unit can be represented as a decomposition of an abstract non-atomic agent (Figure 4).

abstract non-atomic sc-agent of unit-simulator operation

⇒ *decomposition of abstract sc-agent**:

{
- *abstract sc-agent of input signals processing*
- *abstract sc-agent of output signals generation*

}

Figure 4. Decomposition of the abstract non-atomic sc-agent of the operation of the simulator unit of the CS SM of TP

The operation of the simulator unit depends on some set of input signals that may be a result of operation of other simulator units or signal generator units. The simulator unit must process them and generate the appropriate output signals according to certain rules. Thus, in the context of the OSTIS ecosystem, the agent of the simulator unit operation is represented by a set of two agents for processing input signals and generating output signals.

Figure 5 shows a block diagram of a control system for a probabilistic technological process when modeling the problem of stabilizing operating parameters by searching for an optimal strategy for servicing TP devices.

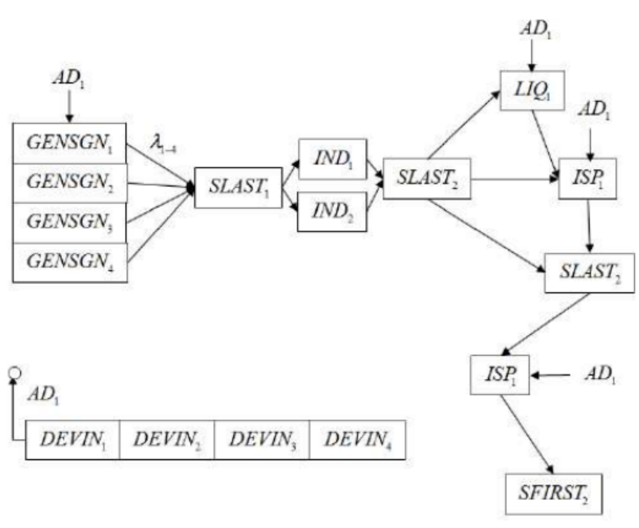

Figure 5: Example of a PTP control system

This control system is responsible for the execution of the technological cycle, during which maintenance of technological cycle equipment devices can occur, as well as the elimination of equipment failures and the elimination of emergences when they occur. The equipment of the technological cycle is represented by 4 devices for individual use, each of which performs a corresponding microtechnological operation

$GENSGN_{1\text{-}4}$ are signal generator units, the intensity of which is set by the corresponding distribution of reliability characteristics of equipment devices. The intensities of the generated signals during the simulation process determine the probability of failures occurring in the corresponding devices.

Synchronizer $SLAST_1$ (type "AND") starts the process of indicating equipment (IND_1) and control variables (IND_2). If an accident is indicated on one of the equipment devices, the consequences of the accident are eliminated (LIQ_1). If the specified intensity value of the control variable (variables) (U) is exceeded, the corresponding device is serviced (ISP_1 - the corresponding operation is performed). If the maintenance was completed or was not performed, microtechnological operations determined by the technological process are performed on each of the devices.

When the $SFIRST_2$ unit is executed, the technological cycle finishes it's operation.

VII. Conclusion

The paper proposes a method for constructing a new generation intelligent computer system for adapting the control of the technological cycle of automated production with control feedback in the presence of random disturbances and external control influences in the integrated environment of open semantic technologies for designing intelligent systems OSTIS. Control feedback is formed on the basis of algorithms for constructing neuroregulators using simulation modeling to find the optimal control adaptation strategy according to specified criteria. An example of a simulation model of a TP control system is given when solving the problem of servicing TP equipment devices and a method for describing its elements within the OSTIS ecosystem is given.

When considering the problem of synthesizing the optimal structure of a technological system with an arbitrary organization of the technological production process and stabilizing the parameters of technological operations, algorithms for constructing control feedback based on genetic algorithms and artificial neural network models were implemented. Stabilization of the parameters of technological operations is carried out within the framework of solving the multi-criteria problem of assessing the quality of the technological process while minimizing the costs of performing a closed technological production cycle based on effective control adaptation algorithms.

