



[2, 3]

« »

$$U^T D U$$

[4]

[5]

GPU.

[6]

$$L L^T$$

[7]

[8].

- 
- 
- 
- 
- 

$$y^* : X \rightarrow Y,$$

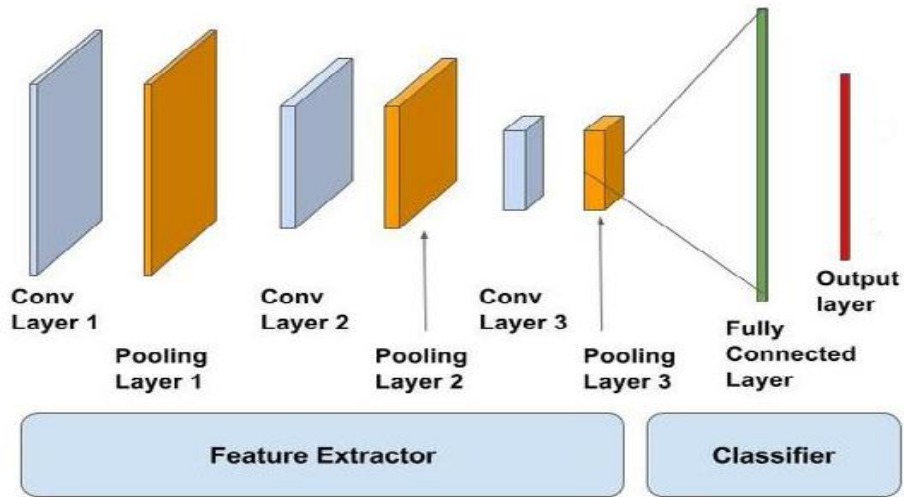
$$X^m = \{(x_1, y_1), \dots, (x_m, y_m)\}.$$

$$\alpha : X \rightarrow Y,$$

$$x \in X.$$



. 1



. 1. "Sparse Matrix Vision"

224 224 . 3 : JPEG, , , 0 1,

$$f(p, \min, \max) = \frac{p - \min}{\max - \min},$$

$f -$  ,  $p -$  ,  $\min -$  ,  $\max -$  ( - , ) , ( - , ) .

$$(w, h) = (mW - kW + 1, mH - kH + 1),$$

$(w, h) -$  ,  $mW -$  ,  $kW -$  ,  $mH -$  ,  $kH -$  .

...

- 0.5 0.5.

$$(f * g)[m, n] = \sum_{k, l} f[m - k, n - l] * g[k, l],$$

$f -$  ,  $g -$  .

:

$$x_j^l = f\left(\sum_i x_i^{l-1} * k_j^l + b_j^l\right),$$

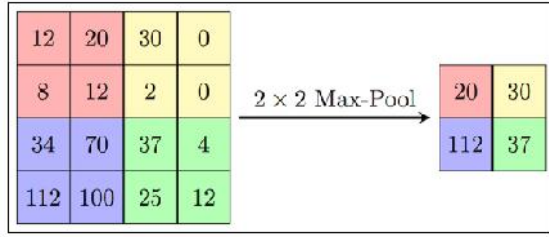
$f() -$  ,  $x_j^l -$  ,  $l, b^l -$   $l$

$j, k_j^l -$   $j$  ,  $l, * -$   $-$   
 $l, k.$

( , ) . -

( MaxPooling- )

ReLU.  
. 2.



. 2. "Max-Pool"

$$x^l = f\left(a^l * \text{subsample}(x^{l-1}) + b^l\right),$$

$f() -$  ,  $x^l -$  ,  $l, a^l, b^l -$

$l \text{ subsample}() -$

•  
•  
•  
•  
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;

1. *ReLU*  $f(s) = \max(0, s)$ ;

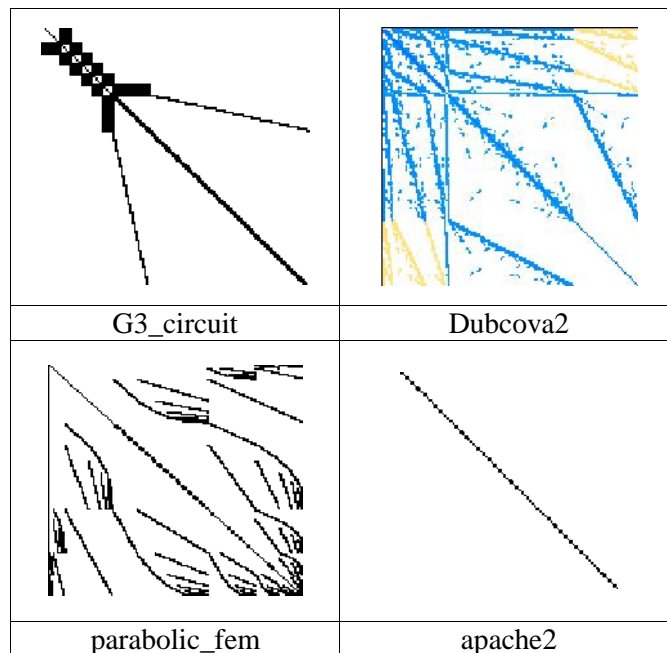
2. *Sigmoid*  $f(s) = \frac{1}{1 + e^{-s}}$ .

Python [10]

Keras [11], Tensorflow [12].

- 2 Intel Xeon E5-2600 2.6 ;
- 200 ;
- Infiniband FDR 56 / ;
- 128 2500

( .3).



.3.

( .4).



. 4. : - ; -

0.8869001 0.00093775 0.00008755 0.00000035 0.0000434.

88 %

*V.A. Sydoruk, P.S. Yershov, D.O. Bohurskyi, O.R. Marochkanych*

**INTELLECTUALIZATION OF COMPUTATION FOR MATHEMATICAL MODELING OF COMPLEX PROCESSES AND OBJECTS**

An approach for automating the choice of algorithm for solving applied problems is proposed. We develop and train a neural network to recognize the type of sparse matrix. Numerical experiments were carried out on the node of the supercomputer SKIT.

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10.06.2019

**Про авторів:**

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