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АҚМОЛА ОБЛЫСЫНДАҒЫ КӨШІ-ҚОН ПРОЦЕСТЕРІНІҢ ЗАМАНАУИ ЖАҒДАЙЫ

Бұл жұмыс Ақмола облысының тұрғындарының көші-қонын зерттеуіне арналған. Ақмола облысының тұрғындарының көші-қонын зерттеудің өзектілігі өңірдің ұлттық экономикалық кешенінің көші-қон процестерінсіз қалыпты жұмыс істеуінің мүмкін еместігімен анықталады. Себебі, көші-қон ағындары демографиялық ахуалды және өңірдегі және тұтастай өңірдегі еңбек нарығын қалыптастыруға әсер етеді. Мигранттардың ағыны мен ағымы еңбек нарығындағы жағдайды, инфрақұрылымға, этносаралық қатынастарға, экологиялық жағдайға және өңірдегі қылмыс деңгейіне қатысты жағдайды өзгертеді. Жұмыста көші-қон мәселелерінің себептері және олардың шешілуі зерттелді. Зерттеу нәтижесінде аймақтағы көші-қонды жақсарту бойынша ұсыныстар келтірілді.

Мақаланың мәнін ашатын сөздер: *көші-қон, көші-қон ағымы, Ақмола облысы, көші-қон балансы, демографиялық жүктеме.*

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THE MODERN STATE OF MIGRATION PROCESSES IN AKMOLA REGION

This work is devoted to the study of migration of the population of Akmola region. The relevance of the study of the population migration of Akmola region is determined by the impossibility of a normal functioning of the region's national economic complex without a migration process. Since migration flows affect the demographic situation and the formation of labor markets in the region and in the region as a whole. The influx and outflow of migrants is changing the situation in the labor market, the burden on infrastructures, on interethnic relations, on the ecological situation, and on the level of crime in the region. In work the reasons, problems and the decision of problems of migration are investigated. As a result, the research offered its own proposals for improving migration in the region.

Keywords: *migration, migration flows, Akmola region, migration balance, demographic burden.*

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CASCADING OF NEURAL NETWORKS

Abstract

There are technologies that allow combining several neural modules into a single neural network. The cascading procedure is designed to interface neural networks on data flow and error back propagation. This allows the use of the generic method for forward propagation modular networks training with arbitrary structure. The mathematical model of cascading neural networks is given.

In case of cascade connection modules, the neural network learning can be made with different speeds of training for the incoming modules. Next, the article presents the tasks based on neural networks.

Features that the task should have in order to justify the application of neural networks, and the neural network could solve it, are:

- there are no algorithm or known principles for tasks solution, but there is a sufficient number of examples;

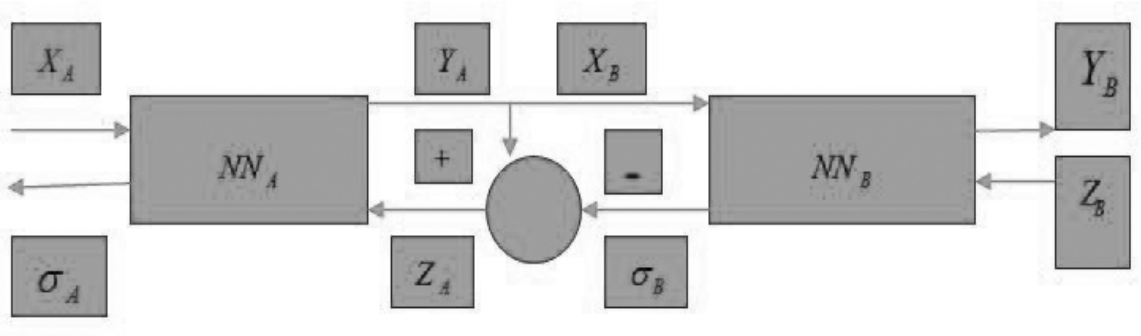
- the task is characterized by large volumes of input data;

- the data is either incomplete or redundant, noisy, partially contradictory.

Neural networks are well suited for image recognition and solving problems of classification, optimization and forecasting.

Keywords: *neural network, cascading, model, training, modules, tasks.*

There are technologies that allow combining several neural modules into a single neural network. The cascading procedure is designed to interface neural networks on data flow and error back propagation. This allows the use of the generic method for forward propagation modular networks training with arbitrary structure (Figure 1.) [1, 2].



Picture 1 – The diagram of cascade connection of two neural modules

Cascading procedure presupposes that each neuron module has an output module for the generalized error vector, which is formed in the first layer of the neural network. Generalized error vector is used to build the reference vector for the preceding neural module.