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СТАБИЛИЗАЦИЯ ПАРАМЕТРОВ ТЕХНОЛОГИЧЕСКИХ ОПЕРАЦИЙ ПРИ НАЛИЧИИ ВНЕШНИХ УПРАВЛЯЮЩИХ ВОЗДЕЙСТВИЙ

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Предложена новая методика формализации вероятностных технологических процессов при стабилизации параметров функционирования технологических операций с использованием открытых семантических технологий проектирования интеллектуальных систем. Для стабилизации параметров технологических операций в режиме реального времени представлена процедура адаптации управления под изменяющиеся внешние управляющие воздействия на основе разработки алгоритмов нейрорегуляторов интеллектуальной системы стабилизации, реализующих обратные связи по управлению. Изложены принципы создания и разработки системы стабилизации параметров и контроллера автоматизированной системы управления технологическим процессом.

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Crowd Attention Estimation Automatisation Based on Semi-Automatic Image Semantic Segmentation by Using UNet and CRF Networks

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***Abstract*—Semantic segmentation of crowd images plays a pivotal role in various applications such as crowd management, surveillance, and urban planning. In this paper, we propose an approach for dense and sparse crowd image semantic segmentation based on semi-automatic labeling by employing a combination of UNet and Conditional Random Field (CRF).**

We introduce a technique for generating segmentation maps for crowd images. We utilize UNet for initial rough segmentation followed by refinement using CRF. Experimental results demonstrate the model performs better in binary segmentation (crowd and on-crowded regions) rather than ternary segmentation (dense crowds, sparse crowds, and non-crowded areas). However the latter shows better results in terms of crowd detection (regardless of its type). Besides, we show the CRF refinement is significant in ternary segmentation.

Also, we highlight some crowd behavior patterns based on the proposed segmentation model. They differ in people's attention types, connections within and between crowds, and possibilities of emergencies.

***Keywords*—artificial neural networks, computer vision, crowd images, crowd detection, crowd behavior, image analysis, machine learning, semantic segmentation**

I. INTRODUCTION

Segmentation is the process of breaking the image into distinct segments or regions that represent objects of interest or their structure. Image segmentation is one of the pivotal stages in computer vision and image analysis. The main purpose of segmentation is to highlight key objects and their features for a more detailed understanding of the content represented in the image. More rigorously, during image segmentation, a label representing a certain class is assigned to each image pixel so pixels in the same class stand for a joint object and demonstrate some shared characteristics, and pixels with different labels somehow differ from each other.

Image segmentation can be compared with a classification task with some initial classes given. However, the image classification task implies a label for the whole image as the result, whereas in semantic segmentation, a label is assigned to each image pixel. Thus, unlike classification tasks, not only does segmentation have a purpose to determine the main object of interest but also to examine its optical and morphological characteristics like its edges, position on the image, and its position relative to other objects (if any).

In computer vision, there are two main types of image segmentation: semantic and instance segmentation. In semantic segmentation, each pixel must be associated with one of the predefined classes (e. g. background, person, vehicle, building, etc.), and such classes are represented by their colors. In instance segmentation, each pixel is also classified based on some given classes, but distinct objects within a class are highlighted by different colors.

Semantic segmentation of crowd images is an effective tool for analyzing and understanding crowded scenes, crowd structure, and behavior. Crowd semantic segmentation can be used in the following applications:

(1) Counting and analyzing the crowd. Segmentation can facilitate such tasks by decomposing the image into clusters, and some basic techniques could be applied to them to analyze the crowd structure within them. It is useful for monitoring crowded places like stadiums, markets, malls, fairs, social events, etc. [1]–[4].

(2) Security and surveillance. Some segmentation techniques allow highlighting single persons which is important for detecting abnormal, troublesome,

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