The Invention relates to a Tobacco Silk Big Data and AI Development Platform and its Application

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Abstract: In recent years, big data and AI technology has been widely used, and the traditional manufacturing industry has also obtained a huge space for technological transformation and upgrading. For tobacco silk production, due to its abundant sensors in the production line and high degree of automation, it has unique advantages in the application of big data and AI technology; At the same time, due to the complexity of its production process and technology, the application of big data and AI technology is facing challenges. Therefore, this paper designed a graphical silk making big data and AI development platform to accelerate the application of big data and AI technology in tobacco processing and manufacturing industry.

Keywords: Big data; aritificial intelligence; tobacco industry

1. Introduction

With the rapid development of sensor technology, semiconductor manufacturing process and communication technology in recent years, big data and artificial intelligence technology have been widely used, which has a significant impact on society and people's livelihood as well as all walks of life, and the traditional manufacturing industry has also obtained a huge space for technological transformation and upgrading. For tobacco silk production, due to its abundant sensors and high degree of automation in the production line, it has unique advantages in the application of big data and AI technology; At the same time, due to the complexity of its production process and technology, how to effectively use big data and AI technology also has certain technical difficulties and challenges.

The combination of tobacco silk and big data and AI technology has at least the following challenges: First, the production of tobacco silk is a continuous process, compared with discrete process, itself has a higher complexity, and it is also more difficult to combine with AI algorithm; Second, tobacco quality identification largely depends on the sensory evaluation of the appraiser, this part of the qualitative index is not good at computer content; Third, although there is a lot of data in the process of silk production, the quality of the accumulated data is not high, and the available data is not much, which can not meet the requirements of AI algorithms. This is a common problem in all walks of life, before the use of big data and AI technology, it is difficult to accurately grasp their data needs.

For large and complex systems and processes such as tobacco manufacturing, big data and AI are bound to find a place where they can play an important role. Big data and AI are not subversive or major changes to the tobacco manufacturing industry, but try to make great improvements in some aspects of tobacco manufacturing that computers are good at. Therefore, before the application of big data and AI technology, first of all, it is necessary to explore and apply the whole process of the silk production line in a large range, and according to the exploration results, it is possible to determine which links have the basic conditions for the application of big data and AI, and may obtain good results. This requires a user-friendly, low threshold to use, customized graphical big data and AI development platform for silk production, based on this platform to quickly explore and try big data and AI applications, find the entry point to improve the quality and efficiency of silk production, and finally improve.

This paper first designed the graphical big data and AI development platform for silk making, and based on this platform, studied the technology of improving the quality and efficiency of silk making production. The R & D platform includes core modules such as customized data processing and customized AI, which are used to support big data processing and AI applications in silk making. In the scenario of tobacco quality improvement, correlation analysis between tobacco quality and process parameters is realized based on this platform to assist in improving the production quality of silk making; In the production planning management scenario, based on the platform practical silk production intelligent production scheduling, improve the production efficiency of silk.

2. System Architecture

In order to improve the construction efficiency and resource reuse rate of big data and artificial intelligence applications, get rid of the traditional dedicated system-oriented, one-to-one "chimney" construction mode, adopt the component-oriented design idea, encapsulate and model various big data and artificial intelligence resources, form different resource components, and then divide the components according to functions. Assemble into a graphical big data and AI development platform, and based on this platform, develop the correlation analysis case of tobacco quality and process parameters, and the intelligent production scheduling case of silk production.

Among them, (1) The functions of the graphical Big Data and AI development platform are: to provide a convenient development platform for the development of big data and AI applications in the tobacco manufacturing industry, including: Towed WYSIWYG human-computer interaction basic environment, equipment convergence and standardization module set, silk data processing module set, silk artificial intelligence application module set, artificial intelligence modeling process running engine; (2) The function of the correlation analysis case of tobacco quality and process parameters is as follows: based on the graphical big data and AI development platform and

various algorithm sets provided by it, the correlation analysis of tobacco quality and process parameters is completed, and the improvement of tobacco quality is assisted; (3) The function of intelligent production scheduling case of silk production is: based on the graphical big data and AI development platform and various algorithm sets provided, complete intelligent production scheduling of silk production and help improve the production efficiency of silk production.

