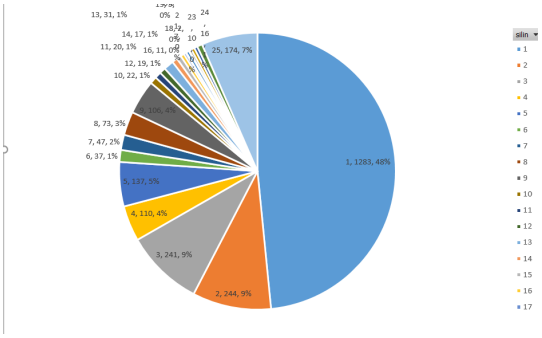
Conclusion:

- Task with single granularity: picking time is moderately positively correlated with the number of storage areas, number of storages, number of SKUs and number of roadways. Picking time will decrease at least when these parameters are optimized

3.3 Analysis of picking efficiency for different working ages and parts

Background: In our common sense, the longer the length of business, the clearer the understanding of the distribution of goods in the warehouse, storage area, roadway, and storage, the smaller the corresponding picking time will be. Find out which age group is most productive.

The current analysis of the number of pickers in the recent 7 days according to the statistics of different ages is shown in the figure, among which the number of pickers with the ages of less than one-month accounts for 48%.

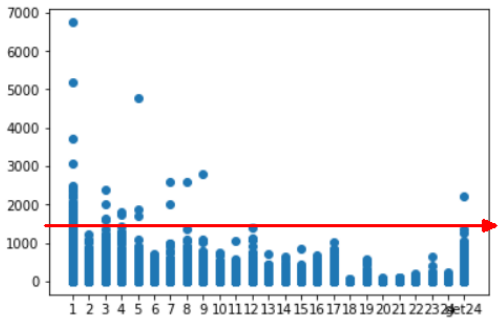


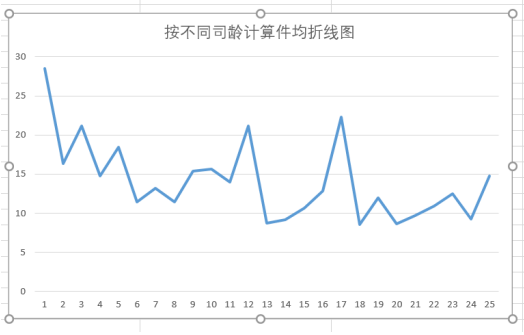
The average picking time and age distribution of pickers in the recent 7 days on November 7 are as follows:

The figure shows the scatter chart information of picker positions in the warehouse in recent 7 days according to the task of single granularity production

Abscissa: picker's seniority, 25: get24 is the picker's seniority more than 2 years

Ordinate: distribution of picking time





Conclusion:

- 1: It can always be seen from Figure 2 that the picking time of pieces will be stable when the age is more than 1 month. However, it can be seen from the figure that 48% of employees are less than one month old. The more employees are less than one month old, the greater the impact on the fluctuation of the average picking time will be.
- 2: According to the average picking time of different ages in Figure 3, it can be seen that the efficiency of employees less than one month is the lowest. So we can prove conclusion 1. Therefore, when the algorithm optimizes the efficiency of picking goods, if there are too many new employees, the algorithm will also fluctuate. Whether this kind of influence algorithm can be taken into account when grouping orders.

3.4 Analysis of single volume and piece picking time

3.4.1 Data status

The purpose is to explore the correlation between the number of unfilled orders and the average time of picking through data analysis.

3.4.2 Holding single caliber:

Run the oblocate_shipment_count command from FDM_wMS5_report_OB_ASSIGN_batch_LOG_STATISticS_chain to obtain the order pool number oblocate_shipment_count whose type is' ALG 's

3.4.3 Average picking Time:

app_store_pick_task_det_d Order set Picking duration task_pick_tm and Number of Pickings picking_oty, average number of pickings Duration = Duration of pickings/Number of pickings.

Elimination conditions:

1) Eliminate informal picking and dispatch picking

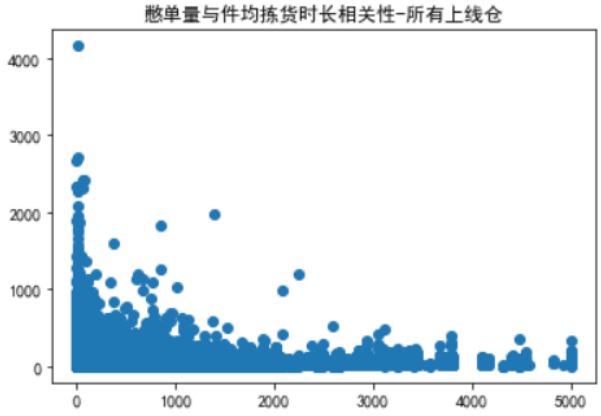
2) Eliminate internal matching, irregular products and platforms (non-Beijing warehouse)

3) The time of culling and picking is less than or equal to 1

- Correlation between all on-line storage units and the time taken to pick each piece

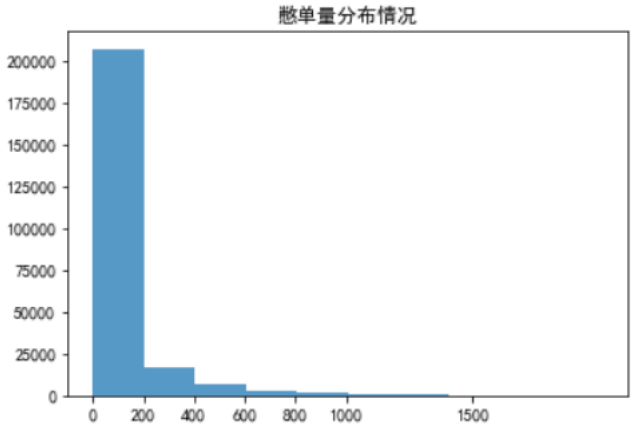
(1) Correlation between volume and pick time - all online bins

As can be seen from the figure, the abscissa is the holding unit quantity, and the ordinate is the average picking time (s) of a task unit. There is a negative correlation between the two, namely, the larger the holding unit quantity, the smaller the average picking time of a task unit.



