



Laboratory for  
information systems

Rudjer Boskovic Institute, Croatia

# **jGMDH – Java implementacija GMDH**

13.11.2009

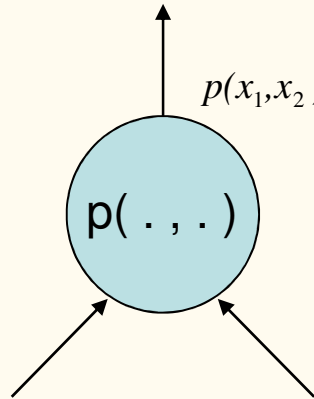


# Group Method of Data Handling

- ▣ Ivakhnenko, 1966.
- ▣ predikcija, kontrola, identifikacija sistema...
  
- ▣ *Svojstva:*
  - ▣ *samopodešavanje strukture*
  - ▣ *selekcija ulaznih varijabli*

# Osnovni čvor

$$\hat{\mathbf{y}} = [\hat{y}_1 \quad \hat{y}_2 \quad \dots \quad \hat{y}_N]^T$$



$$p(x_1, x_2) = a_5 x_1^2 + a_4 x_1 + a_3 x_2^2 + a_2 x_2 + a_1 x_1 x_2 + a_0$$

$$\mathbf{x}_i = [x_{i1} \quad x_{i2} \quad \dots \quad x_{iN}]^T$$

$$\mathbf{x}_j = [x_{j1} \quad x_{j2} \quad \dots \quad x_{jN}]^T$$

LS regresija:

• regresori:  $\mathbf{x}_i = [x_{i1} \quad x_{i2} \quad \dots \quad x_{iN}]^T$   
 $\mathbf{x}_j = [x_{j1} \quad x_{j2} \quad \dots \quad x_{jN}]^T$

• na izlazu bloka želimo:  $\mathbf{y} = [y_1 \quad y_2 \quad \dots \quad y_N]^T$