The output vector of generalized errors for nuclear neural network is determined by:

$$\sigma_B(U) = 0.5\sum_v \sigma^1_{Bi}(v) W^1_{Bi}(u,v)$$

where:

$W^1_{Bi}(u,v)$ is a synoptic map of nucleus Bi, the first layer of the neural network, $\sigma^1_{Bi}(v)$ are generalized errors of nucleus Bi, the first layer of the neural network,

$U = (u)(\sigma^1_{Bi})^{-1}$ is the global number of input layer receptor.

In case of cascade connection modules, the neural network learning can be made with different speeds of training for the incoming modules.

The beginning of the modern mathematical modeling of neural computation was put in 1982 by Hopfield's works, which formulated the mathematical model of associative memory at the neural network using Hebbian rules for network programming [3].

But not only the model itself has caused the emergence of other authors works on the subject as the neural network computing power function introduced by Hopfield. This is an analog of the Lyapunov's function in dynamic systems.

It is shown that for a single-layer neural network with links such as "all for all" convergence to one of a finite set of equilibrium points (dots) is typical; they are local minimum of the energy function which contains the whole structure of relationships in the network in itself.

Other researchers also understood this neural network dynamic. However, Hopfield and Tank have shown how to construct the power function for a given optimization task and how to use it for the task imaging in the neural network. This approach was developed for other combinatorial optimization problems solution too.

Hopfield's approach attractiveness is that the neural network for a specific task can be programmed without training iterations. Connections weights are computed on the basis of the power function type that is designed for this task.

Boltzmann's machine proposed and researched by Jeffrey E. Hinton and R. Zemel is the development of the Hopfield's model for combinatorial optimization problems solution and for artificial intelligence tasks [4].

Problems solved on the basis of neural networks

Features that the task should have in order to justify the application of neural networks, and the neural network could solve, are:

- there are no algorithm or known principles for tasks solution, but there is a sufficient number of examples;
- the task is characterized by large volumes of input data;
- the data is either incomplete or redundant, noisy, partially contradictory.

Thus, neural networks are well suited for image recognition and classification tasks solution, optimization and forecasting.

The following is a list of possible industrial applications of neural networks, on the basis of which either already established commercial products created, or demonstration prototypes are realized.

Banks and insurance companies:
- Automatic checks and financial documents pick-up;
- Verification of signatures;
- Risk assessment for loans;
- Prediction of changes in economic indicators.

Administrative services:
- Automatic documents pick-up;
- Automatic barcodes recognition.

Petroleum and Chemical Industry:
- Geological information analysis;
- Equipment failure identification;
- Mineral deposits exploration on aerial photographs data;
- Impurities composition analysis;
- Process control.

Armaments industry and Aeronautics:
- Audio signal processing (separation, identification, localization, noise elimination, interpretation);
- Radar signals (target detection, identification and sources localization);
- Infrared signals processing (localization);
- Information generalization;
- Automatic piloting.

Industrial production:
- Manipulators control;
- Quality control;
- Processes control;
- Failure detection;
- Adaptive robotics;
- Voice control.

Security personnel:
- Face, voice and fingerprints detection.

Biomedical industry:
- X-ray photograph analysis;
- Deviation in the electrocardiogram detection.

TV and communication:
- Adaptive network connection control;
- Image squeezing and restoration.

The presented list is far from being complete. Every month mass media report about new commercial products based on neural networks. So, different equipment which can, for example, monitor water quality, find plastic bombs in the luggage of passengers, etc., is produced. Investment banks experts by means of software neuropackage make short-term forecasts of currency fluctuations.

The major commercial hardware products based on neural networks are, and probably in the near future will be, neuro LSI (large-scale integration circuit). Different types of neuro LSI the parameters of which often differ by many times are produced. Among them is ETANN model of Intel. This LSI, made according to Micron Technology, is an implementation of a neural network with 64 neurons and 10,240 synapses.

Among the cheapest is the model MD 1220 neuro LSI of Micro Devices. This LSI implements a neural network with 8 neurons and 120 synapses.

Among the currently developed neuro LSI there is a model of Adaptive Solutions (USA) and Hitachi (Japan). Neuro LSI of Adaptive Solutions is likely to become one of the fastest: the processing speed is 1.2 billion connections. (Neural network contains 64 neurons and 262,144 synapses). Neuro LSI of Hitachi allows realizing of the neural network with up to 576 neurons. These neuro LSIs undoubtedly will become the basis for new neuro-computers and specialized multiprocessor products.