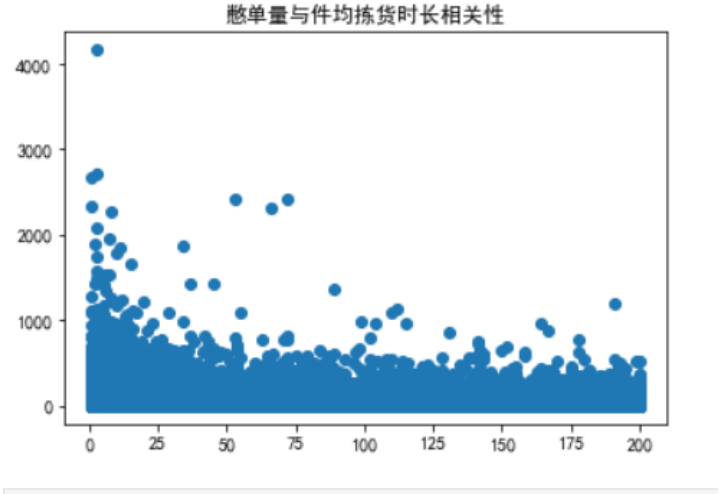
(2) The monotonic distribution

It can be seen from the histogram that the bulk order is mainly distributed in the range of 0-200. According to the bulk order distribution range, the relationship between the average picking time and the bulk order is statistically analyzed in different bulk order distribution ranges.

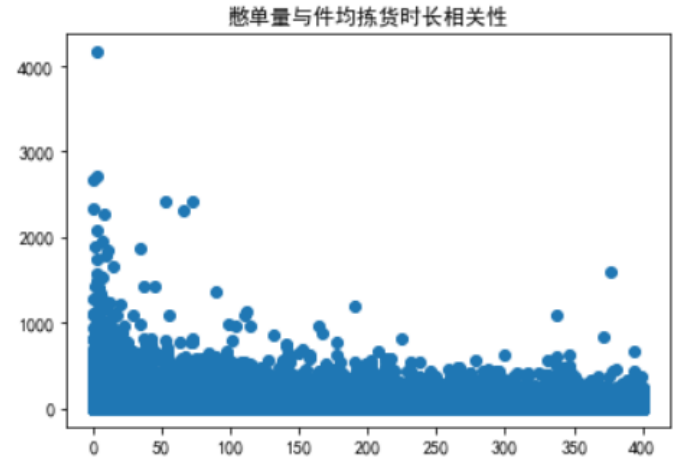


(3) Hold a single volume and piece per pick market correlation:

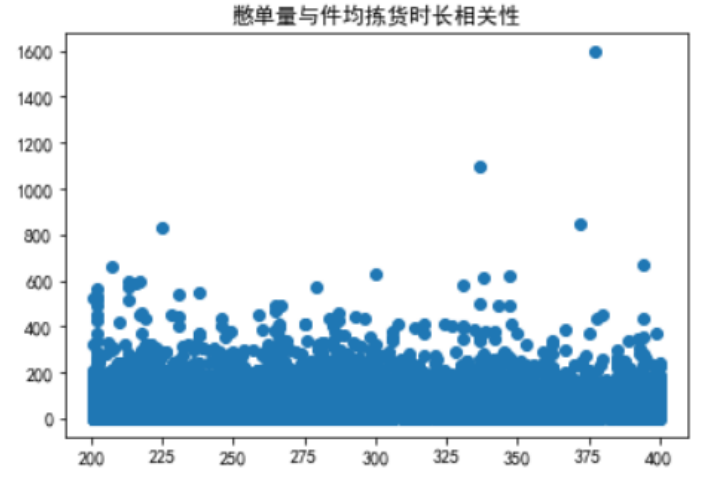
- When the volume is less than or equal to 200, the volume is correlated with the average picking time.



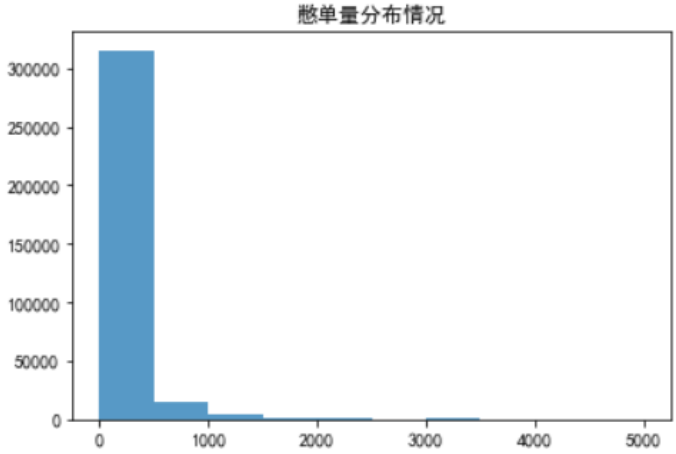
- When the volume is less than or equal to 400, the volume is correlated with the average picking time.