$$SSE = \sum_{i=1}^N (\hat{y}_i - y_i)$$

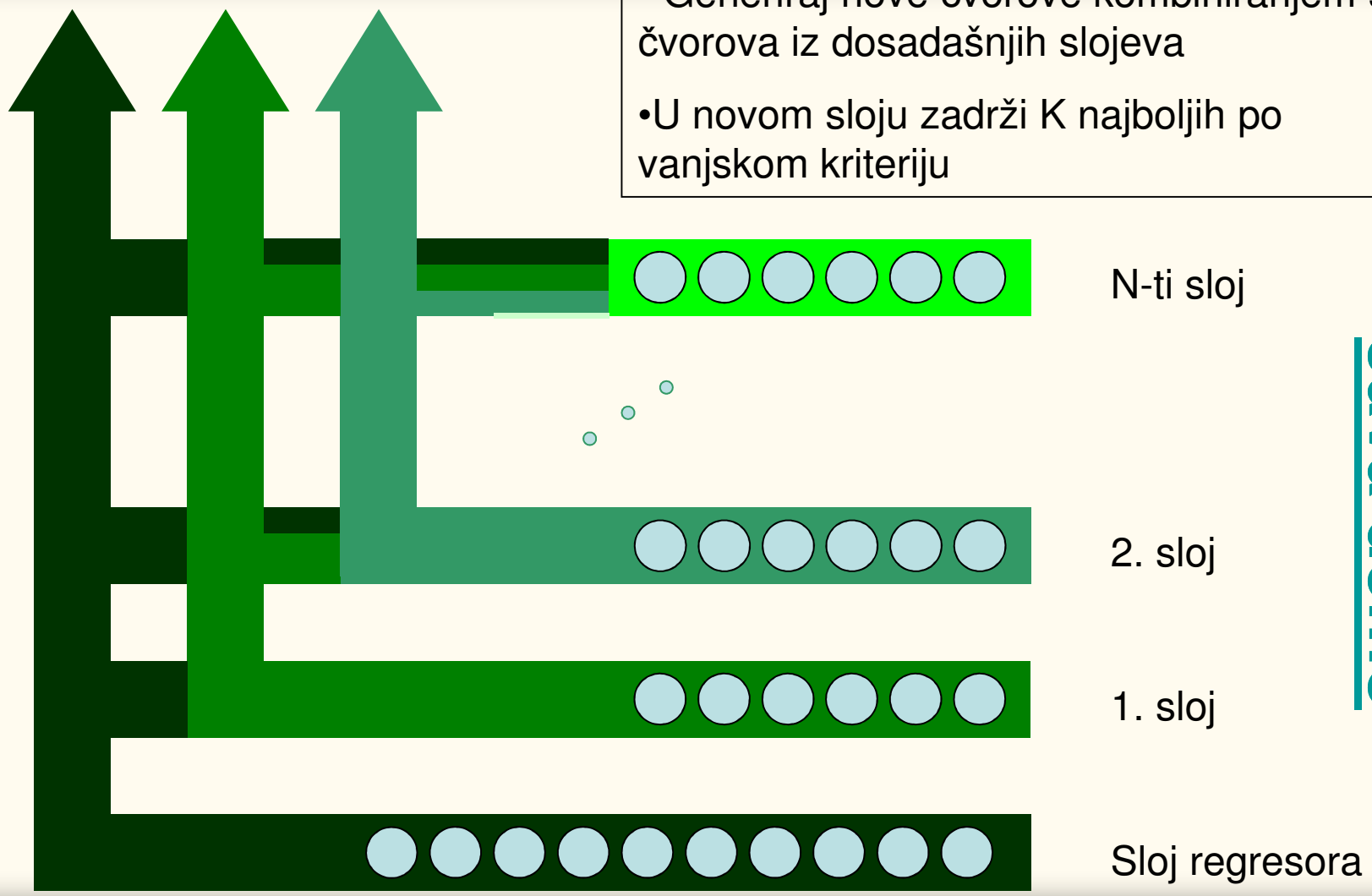
$$dSSE = 0$$

želimo

$$\Rightarrow \begin{bmatrix} N & \sum x_{1i} x_{2i} & \sum x_{2i} & \sum x_{2i}^2 & \sum x_{1i} & \sum x_{1i}^2 \\ \sum x_{1i} x_{2i} & \sum x_{1i}^2 x_{2i}^2 & \sum x_{1i} x_{2i}^2 & \sum x_{1i} x_{2i}^3 & \sum x_{1i}^2 x_{2i} & \sum x_{1i}^3 x_{2i} \\ \sum x_{2i} & \sum x_{1i} x_{2i}^2 & \sum x_{2i}^2 & \sum x_{2i}^3 & \sum x_{1i} x_{2i} & \sum x_{1i}^2 x_{2i} \\ \sum x_{2i}^2 & \sum x_{1i} x_{2i}^3 & \sum x_{2i}^3 & \sum x_{2i}^4 & \sum x_{1i} x_{2i}^2 & \sum x_{1i}^2 x_{2i}^2 \\ \sum x_{1i} & \sum x_{1i}^2 x_{2i} & \sum x_{1i} x_{2i} & \sum x_{1i} x_{2i}^2 & \sum x_{1i}^2 & \sum x_{1i}^3 \\ \sum x_{1i}^2 & \sum x_{1i}^3 x_{2i} & \sum x_{1i}^2 x_{2i} & \sum x_{1i}^2 x_{2i}^2 & \sum x_{1i}^3 & \sum x_{2i}^4 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \end{bmatrix} = \begin{bmatrix} \sum y_i \\ \sum y_i x_{1i} x_{2i} \\ \sum y_i x_{2i} \\ \sum y_i x_{2i}^2 \\ \sum y_i x_{1i} \\ \sum y_i x_{1i}^2 \end{bmatrix}$$

# COMBI algoritam

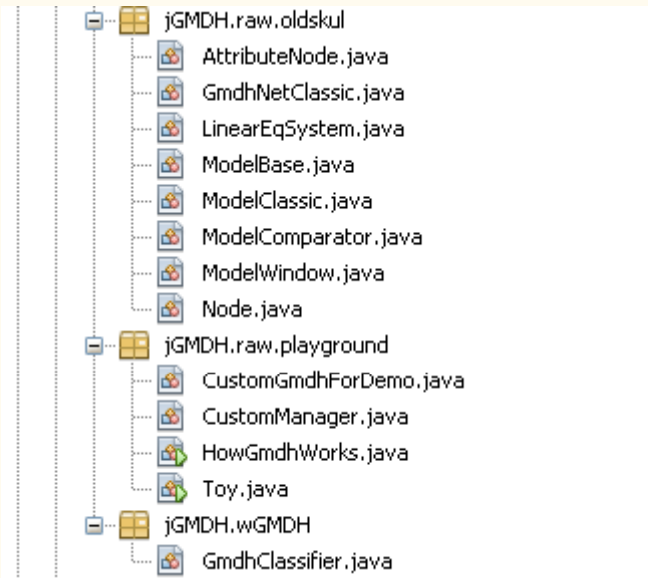
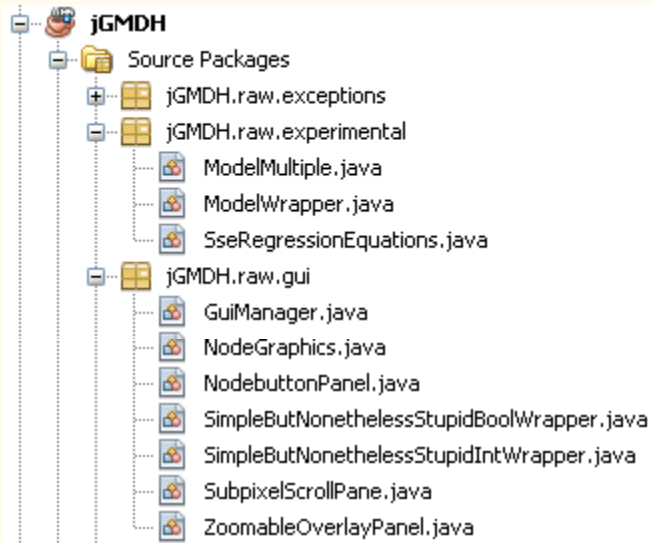
- Generiraj nove čvorove kombiniranjem svih čvorova iz dosadašnjih slojeva
- U novom sloju zadrži K najboljih po vanjskom kriteriju



