

ISS0031 Modeling and Identification

Practical Work #4*: Fuzzy Logic based Modeling

1. System Modeling with ANFIS

This task introduces you to the Adaptive Neuro-Fuzzy Inference System (ANFIS).

1.1. Open simulation

Open folder `anfis_modeling`, set the MATLAB path to the folder, open `invpen_sugeno.mdl` and explore the model.

1.2. Open ANFIS Editor

Open the editor using the `anfisedit` command. Explore the editor GUI.

1.3. Gather training and testing data, train ANFIS

Change the To Workspace block variable name to `train_data`, choose a target position function type in the animation window and run the simulation for two signal cycles. Change the To Workspace block variable name to `test_data`, choose a different target position function type in the animation window and run the simulation for two signal cycles.

Load the training data from workspace into ANFIS Editor, specify FIS properties as you see fit and train. After training load testing data and perform a test.

Save the trained FIS in a file with a different name, e.g. `anfis.fis`, change the FIS name in `init_s.m` to this name and perform the simulation.

Open the FIS Editor and explore the trained FIS.

1.4. Increase the quality of control

Generate more training and testing data using other target position function types, load your trained FIS into the ANFIS editor and train it using new data. Test with new test data.

Save the FIS and load it into the simulation. Observe the changes.

Try to generate a training dataset, that will train the FIS for all (Sinusoid, Square, Saw) kinds of target position function types.

Open the FIS Editor and explore the trained FIS.

2. Fuzzy Classification, Supervised Training

This task introduces you to fuzzy classification principles.

2.1. Classification using ANFIS

Open folder `datasets`, set the MATLAB path to the folder, open ANFIS Editor. Train ANFIS on the `iris` dataset.

2.2. Classification using another classifier

Open folder `fuzzy_classifier`, set the MATLAB path to the folder, open `readme.m` and go through the steps of fuzzy classifier training using the Ctrl+Enter key combination for every section of script code.

Observe the division of the dataset into clusters and the derivation of fuzzy rules.

3. Fuzzy Clustering

This task introduces you to fuzzy clustering principles.

Open the clustering demo GUI by typing `fcmdemo` in the command line. Select `fcm` as the clustering method. Select different datasets and different number of clusters per each set. Observe the behavior.

Open the MATLAB clustering GUI by typing `findcluster` in the command line. Select the dataset `iris_t.dat` from the datasets folder and try the GUI on it.

Observe the division of the dataset into clusters and the derivation of fuzzy rules.

Compile the Report

1. Provide the analysis of the solution of the given task and answers to questions.
2. Draw conclusions based on the results of the work.
3. Compile your individual report and present it no later than **December 5, 2017** via electronic submission—as a PDF file—to aleksei.tepljakov@ttu.ee.