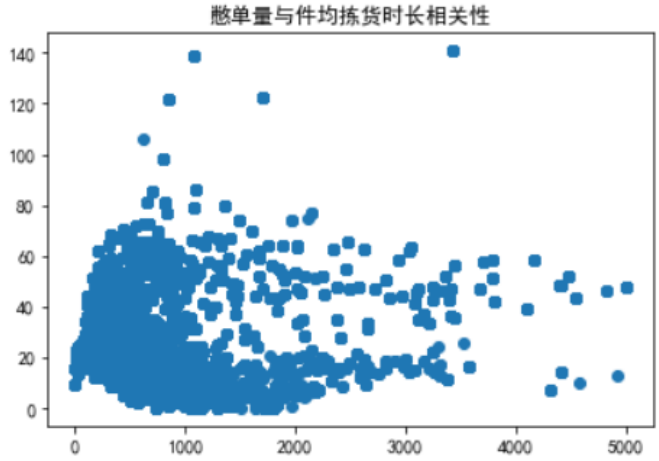
- When the volume is between 200 and 400, the volume is correlated with the average picking time of pieces. It can be seen that in this range, there is almost no correlation between the volume and the average picking time of pieces, and the average picking time of pieces does not fluctuate by the change of the volume.



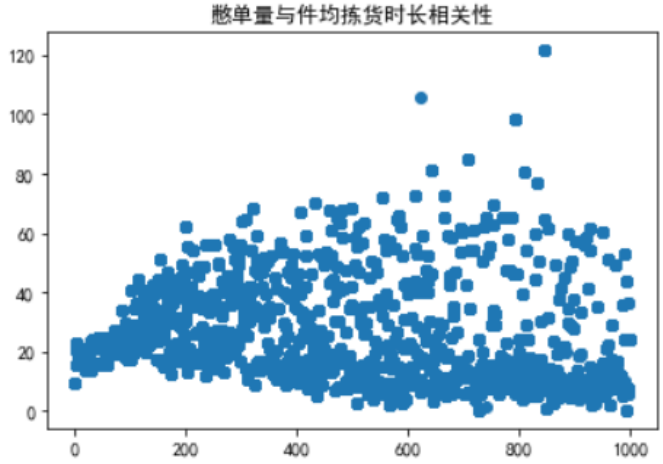
- The median is taken for the average picking time of each holding unit, and the average picking time of each holding unit keeps two decimal places. The distribution of holding unit is as follows: It can be seen from the figure that, when the median of each piece is taken, the volume is mainly distributed between 0 and 500.



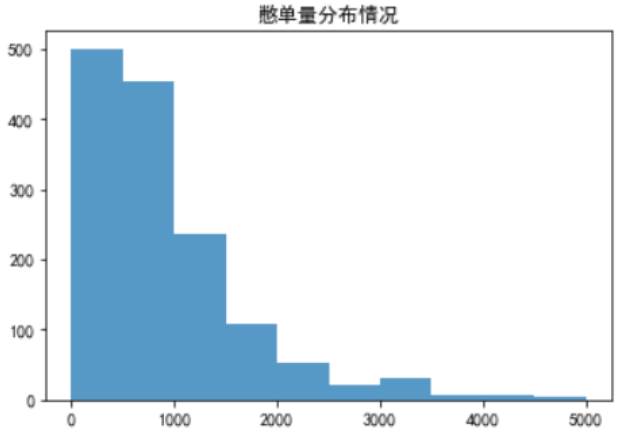
- For all online warehouses in the figure, the median of the average picking time is taken, and the correlation between the average picking time and the average picking time is shown. It can be seen from the figure that there is a certain correlation between the two. With the increase of the average picking time, the average picking time increases first and then decreases.



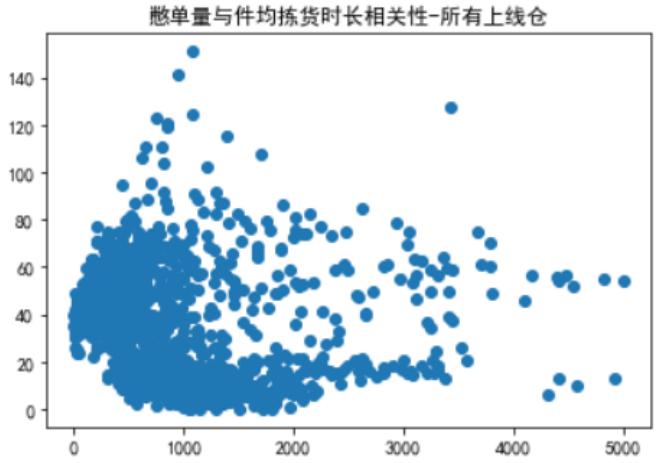
- As shown in the figure, the median of each piece is taken, the quantity of each piece is between 0 and 1000, and the correlation between the quantity of each piece and the length of each piece picking.



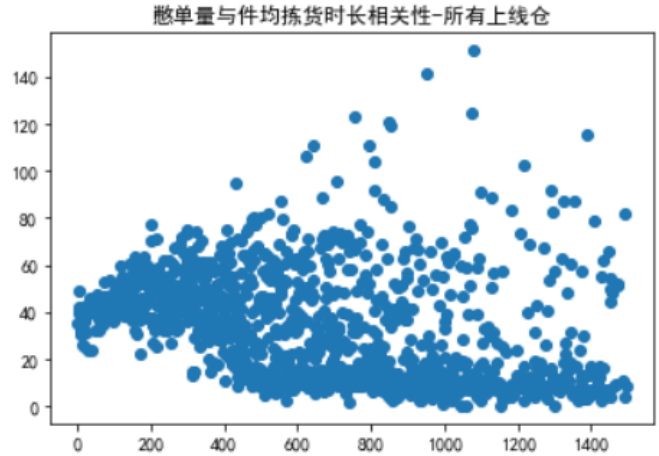
- The average picking time of each holding unit quantity is taken, and the picking time of each holding unit quantity is kept two decimal places. The distribution of holding unit quantity is as follows:



- As can be seen from the figure, when the average value of all components is taken, the volume is mainly distributed between 0 and 1500.
- The figure above shows the average picking time of all online warehouses, and the correlation between the holding quantity and the picking time of each piece. It can be seen from the figure that there is a certain correlation between the two. As the holding quantity increases, the picking time of each piece increases first and then decreases.



