Digital Autonomy in the Internet of Things Era

Moderator: Viviane Torres da Silva, IBM Research, Brazil

Panelists: Irina Topalova, Technical University Sofia, Bulgaria
Luis Fernando Orleans, Universidade Federal Rural do Rio de Janeiro, Brazil

Agenda

- Introduction to Internet of Things
- Internet of *Autonomous* Things
  - Viviane Torres da Silva, IBM Research, Brazil
- Concepts to the design of knowledge-based AI agents in cognitive systems.
  - Irina Topalova, Technical University Sofia, Bulgaria
- Education and IoT: Possible Applications and Challenges
  - Luis Fernando Orleans, Universidade Federal Rural do Rio de Janeiro, Brazil
- Topics to Discuss

Internet of Things

- Growing range of connected devices or Things that send data across the Internet

- Thing is any object with embedded electronics that can transfer data over a network - without any human interaction

By 2020

- 30 billions connected devices
- 7.1 Trillion dollars of value

Important Things to Concern About

- Collect & Secure Data from many devices
- Run Analytics to understand usage patterns
- Gain Real-Time Insights
- **Autonomously act**

Internet of *Autonomous* Things

Viviane Torres da Silva, IBM Research, Brazil

Internet of Things + Autonomous Agents = Internet of *Autonomous* Things

- Knowing the wright action to take
- Knowing the wright moment to act
  - Without annoying, embarrassing, disturbing, confusing, …. the user and other devices

- Communication among Autonomous Things
  - Languages
  - Protocols

- Society of Autonomous Things
  - Together with People: Human-Robot Symbiosis
  - Undesired behavior: Norms, Governance, …

- Reputation and Trust of Autonomous Things
  - Are all things trustable?

Concepts to the design of knowledge-based AI agents in cognitive systems

Irina Topalova, Technical University Sofia, Bulgaria

Education and IoT: Possible Applications and Challenges

Luis Fernando Orleans, Universidade Federal Rural do Rio de Janeiro, Brazil

Topics to Discuss

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Topics to Discuss

- How advanced is the *Internet of Autonomous Things* area?
  - Research
  - Business
- Putting together Autonomous Agent community with IoT community
- Big Challenges
- Advices for those that would like to start researching in this area
  - Conferences, courses, groups, …

