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Original Research Article

Artificial intelligence for product formation

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Abstract

In this paper artificial intelligence in process system product formation was studied. The process intelligent analysis have defined. How artificial intelligence works has examined. Artificial intelligence programs are programs that exhibit behavior normally identified with human intelligence. The expert systems are programs that contain the knowledge of human experts, encoded so a computer can understand it. A human like reasoning mechanism uses this knowledge to solve problems in specific domains. Artificial intelligence architecture for chemical product formation has developed. Intelligent simulation and diagnosis have defined.

Keywords: *process system, human exhibit, mechanism, knowledge coded, intelligent analysis.*

1. Introduction

The practice of the process engineering has benefited greatly from the continuing explosion of scientific and engineering knowledge. The result is not only a tremendous increase in the depth of our understanding but also a much wider geographic application of it. No longer are the benefits limited to a few industrial nations. It is now a necessity worldwide that the process industries, as well as others, carry out their missions in the most efficient and economic manner possible.

The process industry has undergone significant changes during the last decades due to the increased cost of energy and increasingly stringent environmental regulations. Modification of both plant design procedures and plant operating conditions have been implemented in order to reduce costs and meet constraints.

Most industries observers believe that the emphasis in the near future will be on improving efficiency, and increasing profitability and safety of existing plants rather than on plant expansion. The use of scientific methods in process intelligent analysis is not new, but we certainly can observe a more pronounced impetus in this area. Scientific methods mean the gathering of information, the analysis of this information by suitable techniques, synthesis, and decision making, all utilizing a framework. This trend will no doubt continue in the future as new methods are developed and as the available tools become more sophisticated [1]-[7].

Developing competence in process safety requires a dual capability on the part of the engineer.

First, and most obvious, he must command a sound and versatile background in engineering.

Second, he must be perceptive enough to find where the techniques and methods described can be employed with great effectiveness.

This paper outlines artificial intelligence, human assisted intelligent computing, process development, operation and product formation.

2. How artificial intelligence operates

Artificial intelligence is a real computer program. The concepts and techniques used in building these programs are part of a field known as artificial intelligence.

Artificial intelligence programs are programs that exhibit behavior normally identified with human intelligence, but until recently, not with computers. In particular, artificial intelligence programs seem to grasp concepts and ideas. Some understand natural language, some can see. Others can infer new information.

The people leverage occurs because artificial intelligence systems have the knowledge and reasoning powers to advise and consult with people so that the people perform their jobs more expertly and appear smarter than they would otherwise.

The leverage for people translates to leverage for companies. For example, the artificial intelligence programs developed help the firm's oil-exploration experts evaluate seismic data to locate oil. The seismic data are measured with proprietary tools. The firm's artificial intelligence objective was to improve its competitive position and generate an additional million a year in sales - of- service revenues for the use of just one particular tool.

Another group of artificial intelligence systems provides intellectual leverage. Artificial intelligence programs have also demonstrated leverage in the equipment diagnosis and financial services fields.

Artificial intelligence program falls into three basic categories: expert (or knowledge base) systems and the tools to build them, natural language (every day native language) systems, and perception systems for vision, speech, and touch.

This encoded knowledge and reasoning mechanism; expert system can tackle problems that are beyond the reach of conventionally programmed computers [8].

One of the most important types of artificial intelligence programs associated with expert systems are artificial intelligence application development tools. These tools help artificial intelligence novices (expert also) build and maintain their own expert systems. And therein lies their vale-because these tools are available to the artificial intelligence non-expert, they facilitate the spread of artificial intelligence technology and artificial intelligence applications into interested organizations.

The second artificial intelligence area, call natural language systems, encompasses programs that understand the native language of the user, such as English. The most popular natural language systems are those that act as interface to databases. These interfaces allow database users to query databases in fairly unconstrained English instead of formal query languages. This makes database information accessible to non-computer professionals.

The third type of artificial intelligence programs are simple perception systems for vision, speech, and touch [9]. Computer vision systems, for example, can interpret visual scenes and decide if objects meet inspection standards and quality control criteria, or move a robot to the proper location to grasp a part for manufacturing.