Java demo



# jGDMH – Snapshot



☐ Troši još i:



- ☐ <http://www.cs.waikato.ac.nz/ml/weka/>
- ☐ <https://jxlayer.dev.java.net/>
- ☐ <http://www.pbjar.org/blogs/jxlayer/jxlayer40/>



# Poziv iz Java koda

```
public class Toy {  
  
    private Toy() {  
    }  
  
    /**  
     * @param args the command line arguments  
     */  
    public static void main(String[] args)  
        throws IOException, ExpressionEqualToZero, TooBig {  
  
        Instances data = new Instances(  
            new Buffered  
            new FileRead  
  
        GmdhNetClassic gmdhT  
        /* We will simply sp  
        */  
        gmdhTest.oneFold(0,  
  
        data.setClassIndex(data.numAttributes() - 1); // set class  
        gmdhTest.setAttributeLayer(); // set layer of attribute nodes  
        gmdhTest.multiSelectCombi(5, 50); // initiate MSC algorithm  
  
        /* Graphical stuff  
        */  
        final GuiManager drawModel = new GuiManager(gmdhTest.selectedLayers,  
            1000, 800, 50, 50);  
        javax.swing.SwingUtilities.invokeLater(new Runnable() {  
  
            public void run() {  
                drawModel.launchGUI();  
            }  
        });  
    }  
}
```



# Poziv iz Weka GUI-a (1)

## ❑ Weka *Bean-conform wrapper*

❑ *jGMDH.wGMDH.\**

## ❑ Modificiraj

❑ *GenericObjectEditor.props*

```
# Lists the Classifiers I want to choose from
weka.classifiers.Classifier=\
    # Add jGMDH it at the end of the list
    # ...
jGMDH.weka.GmdhClassifier
```

❑ *RunWeka.ini*

```
# The classpath placeholder. Add any environment variables or jars to it that
# you need for your Weka environment.
#...
# Depends where you put the jGMDH.jar
cp=%CLASSPATH%;jGMDH.jar
```



# Poziv iz Weka GUI-a (2)

The screenshot displays the Weka GUI interface. The main window is titled "Explorer" and has tabs for "Preprocess", "Classify", "Cluster", "Associate", "Select attributes", and "Visualize". The "Classify" tab is active, showing the "Classifier" section with a "Choose" button and a text field containing "GmdhClassifier -P 20.0 -L 20 -N 100 -V true". Below this, the "Test options" section includes radio buttons for "Use training set", "Supplied test set", "Cross-validation", and "Percentage split". The "Supplied test set" option is selected. There are input fields for "Folds" (10) and "Percentage split" (% 66), and a "More options..." button. A "Start" button is also visible. A "Result list" section is present but empty. At the bottom, there is a "Status" bar showing "OK" and a "Log" button.

Overlaid on the main window is a dialog box titled "weka.gui.GenericObjectEditor". The dialog box has a title bar with standard window controls. The main content area shows the class name "jGMDH.weka.GmdhClassifier" and an "About" section with the text "A GMDH classifier aimed at regression problems". There are "More" and "Capabilities" buttons. Below the "About" section, there are several configuration options with input fields or dropdown menus: "debug" (False), "maxLayers" (20), "modelsPerLayer" (100), "validationSetPercentage" (20), and "visualize" (True). At the bottom of the dialog box, there are four buttons: "Open...", "Save...", "OK", and "Cancel".





<http://gmdh4weka.irb.hr/>

**Pitanja dobrodošla.**