- As shown in the figure, the average of each piece is taken, and the quantity of each piece is between 0 and 1000. The correlation between the quantity of each piece and the length of each piece picking is shown.



4 Large data monitoring screens

4.1 Introduction to the Data Monitoring Screen

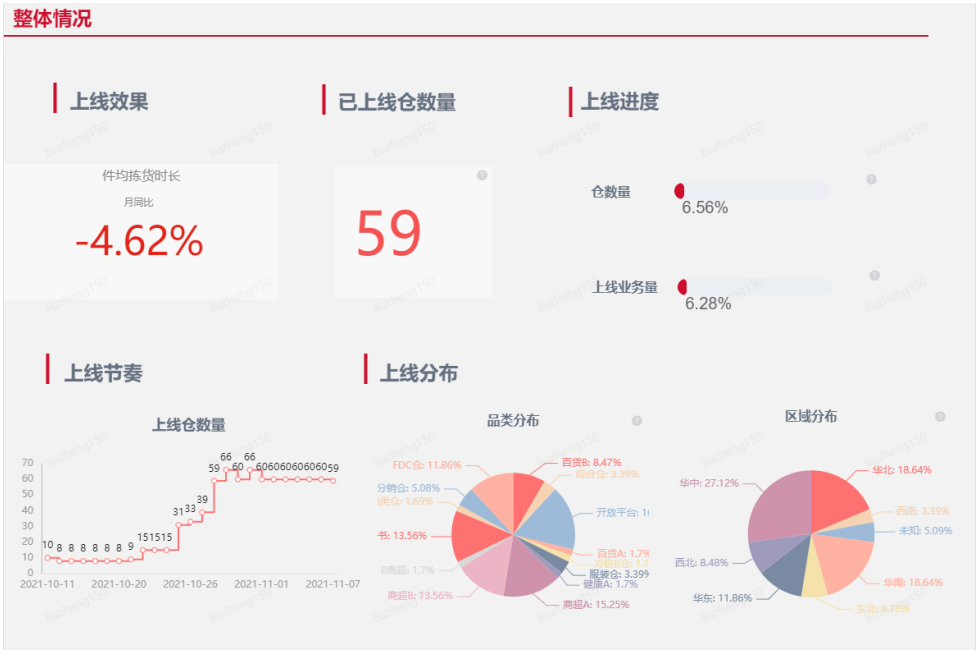
4.4.1 background

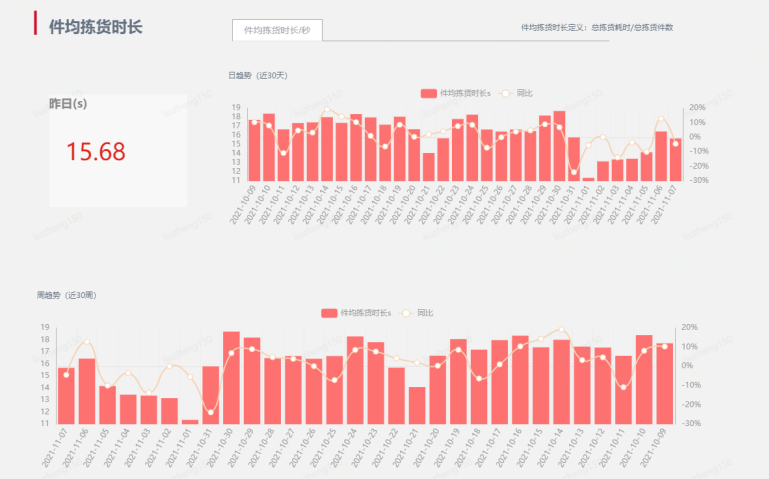
Warehouse through the intelligent set single algorithm to replace the original WMS rule group single strategy, the first phase of the goal to achieve the shortest and optimal picking path, improve the human efficiency of picking personnel, the second phase to achieve single screen set single automation, unmanned, through the warehouse production scheduling to achieve global link optimization, help warehouse cost reduction and efficiency.

4.1.2 Scope of requirements

Demand	Brief Description
The project board	Monitor and manage the process information and result information generated during project promotion
Implement board	Reduce on-site concerns about holding orders through data and motivate in-store execution through ranking