3. Process intelligent analysis

The rapid development process intelligent analysis, system engineering, or operation research as an essentially interdisciplinary field has brought into usage an inevitable proliferation of terms and concepts. Such terms as *system*, *model*, *variable*, *process*, and *diagnosis* have been used in quite different connotations. Process intelligent analysis refers to the application of scientific methods to the recognition and definition of problems and the development of procedures for their solution. In more detail, this means logical specification of the problem for the given physical situation, detailed analysis to obtain models, and synthesis and presentation of results to ensure full comprehension [10]-[14].

The *process* denotes an actual series of operations or treatment materials as contrasted with the model, which represents a linguistic, logical, mathematical description of the real process [3]-[5].

System is the assemblage of elements which are tied together by common flows of materials, energy and information. The output of the system is a function not only of the characteristics of the elements of the system, then also of their interactions and interrelations.

Parameter is the property of the process and its environment, that can be assigned arbitrary numerical values, also, a constant or coefficient in an expression.

Simulation is the study of the system or its parts by manipulation of its representation or its physical and mathematical model.

Simulation is relative new discipline supported by computer. Universal application is making difficulty for its directed development to exact scientific discipline. Today simulation is single discipline and as method necessary part of operational investigation of complex system. Simulation is caring out operation on model. It was accepted definition that simulation is represented dynamic behavior of the system which move from state to state according to defined operation procedure. If model is result of abstraction of the real system by application of the systematic analysis and defined modelling principles then simulation is procedure development for obtained model solving by computer.

In experimental procedure at the work by simulator need to identifying variables and determine their interrelations. Simulation is procedure which integrating collected data of the real system, creating conceptual model, algorithm development and programming, experiments carried out with this simulation program and results analyzing of their experiments.

By simulation experiments is carrying out the parameters values are obtaining during the process simulation, that is similarity with physical experiments. Advantage is, that simulation enabling virtual system representation and difference in results depends only from controlled input parameters. Requested modifications follow results analysis, it gives iterative character in achievement new knowledge about system and innovation technology development. The optimization procedure can be built in simulation model on different levels.

The first reason to use simulation in problems solving, the second knowledge increasing about phenomena, the third reason is abstract system investigation, and fourth innovation technology producing.

Diagnosis means gathering information, formulating hypothesis and testing hypothesis. Sometimes, it may need to be done several times if the hypothesis formulated turn out negative. The end of this process can make possible repair the fault [1], [5].

Process intelligent analysis involves an examination of the overall process, alternative processes, safety and economics. If a wise choice is to be made, the cost of a project must be known and compared with the cost of other projects. In the same manner, the possible benefits of each alternative must be known in a fashion that will permit comparison. Cost estimates for various systems are vital not only because new system proposals are very expensive but also because there are so many systems competing for consideration.

The *system approach* brings together the techniques of engineers of varied backgrounds and training as well as the operating personnel who are or will be the system's users. The viewpoint must be one of an overall approach based on the functional requirements the system must satisfy. These, can be expressed in terms of desired outputs for given inputs and parameters. Furthermore, analysis often incorporates dynamic analysis, in contrast to the more classical steady-state studies [15],[17].

There are certain characteristics of the process industries make them differ from other industries, namely they are a complex structure of many stages each containing many subcomponents. The equations describing the relationships among the important variables range from the very simple to the very complex. Since such a large flow of material having a fairly high economic value takes place, even small change in design and operating characteristics may have considerable economic impact. Finally, the characteristics of the subcomponents of the process are usually not well enough known to permit the engineer to rely solely on theory for design, operation, optimization, control and safety.

There are two main tasks in the process industries with which engineers are ultimately concerned, the safe operation of existing plants, and the design of new or modified safe plants.

In the area of operations, control, optimization and safety of performance stand out as four of the main functions of engineers. For the engineer to be effective in these areas he must conduct a sophisticated analysis of the process itself [3].