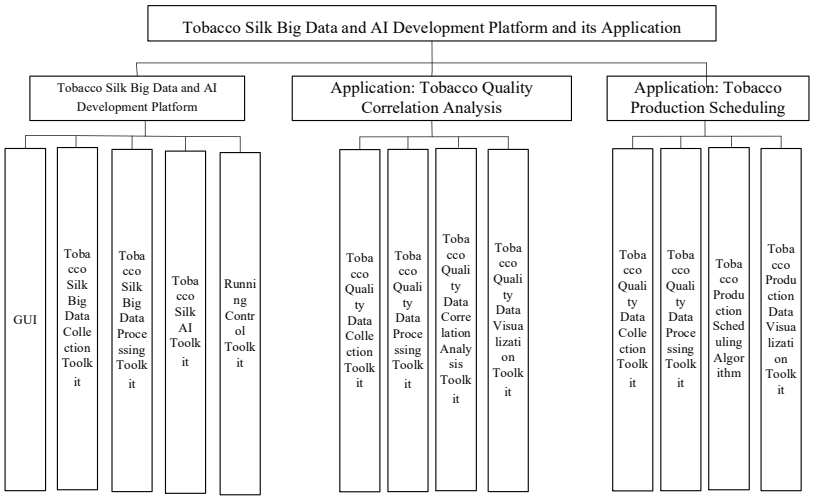

FIG. 1 Architecture diagram of graphical big data and AI development platform

3. Graphical Big Data and AI Development Platform Subsystem

3.1. Use of Sub-system

Before the application of big data and AI technology, it is first necessary to explore and apply the whole process of the silk production line in a large range, and according to the exploration results, it is possible to determine which links have the basic conditions for the application of big data and AI, and may obtain good results. This requires a user-friendly, low threshold to use, customized graphical big data and AI development platform for silk production, based on this platform to quickly explore and try big data and AI applications, find the entry point to improve the quality and efficiency of silk production, and finally improve.

In order to achieve the above purposes, a graphical and dragging-type big data and AI development platform for silk making is designed to support the development of big data and artificial intelligence applications in the process of silk making, and to support the improvement of the quality and efficiency of silk making production.

3.2. Composition of Sub-system

The graphical big data and AI development platform sub-system is composed of the following four parts: graphical human-computer interaction environment, data aggregation and standardization module set of silk making equipment, big data processing module set of silk making, artificial intelligence application customization module set, artificial intelligence modeling process running engine.

Among them, (1) the function of the graphical human-computer interaction environment is: to provide a convenient development platform for the big data and AI application development of tobacco manufacturing industry, including: project management area, work area, console, component area, menu and toolbar; (2) The function of data aggregation and standardization module set of silk making equipment is to gather and standardize the data of silk making equipment, so as to facilitate the subsequent AI application development; (3) The function of the big data processing module set is to process the standardized data of the silk making equipment for the purpose of subsequent data analysis or AI application development; (4) The functions of the custom module set of artificial intelligence application for silk making are as follows: including various artificial intelligence algorithm modules, which are used to support the AI application in silk making production; (5) The function of the artificial intelligence modeling process running engine is to provide the underlying operation support of the AI modeling process, which is used for debugging or running the AI modeling process.