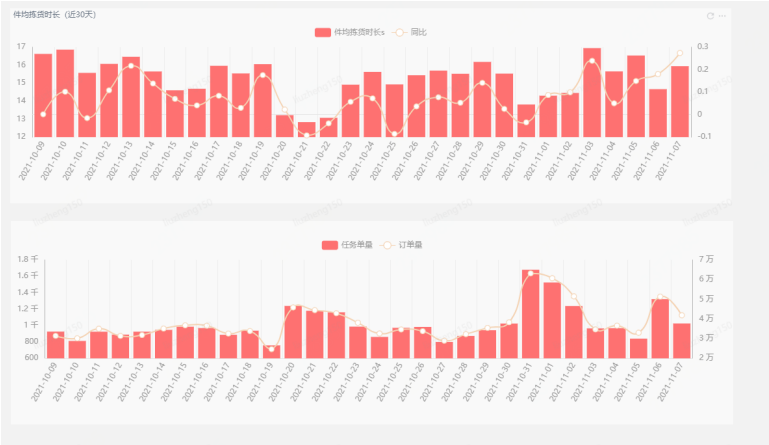
4.2 Interactive prototype diagram

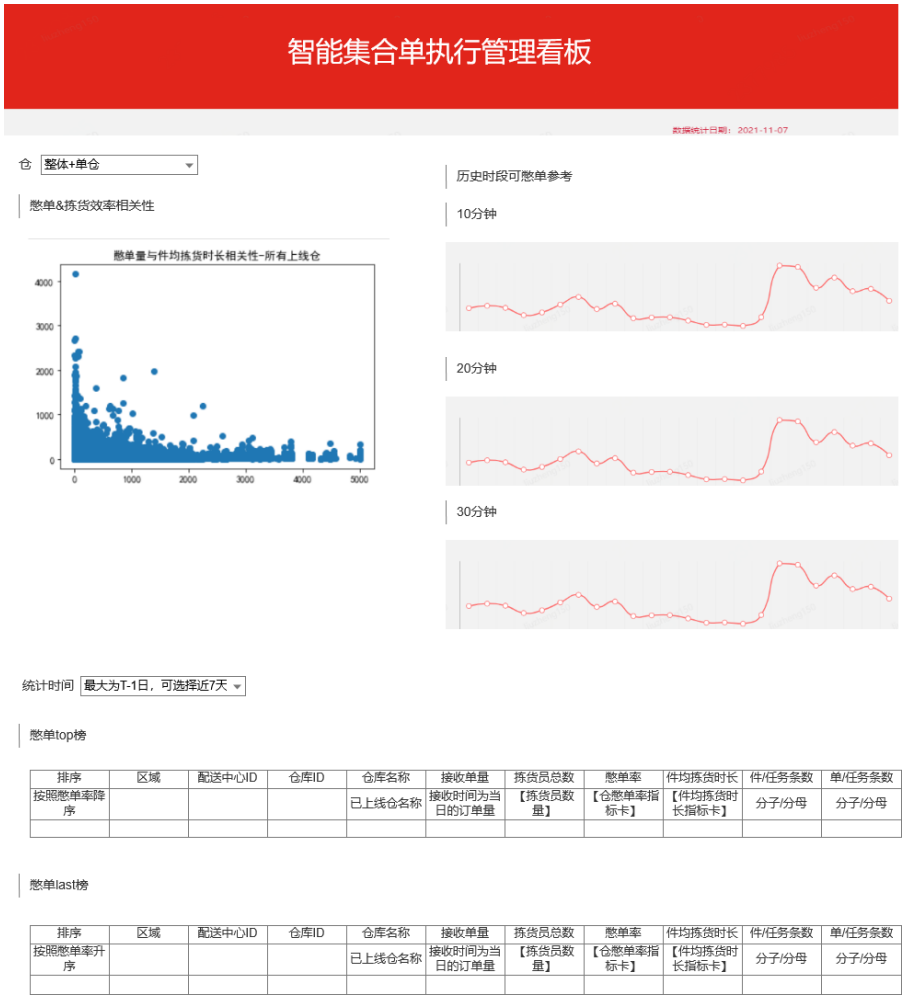



件均拣货时长
件均拣货时长/秒
件均拣货时长定义：总拣货耗时/总拣货件数
昨日(s)
15.68
日趋势（近30天）
件均拣货时长s
同比
周趋势（近30周）
件均拣货时长s
同比


月趋势（近12月）
件均拣货时长s
月同比


单仓生产数据
仓选择
北京图书音像仓1号库
整单率
16%
日趋势（近15天）
目标值
整单率
每日
每周
每月
拣货员数量
拣货员数量：正式拣货员+派遣拣货员


件均拣货时长（近30天）
件均拣货时长s
同比
任务单量
订单量



4.3 Function description

No.	Module	Function	Function Description
1	Project Dashboard	The overall situation	Describe the information related to the project going online process, used to manage the going online progress, which is initially defined as going online problem.
2		Process monitoring	Describe the effect and trend of the overall process and result indicators of the project warehouse, and the time for further investigation of abnormal process or result.
3		Single warehouse production data	Describe the effect and trend of the process and result indicators of the warehouse receipt warehouse of the project online, as well as the time for fine-grained investigation of abnormal process or result.
4		Group order process details	Describes the grouping process information of the project online warehouse, which is used to discover abnormal information about the grouping process.
5	Implement Dashboard	Correlation between order holding and picking efficiency	Describe the correlation information between the operation process and the execution effect and eliminate the doubts of the front-line execution on the effect of suppressing orders through the positive correlation conclusion.
6		Historical period can hold a single reference	This section describes the number of available orders in 10, 20, and 30 minutes in a historical day period, which is used as reference data for front-line operations.
7		Hold the top list	Describes the order information of online positions in descending order based on the filled order rate.

8		Hold on to your last list	Describes the order information of online positions in ascending order based on the filled order rate.

4.4 Indicator Description

4.4.1 Efficiency index

(1) Average picking time:

- Numerator: Total order set time of the day = sum of all order set time of the day (order set time: latest product scan time - earliest product scan time)
- Denominator: Total number of items in the current day order set = sum of all items in the current day order set
- Elimination logic: logical area elimination, including: YXP (abnormal products), PT (platform), NP (internal matching); Picking personnel retention, including formal picking personnel and dispatched picking personnel; Task list elimination, RT (anti-shelf task list in the library) and T (internal task list); Pick time to delete, including Pick time is empty. The order sets less than 1 month old and the storage time of picking goods more than 5 minutes were excluded

(2) Average picking time (month)

- Numerator: Total task time in a month = sum of all task time in a month
- Denominator: Total number of items in a current month = Sum of all items in a current month
- Elimination logic: logical area elimination, including: YXP (abnormal products), PT (platform), NP (internal matching); Picking personnel retention, including formal picking personnel and dispatched picking personnel; Task list elimination, RT (anti-shelf task list in the library) and T (internal task list); Pick time to delete, including Pick time is empty.