Computers must be instructed so that the relations describing individual parts of the plant can be combined, the basic parameters in those relations must be evaluated, and qualitative aspects of criteria must be made more quantitative.

The second task, that of safety design, is in a sense more difficult. Actual plant data are, of course, not known before hand, and the engineer must employ a certain amount of intuitive judgment, concerning environment and people. On the other hand, when modifying existing plants or designing plants similar to those already built, the engineer can draw more heavily on experience. The construction of theoretical or semi -theoretical mathematical models frequently is a necessary prelude.

All design, operation, optimization and diagnosis can be facilitated by simulation of the process its parts. For one thing, management rarely cares to have engineers arbitrarily make changes in a successfully operating plant in order to see what will happen. Also, models of the process may be more easily manipulated than the plants themselves. For example, operation outside of normal ranges can be simulated, and the plant can even be "blown up" in order to find forbidden areas of operation, or safety examination.

4. Artificial intelligence for product formation

The model's manager operations perform real time process operations on various levels. Model manager shows how do you seek out a new way to the operation life cycle model and how do you make process history.
The segregation of the databases, knowledge base systems and inference engine allows us to organize the different models and domain expertise efficiently because each of these components can be designed and modified separately.

The knowledge representation of differential models is described using semantic network. It provides rigorous on-line modelling tools for the process design and operation and raw material and energy minimization. Raw material minimization was simulated seeking out optimal initial materials ratio. Energy minimization was provided by heat recovery simulation. This simulation integrates data bases for component data, experimental data, dynamic data and model parameters tables with structured knowledge representation subsystems.

The model generation methodology is a blend of several problem solving paradigms, and hierarchical dynamic goal system construction serves as the basis for model generation. Database protocol manages all data bases, reports and tables as linking objects.