3.3. Sub-system Information Processing Process

The information processing flow inside the graphical Big Data and AI development platform sub-system is as follows: (1) In the graphical human-computer interaction environment, users use graphical, drag, WYSIWYG ways to carry out various operations of big data and artificial intelligence application development; (2) According to the needs of big data and artificial intelligence application development, users call modules such as data aggregation, data processing, and artificial intelligence algorithms respectively to build big data and artificial intelligence application processes; (3) After the completion of the big data and artificial intelligence application process construction, the user uses the modeling process engine to run and debug the big data and artificial intelligence application process. If there is a problem, the user returns to the second step to modify and re-run until the big data and artificial intelligence application process runs correctly, then the

big data and artificial intelligence application development process is completed.

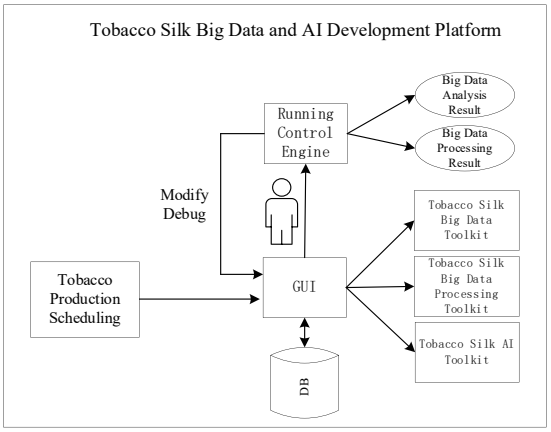

FIG. 2 Application flow chart of graphical big data and AI development platform

4. Correlation Analysis Sbsystem of Tobacco Quality and Process Parameters

4.1. Component of the Subsystem

As shown in the following figure, the correlation analysis system of tobacco quality and process parameters is composed of data aggregation component, data preprocessing component, correlation analysis component and visual display component. Among them, (1) the data aggregation component is responsible for: the import raw material index, equipment configuration parameters, process state data, and export tobacco index data are aggregated; (2) Data preprocessing component is responsible for preprocessing import raw material data, equipment configuration parameters, process status data and export tobacco index, including format conversion, unit conversion, outlier screening and other processes; (3) The correlation analysis component is responsible for: aiming at the export tobacco index, analyzing the data related to the export tobacco index, and providing the correlation measurement quantitative index; (4) Visual display component: Based on the correlation analysis results of export tobacco indicators, visual display in the form of ICONS is convenient for users to understand.

4.2. Correlation Analysis Process

As shown in the following figure, the correlation analysis process between tobacco quality and process parameters includes the following steps: (1) Data aggregation. All kinds of data are gathered from the hardware and software of various production systems, including: import raw material index, equipment configuration parameter, process state data, export tobacco index data, etc. (2) Data preprocessing. All kinds of data are preprocessed, including: format conversion, unit conversion, outlier screening and other processes. (3) Correlation analysis. Aiming at export tobacco index data, correlation analysis was carried out to obtain various quantitative indicators of correlation measurement. (4) Visual display. Display the correlation analysis results in chart form.

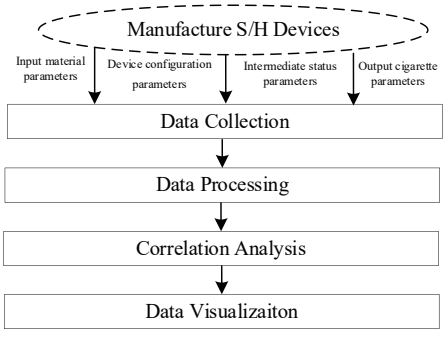

FIG. 3 Correlation analysis flow of tobacco quality and process parameters

5. Intelligent Scheduling Subsystem for Silk Production

5.1. Intelligent Production Scheduling Problem

Definition 1 (intelligent scheduling problem) : Assuming that there is only one production line with sufficient raw materials and orders arrive evenly, order scheduling is carried out to minimize inventory and late delivery costs. Let the working time of the production line be h hours per day, the minimum production unit be mpn, the production cycle of the minimum production unit be mpt, the output per unit time be pn, and the inventory cost be cpd. Let the existing order set O:{o0,o1,... om-1},, the attribute set of the order is {idk,pdtk, adtk,regionk,numk,typek,cpdk}. Where, idk is the order number, pdtk is the promised delivery time, adtk is the planned delivery time, regionk is the delivery place,numk is the quantity of the goods,typek is the size and model of the goods, and cpdk is the late delivery cost. In