(3) Comparison of the effect of picking time per piece:

- Under the particle size of single warehouse, calculate the mean of the average picking time of one week before and one week after the launch of each online warehouse, and calculate the single warehouse effect based on the monthly results, and then summarize and average the overall effect of the online warehouse.
- Numerator: single warehouse size, the weekly size of the online warehouse is pushed forward by the whole week plus one day [average picking time of pieces] - The weekly size of the online warehouse is pushed forward by the whole week [average picking time of pieces]
- Denominator: single warehouse granularity, the weekly granularity of the whole week is pushed before the date of the online warehouse [average picking time of pieces]

4.4.2 Business Indicators

(1) Number of online warehouses:

- Calculation logic: Algorithm_new and value 1 in fdm_wms5_report_bs_systemconfig_chain is enabled. Or a bin with group list information
  (Group list information of the bin exists in fdm_wms5_report_ob_assign_batch_log_sratistics_chain).
- Elimination logic: Data before October 14 is excluded from the group single record warehouse

(2) Online business volume:

- numerator: number of algorithm-block orders (fdm_wms5_report_ob_assign_batch_log_sratistics_chain type= alg, and locate_shipment_count_actual)
- Denominator: the receiving time is the sum of [online warehouse] order quantity on that day

(3) Distribution on line:

- Category distribution: proportion of category in [online warehouse]
- Regional distribution: the regional proportion of [online warehouse]

(4) The single rate of storage:

- Index of single rate for all positions

- mol Numerator ecules: On the same day, the total number of orders greater than or equal to 3 is actually generated by the online warehouse (fdm_wms5_report_ob_assign_batch_log_OBlocate_shipme of assign_batch_count_expect greater than or equal to 3 in statistics_chain) nt_count sum)
- Denominator: sum of daily orders
  (sum of oblocate_shipment_count in fdm_wms5_report_ob_assign_batch_log_startstics_chain)
- Culling logic: Data prior to October 14 was removed

4.4.3 Weekly trend chart of Average Picking Time:

- Calculation logic: weekly average picking time.
- Numerator: Total task time in the current week = sum of all task time in the current week.
- Denominator: Total number of items in an order set in a week = sum of all items in an order set in a week.
- Elimination logic: logical area elimination, including: YXP (abnormal products), PT (platform), NP (internal matching); Picking personnel retention, including formal picking personnel and dispatched picking personnel; Task list elimination, RT (anti-shelf task list in the library) and T (internal task list); Pick time to delete, including Pick time is empty.

4.4.4 Suppress single rate

(1) Single rate index card:

- Look at both the expectation and the reality. The expectation is to see the on-site cooperation, and the reality is to see the implementation of the algorithm
- Numerator: On that day, the store expects or generates the total number of orders whose number is greater than or equal to 3 (fdM_wMS5_report_ob_assign_batch_log_OBlocate_shipme of assign_batch_count_expect greater than or equal to 3 in statistics_chain) nt_count sum)
- Denominator: sum of the order number of the current day (sum of oblocate_shipment_count in fdm_wms5_report_ob_assign_batch_log_statistics_chain)

(2) Number of pickers

- Calculation logic: Daily Trend of the current warehouse: total of formal and dispatched pickers in a day; Weekly Trend: total of formal and dispatched pickers in a week /7; Monthly Trend: total of formal and dispatched pickers in a month/number of days in a month
- Elimination logic: logical area elimination, including: YXP (abnormal products), PT (platform), NP (internal matching); Task list elimination, RT (anti-shelf task list in the library) and T (internal task list); Pick time to delete, including Pick time is empty.

(3) Single task

- Calculation logic: Daily Trend: indicates the total number of daily order sets, Weekly Trend: indicates the total number of weekly order sets, and Monthly Trend: indicates the total number of monthly order sets.
- Elimination logic: logical area elimination, including: YXP (abnormal products), PT (platform), NP (internal matching); Task list elimination, RT (anti-shelf task list in the library) and T (internal task list); Pick time to delete, including Pick time is empty

(4) Order quantity

- Calculation logic: Daily Trend: indicates the total number of orders under a single granularity of a daily task. Weekly Trend: indicates the total number of orders under a single granularity of a weekly task. Monthly Trend: indicates the total number of orders under a single granularity of a monthly task.
- Elimination logic: logical area elimination, including: YXP (abnormal products), PT (platform), NP (internal matching); Task list elimination, RT (anti-shelf task list in the library) and T (internal task list); Pick time to delete, including Pick time is empty.

4.4.5 Caliber screening

- Sets the number of lines of data per number of times
- Total count locate_shipment_count_actual summation
- Algorithm order set filter type = 'alg', then sum locate_shipment_count_actual
- WMS group order policy order filter type = 'WMS', then sum locate_shipment_count_actual
- The algorithm generates a set of single-number filters of type = 'alg' and sums assign_batch_count_actual
- WMS group single policy set single number filter type = 'WMS' and sum assign_batch_count_actual
- The algorithm produces a single number proportion of the set
- Set single number >=3 number of sets, filter locate_shipment_count_actual>=3 number of data lines
- Select the number of data rows/total number of data rows from locate_shipment_count_actual>=3
- Earliest operation time, time
- Latest operation time, time