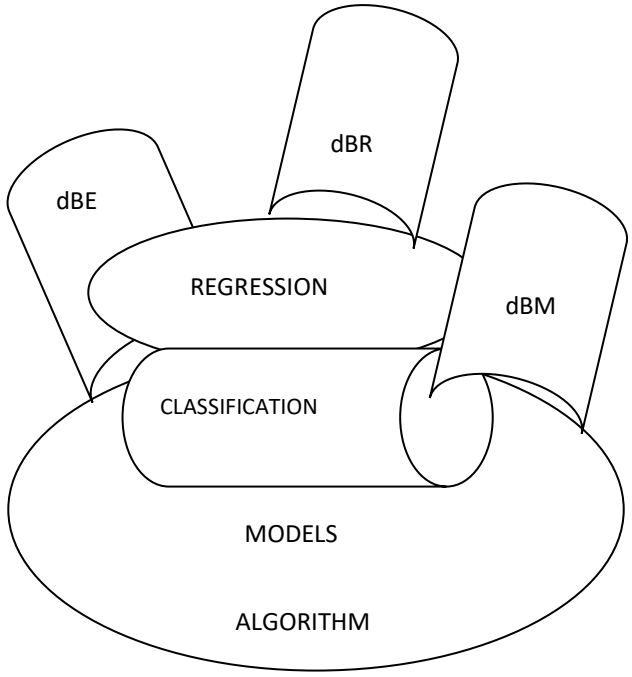


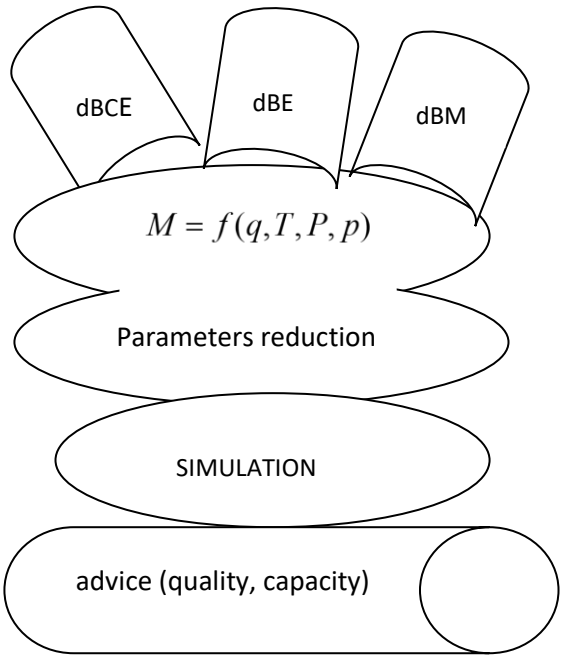
Fig. 1 How make AI

dbE – input data base of the available (experimental) data, dbR-input raw (material) data base, dbM-input market parameters data base.

5. The case study- Product production

Let consider from naphthenates lubricant formation. The main reactant is unknown mole weight. The second reactant can be hydroxide lead, zinc, cobalt etc.

How can artificial intelligence assist chemical process engineer.



where M -model, q -quality (concentration), P -pressure, T – Temperature, p -parameters, dBE - input data base of the available (experimental) data, dBC- input (component and materials) data base, dBM– input (map market) parameters data base.

Fig. 2 How uses AI

Methods for parameters expression and reduction have shown in the previous paper [18]-[21].

6. AI benefits

From a more general view point, process intelligent analysis and simulation have the following benefits:
Economical experimentation. It is possible to study existing processes more quickly, economically, and thoroughly than in the real process. Simulation can compress or expand real time in some what the same fashion that a motion picture camera can take slow motion real plant. Also, it is possible to establish critical patterns in performance.

Study of commutability and evaluation of alternate policies. New factors or elements of a system can be introduced and old ones removed while the system is examined to see if these changes are compatible. Simulation makes it possible to compare various proposed designs and processes not yet in operation and to test hypotheses about process systems before acting, and hypothesis of fault diagnosis [22].

Replication of experiments. Simulation makes it possible to study the effect of changes of variables and parameters with reproducible results. Error can be introduced into the model at will and removed, which cannot be done in a real plant.

Safety aids. Simulation safety aids materially in the study of closed - loop and open - loop with artificial intelligence tools can be very intelligent and useful.

Test of sensitivity. The sensitivity of cost parameters and basic system parameters can be tested; for example, conceivably a 10 percent increase in input rate could have either a minimal effect or a serious effect on plant performance.

Study of system stability. The stability of systems and subsystems to disturbances can be examined, and their effects to safety observation process.

Simulation can compress or expand real time in somewhat the same fashion that a motion picture camera can take slow motion or rapid motion pictures, hence the operation of the system is more easily observed and tested.

Extrapolation With suitable mathematical model it is possible to test extreme ranges of operating conditions, some of which might be impractical or impossible and unsafe to use in a real plant. Also, it is possible to establish critical patterns in performance.

7. AI and technical unemployment

A survey of economist showed disagreement about whether the increasing use of robots and AI will cause a substantial increase in long-term unemployment, but they generally agree that it could be a net benefit if productivity gains are redistributed.

Unlike previous waves of automation many middle-class jobs may be eliminated by artificial intelligence; The economist states that "the worry that AI could do to white-collar jobs what steam power did to blue-collar ones during the industrial revolution " is "worth taking seriously.

8. Discussion

1. The process intelligent analysis has defined.
2. Artificial intelligence method for product formation was provided.
3. The intelligent simulation for innovation has defined.
4. Parameters model has derived.
5. Diagnosis method was defined.

9. Conclusion

How AI for process systems works has shown in this paper. The intelligent process system analysis has defined.

If modelling bridge between real system and model, then simulations connecting computer device which activate mechanism into model.

The intelligent simulation procedure has developed. The intelligent simulation has significant roll in innovation development.

Artificial intelligence programs do not substitute for people, but they give people leverage.

Abbreviation

AI- Artificial Intelligence

Notation

M - model

q - quality(concentration)

P - pressure

T - temperature

p - parameters, p

dBE – input data base of the available (experimental) data,

dBC - input (component and materials) data base

dBM – input (map market) parameters data base.

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