the intelligent scheduling problem, a production batch sequence P:{p0,p1,...,pn-1} is obtained based on the prediction of existing orders and future orders, such that the value of the objective function is minimized if the constraint conditions are met. Where, the objective function and constraints are as follows:

Objective function:. Where, represents the sum of inventory costs for all orders, represents the planned delivery date for order k, represents the committed delivery date for order k, represents the inventory cost for order k, and if the actual delivery date is later than the committed delivery date then the inventory cost is zero; Represents the sum of late delivery costs for all orders, which is the late delivery cost for order k, and the late delivery cost is zero when the actual delivery date is earlier than the promised delivery date. α and β are the adjustable weight coefficients of inventory cost and late delivery cost, respectively.

Constraints: The intelligent scheduling problem needs to meet the following two constraints:

(1) The production batch sequence P meets the conditions:

(2),, production batch or .

5.2. Sub-system Composition Structure

The intelligent scheduling sub-system of wire production is composed of the following components: data aggregation component, data preprocessing component, intelligent scheduling component and visual display component. Among them, (1) the data aggregation component is responsible for: importing and gathering the data related to the intelligent production scheduling sub-system from the production planning management system, equipment data acquisition system, procurement materials management system and other systems. (2) Data preprocessing component is responsible for preprocessing data such as production tasks, equipment capacity and raw material quantity; (3) Intelligent scheduling algorithm: taking production tasks, equipment capacity, raw material quantity and other data as input, running intelligent scheduling algorithm to obtain the optimal production plan under the constraint conditions. (4) Responsible for visual display components: Based on intelligent production scheduling results, visual display in the form of ICONS is convenient for users to understand.

5.3. Sub-system Process

In the process of intelligent scheduling of silk production, the following steps are included: (1) data aggregation. Import and gather the data related to the intelligent production scheduling sub-system from the production planning management system, equipment data acquisition system, procurement materials management system and other systems. (2) Data preprocessing. All kinds of data are preprocessed, including: format conversion, unit conversion, outlier screening and other processes. (3) Intelligent scheduling algorithm. With the production task, equipment capacity, raw material quantity and other data as input, the intelligent production scheduling algorithm is run to obtain the optimal production plan under the constraint conditions. (4) Visual display. Display intelligent scheduling results in chart form.

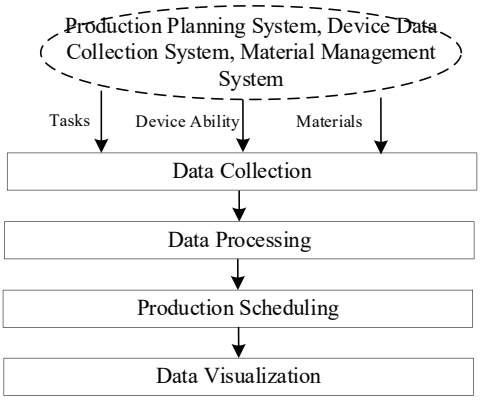

Figure 4 Intelligent scheduling flow chart

6. Summary and Prospect

This paper designed a graphical big data and AI development platform to provide a convenient development platform for the big data and AI application development of tobacco manufacturing industry. Based on this platform, quality correlation analysis and intelligent production scheduling and cases of silk production are completed, which has positive significance for improving the quality and efficiency of tobacco silk production.

In the follow-up research, the platform's functions and component types will be further enriched, and the platform will be iteratively optimized in more production scenarios and application cases, and the supporting role of the platform for intelligent tobacco production will be continuously enhanced.

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