4.5 Implementing Dashboard

- Correlation between holding order and picking efficiency: scatter distribution data of picking time of holding single quantity corresponding to a single task at a single granularity up to that day
- Historical period can be held for reference: under the day granularity, every 10/20/30 minutes the current warehouse receiving time is the trend chart visualized by the number of orders within the current time range
- Top & Last list

5 Value Evaluation

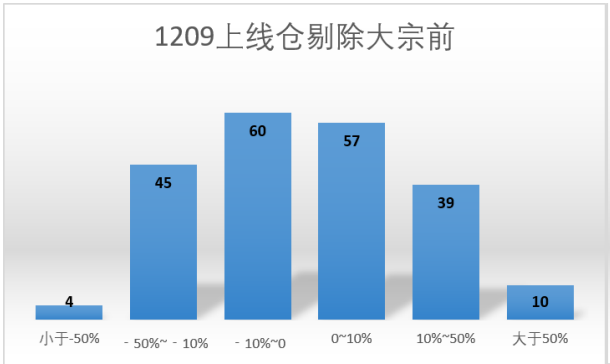
5.1 Value evaluation scheme

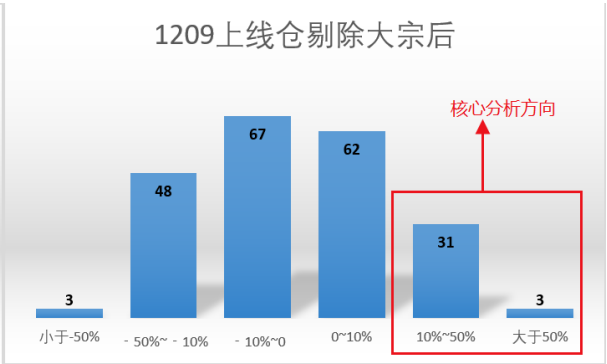
Offline and online (AB) schemes are adopted to carry out value calculation in parallel. The offline scheme looks at the improvement effect of picking time for all online warehouses from the business scope, and the online scheme focuses on real-time picking granularity to evaluate and calculate.

The off-line scheme focuses on the silo with poor lifting effect and conducts targeted analysis under single silo size. Online program this week data, algorithm to determine the final program, including engineering, real-time monitoring and guarantee two parts.

5.2 Offline evaluation:

- Picking time of all online warehouses is -0.86% from the last week of online (excluding bulk goods). Excluding the first 2.13%, bulk: a single SKU has a large number of goods picked at a single time, generally more than 1,000 pieces, which can be identified by the background logo).
- Single warehouse analysis: weekly distribution of pieces online.
- Single warehouse analysis: weekly distribution of pieces online.





5.3 Algorithm optimization

The current version of the algorithm is divided into 2 core steps to solve the set list a: Get an initial set list plan b: Based on the ruin & recreate algorithm, multiple iterations to improve the set list plan. This week we will try to improve these two processes.

For the initial solution strategy, 4 initial solution strategies have been implemented. 254 test cases were constructed based on the Beijing Book 1 warehouse collection order data. The minimum number of orders in the data set is 2 and the maximum is 869. The number of order logic areas is between 1-4. Set the expected collection singular number of each data set to be equal to the actual collection singular number to ensure that almost all orders will be placed in the collection order. In the case that the subsequent iteration strategies remain unchanged, the results of the 4 initial solution strategies are shown in the following table:

	Optimal number of final solutions	Best times as a percentage of data	Total number of roadways	Total number of roadways/the total number of roadways passed by the best solution of each data
Combination Algorithm	143	56.30%	1116937	1.0866
Optimal seed	130	51.20%	1185472	1.1533
Constrained hierarchical clustering	138	54.30%	1119839	1.0894
Best Fit	168	66.10%	1087159	1.0576
The best plan among the 4 plans	254	100%	1027929	1

Set the expected collection singular number of each data set = actual collection singular number/2+1. At this time, due to the upper limit of the maximum order number of the collection order, part of the orders will remain, and the calculation simulation should be performed again.

	Optimal number of final solutions	Best times as a percentage of data	Total number of roadways	Total number of roadways/the total number of roadways passed by the best solution of each data
Combination Algorithm	138	54.30%	836273	1.1366
Optimal seed	101	39.80%	1003934	1.3645
Constrained hierarchical clustering	136	53.50%	844706	1.1481
Best Fit	172	67.70%	822921	1.1185
The best plan among the 4 plans	254	100%	735757	1

Based on 254 data simulation evaluations, the Best Fit initial solution method has the best results. After evaluating more data, the initial solution algorithm will be more migrated to Best Fit. Best Fit is relative to choosing the best initial solution every time, the first scene evaluation objective function has 5% + downward space, and the second scene has 11% space. In most cases, when the initial solution is the best, the final solution is also better. When the calculation time is longer, a simple idea is to calculate several initial solution algorithms and select the best solution to participate in the subsequent iterative improvement process.

Appendix Single iteration specification for intelligent sets

Iterative Management

- Backlog - Manage inventory requirements
- Active iterations - Manage ongoing requirements
- Archived - Manages online and verified requirements

Iteration Plan

- Requirements: Confirm iteration optimizations every Wednesday afternoon
- Development: Finish feature development every Friday
- Testing: Complete functional testing every Tuesday
- Online: online at noon every Wednesday and notice

Specification details

1. Demand Research (required)

Participants: business, product, data analyst, algorithm engineer

(1) Business PD conducts research on demand and produces BRD

(2) Product PD takes an overview and survey of demand, and produces PRD (product, development and sorting parameters)

(3) Data analyst, according to the analysis results, propose corresponding demand change points, and PRD will be produced by product PD

(4) Algorithm engineer, according to the specific algorithm effect, take the initiative to propose optimization scheme, and PRD will be produced by product PD

Note: Product PD refers to unified demand export, analysis of demand feasibility and analysis of evaluation criteria

2. Requirements Review (Required)

Participants: Business, product, data analyst, R&D, testing

(1) Led by product PD, relevant business BP, R&D personnel and testing personnel participate in demand review, and project manager supervises implementation

(2) the products must need in PRD according to the results of PD BRD and business communication, including but not limited to: project background, scope, function implementation rules, the system interaction (flow chart, sequence, etc.), product prototype, UI&UX, dependencies between upstream and downstream system, evaluation index of mining algorithm, developers and testers supervise the implementation

(3) BRD requirement Review PRD change (addition, deletion and update) of sign off shall be strictly implemented according to the requirement change process specified by PMO, including but not limited to: Product PD shall organize relevant R&D personnel and testers to conduct demand review again, evaluate workload change and schedule adjustment, and project manager shall supervise the implementation.