Most of today's neuro-computers are merely a personal computer or workstation, which include additional neuro-board. These include, for example, a series of FMR computers of Fujitsu. Such systems have an unquestionable right to exist, because their capacity is sufficient for the development of new algorithms and solutions of a large number of applications by means of neuromathematics methods. However, the most interesting are specialized neuro-computers which immediately implement the principles of the neural network. Typical examples of such systems are Mark family computers TRW (the first implementation of the perceptron, developed by Rosenblatt, was called Mark I). Mark III model of TRW is a workstation with up to 15 Motorola processors with mathematical coprocessors. All processors are connected by a VME bus. The system architecture that supports up to 65,000 virtual processing elements with more than 1 million adjustable connections enables to process up to 450 thousand interconnections. Mark IV is a uniprocessor supercomputer with a pipelined architecture. It supports up to 236 thousand virtual processing elements that can process up to 5 million interconnects. Mark family PCs have a common modeling environment ANSE (Artificial Neural System Environment) which provides models software compatibility. In addition to these models TRW firm offers a Mark II package – a software emulator of the neural network.

Another interesting model is NETSIM neurocomputer, created by Texas Instruments based on the development of Cambridge University. Its topology is a three-dimensional lattice of standard computing nodes based on processors. NETSIM computer is used for modeling of neural network models such as the Hopfield – Kohonen network and neural network with back-propagation. Its performance reaches 450 million interconnects.

Computer Recognition Systems (CRS) sells a series of WIZARD / CRS 1000 neuro-computers for the processing of video images. CRS 1000 model has already found application in industrial automatic control.

Today, the market offers many models of neurocomputers. In fact, there may be a lot more, but the most powerful and advanced models are still created on the military orders.

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БАЙМУХАМЕДОВ, М.Ф., ЕСЛЯМОВ, С. Г., МУСТАФА КЕМАЛЬ АКГЮЛЬ
НЕЙРОНДЫҚ ЖЕЛІЛЕРДІ КАСКАДТАУ

Нейрондық желілерді каскадтау. *Бірнеше нейрондық модульдерді бір нейрондық желіге біріктіруге мүмкіндік беретін технологиялар бар. Каскадтау процедурасы деректер ағындары бойынша нейрондық желілерді араластыру және кері тарату қателері үшін арналған. Бұл модульдік тікелей тарату желісін ерікті құрылымымен оқытуға арналған жалпыланған әдісті пайдалануға мүмкіндік береді. Нейрондық желілерді каскадтаудың математикалық моделі ұсынылады.*

Модульдерді каскадтау кезінде нейрондық желіні оқыту оған енгізілген модульдер үшін әртүрлі оқу жиіліктерімен жасалуы мүмкін. Сонымен қатар, мақалада нейрондық желілер негізінде шешілетін есептер қарастырылған.

Нейрондық желілердің пайдаланылғанын дәлелдеу және нейрондық желі есепті шешуі үшін, есептер:

- проблемаларды шешудің алгоритмі немесе белгілі принциптері жоқ, бірақ жеткілікті мысалдардың жинақталуымен;

- мәселенің кіріс ақпаратының үлкен көлемімен сипатталуымен;

- бұл есептер толымсыздығымен немесе ішінара қарама-қайшылығымен ерекшеленуі қажет.

Нейрондық желілер құрылымды тану, оларды жіктеу, оңтайландыру және болжау проблемаларын шешу үшін өте қолайлы.

Мақаланың мәнін ашатын сөздер: *нейрондық желілер, каскадтау, модель, оқыту, модульдер, тапсырмалар.*

БАЙМУХАМЕДОВ, М.Ф., ЕСЛЯМОВ, С.Г., МУСТАФА КЕМАЛЬ АКГЮЛЬ
КАСКАДИРОВАНИЕ НЕЙРОННЫХ СЕТЕЙ

Каскадирование нейронных сетей. *Существуют технологии, позволяющие объединять несколько нейронных модулей в одну нейронную сеть. Процедура каскадирования предназначена для сопряжения нейронных сетей по потокам данных и по ошибкам обратного распространения. Это позволяет использовать обобщенный метод, для обучения модульной сети прямого распространения с произвольной структурой. Приводится математическая модель каскадирования нейронных сетей. При каскадном соединении модулей обучение нейронной сети может производиться с различными скоростями обучения для входящих в нее модулей. Далее в статье приводятся задачи, решаемые на основе нейронных сетей.*

Признаками, которыми должна обладать задача, чтобы применение нейронных сетей было оправдано, и нейронная сеть могла бы ее решить, являются:

- отсутствует алгоритм или не известны принципы решения задач, но накоплено достаточное число примеров;

- проблема характеризуется большими объемами входной информации;

- данные задачи неполны или избыточны, зашумлены, частично противоречивы.

Нейронные сети хорошо подходят для распознавания образов и решения задач классификации, оптимизации и прогнозирования.

Ключевые слова: *нейронные сети, каскадирование, модель, обучение, модули, задачи.*