3. Detailed Design Review (Internal - Required)

Participants: product, research and development, testing

Provide detailed design documents for development, review design documents for production and research, evaluate the scope of internal impact, and whether it has an impact on upstream and downstream businesses. R&D supervision and implementation

4. Test case review (Required)

Participants: product, research and development, testing

The test provides test cases, and the production and research institute review the test cases, puts forward the possible risks in the test process, and points out the things that need the cooperation of the production and research institute. Test supervision execution

5. System development (Required)

Participants: product, RESEARCH and development, testing

(1) Static code scan, security scan: use the relevant static code scan tool (such as Sonar), security scan tool incremental scan local iterative code, and require the repair of critical, serious problems

(2) The developer of function realization needs to do CR for the code to be submitted, and at least one experienced partner is required to participate in the test. The test students should also participate in the test. The proposed test code should be read and explained, and whether the code habits meet the requirements of JD code specification and the best coding habits specification, and whether the logical implementation is complete. The developer needs to fix the code based on the results of the review

6. R&D and testing (required)

Participant: R&D

(1) The R&D personnel use the cloud to check whether the test function meets the access requirements according to the test access requirements (self-test and joint test pass) and fill in the relevant information of the test function

(2) Any online changes can be launched only after passing the test and product confirmation, and it is forbidden to take a ride to launch (other people's needs or their own other needs are not allowed).

7.SIT test validation (Required)

Participants: testing, R&D

The test requires comprehensive functional testing, defect recording, BUG verification and regression testing of the test function in the SIT test environment according to the test score document, and this stage is a recurring stage, which needs to be paid attention to the following points:

(1) Smoke test and admittance check should be done for the test function. If the smoke test fails or the admittance only needs to be called back by email

(2) the tester in the test environment test pass, notify acceptance product manager, product manager, acceptance through and then notify the business personnel in the test environment for acceptance, acceptance by sending the test report after all (testers evaluate online cannot cover the use case scenarios and reflect to the test report), the project manager to supervise the implementation.

(3) Interface changes, R&D personnel and testers need to coordinate with the interface caller, and the project manager supervises the implementation

8. System test

(1) The functions of the SIT test should be verified end to end from the system perspective. A complete test report can be provided at this stage

(2) At this stage, the pressure/load test can be carried out on the system under test to verify that the system design meets the performance requirements. At this time, the pressure test plan and pressure test report should be provided

9. Review of online plan (Mandatory)

Participants: business, product, R&D, testing

After passing the system test, it is necessary to review the release plan of all systems to be launched. The proposal of the release plan shall be led by Dev and approved by all relevant parties, and shall include (but not limited to) the following contents:

(1) Background of this iteration

(2) List of function scope and influence scope evaluation of this online launch

(3) Changes to resources and code (including but not limited to)

- Release package upgrades

- Dependency package changes (replacements, version changes, etc.)
- Middleware configuration changes
- Database Changes
- Apply configuration changes

(4) Checklist and plan need to be implemented in person and time nodes

(5) Release order

(6) Gray scale scheme (if any)

(7) Emergency plan

- Rollback scheme
- Business degradation options (if any)
- Other emergency measures (such as system notification)

(8) Configuration manual of new or iterative functions for business PD based on development functions

10. Pre-release Verification (UAT)

Participants: business, product, R&D, testing

(1) Release and deploy the application in the pre-release environment according to the release plan to verify whether the release plan is correct and reliable, etc. Meanwhile, the application needs to be verified in the pre-release environment

(2) Requirements of pre-release environment (such as single warehouse UAT proposed by requirements, after the COMPLETION of UAT, it needs to be verified in 10+ warehouses, or it can be directly merged with branches to go online)

11. Online release & Online verification (Required)

Participants: business, product, R&D, testing

(1) Release time requirements: according to the normal launch and emergency launch, the normal launch release time is Tuesday and Thursday, emergency launch does not limit the release time

(2) Normal launch requires that the launch requirements have been scheduled and meet the release standards. The launch times of each application should not exceed 2 times on the launch date, which will be postponed to the next launch date.

(3) Emergency launch (major defect, major impact demand), requiring the product, development and testing to confirm that the launch demand is an emergency demand. The product or development department shall send an emergency launch email, send the directly subordinate leaders and other leaders for approval, and copy the person in charge of the second and third level departments.

(4) Release standards: Release and deploy applications according to the release plan, including monitoring logs, database, etc., and the products and businesses have passed the acceptance in the test environment; Meet test end standards, including 100% test case coverage and 100% defect repair rate of grade I, II and III)

(5) The online functions need to be verified in the production environment

12. Actual use effect of monitoring algorithm (Mandatory)

Participants: business, product, data analyst, algorithm engineer, testing.

After the requirement goes online, it is necessary to monitor the actual use effect of the algorithm, and extract optimization points and test points from it.

13. System operation and maintenance