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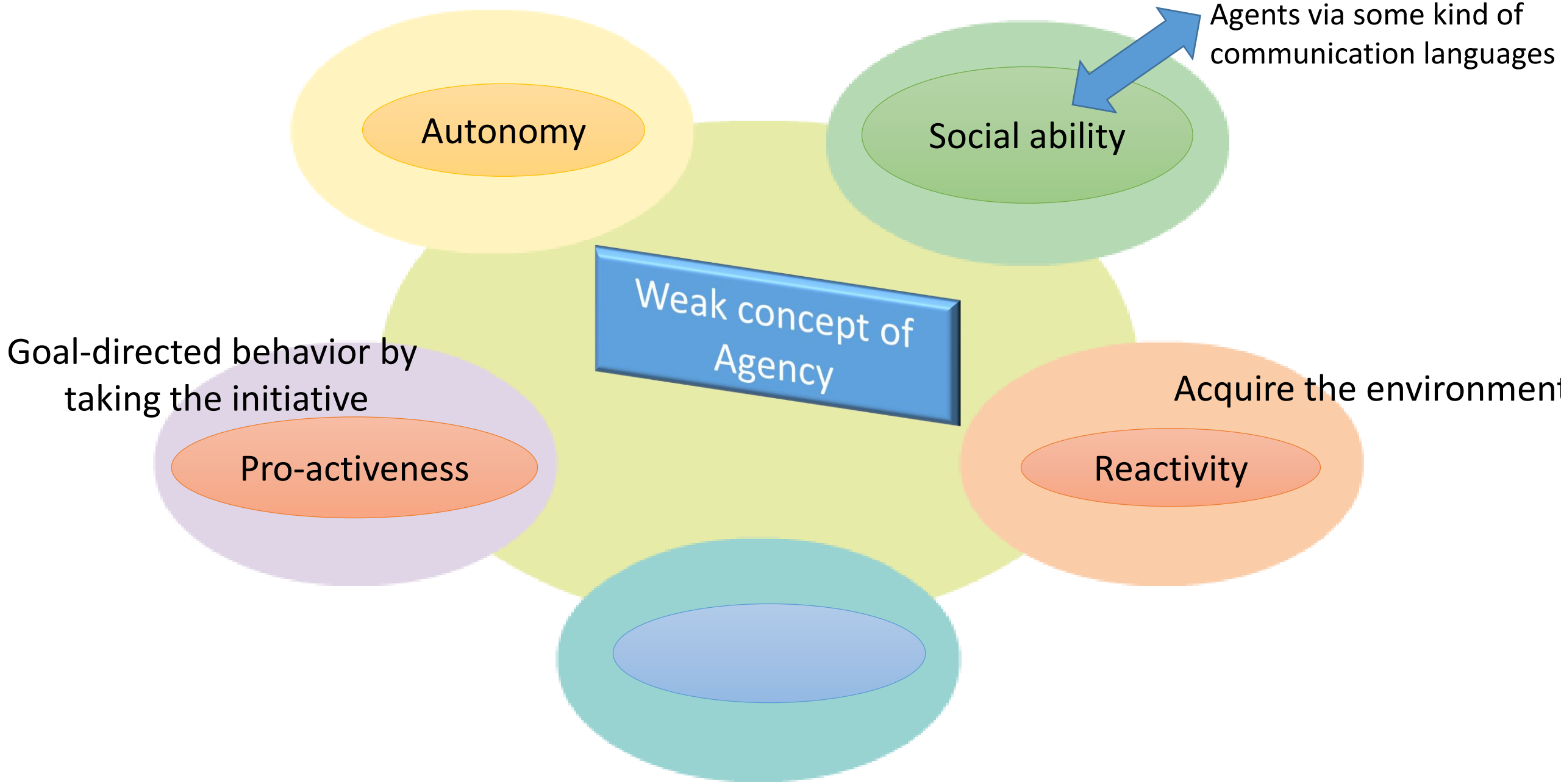
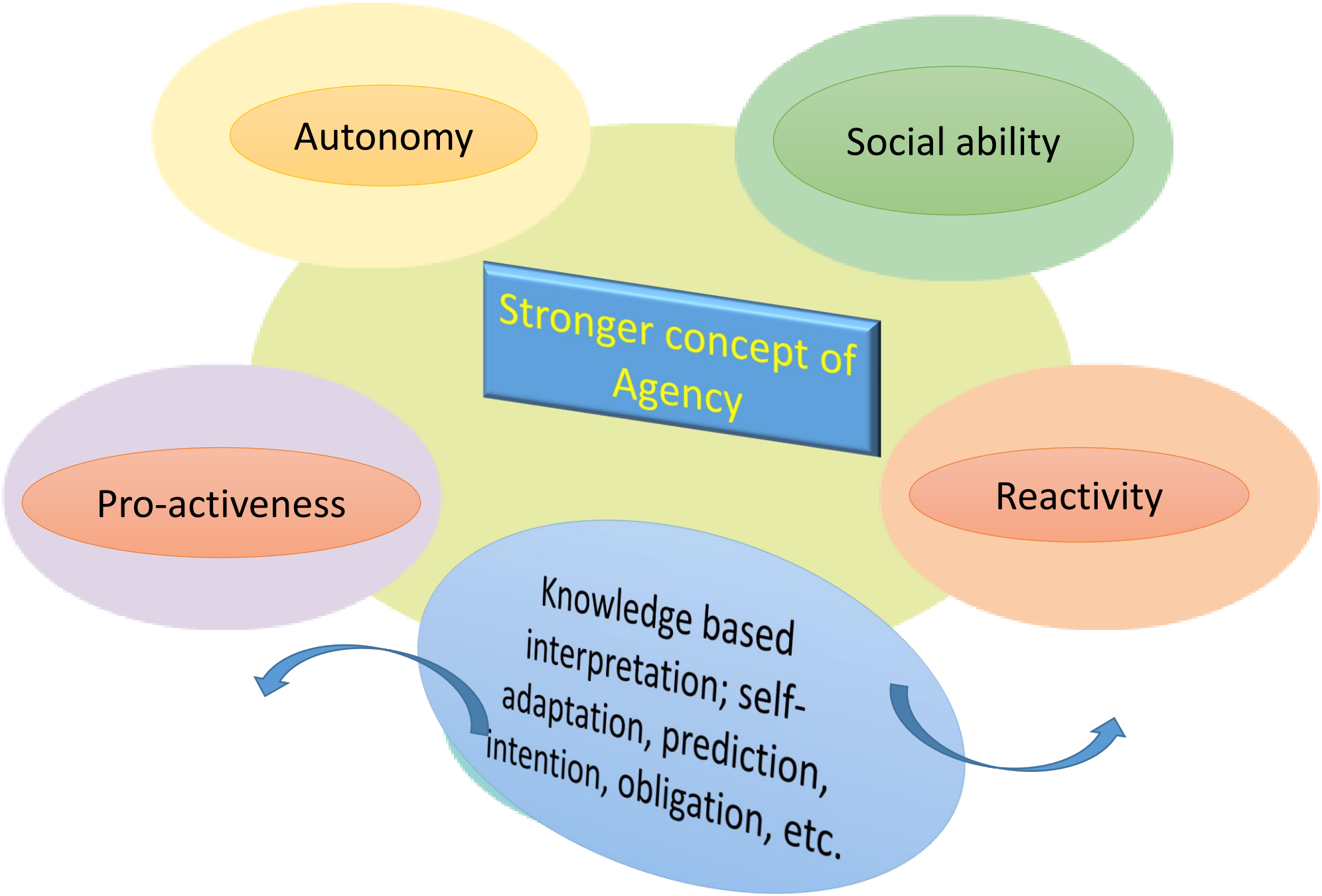
Cognitive Intelligent Agents – Agents of Things: AoT

Assoc. Prof. PhD Irina Topalova
Technical University Sofia

They operate without direct intervention of humans and have some kind of self-control

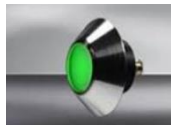
Interact with other Agents via some kind of communication languages




Autonomy
Social ability
Stronger concept of Agency
Pro-activeness
Reactivity
Knowledge based interpretation; self-adaptation, prediction, intention, obligation, etc.

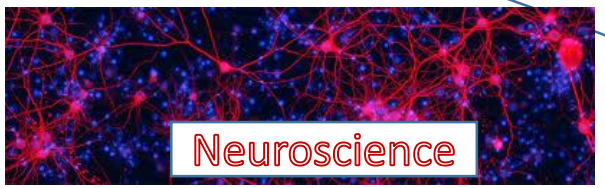
Artificial Intelligence Agents

Other - AI



Internet

Acquisition of the environment



Processing

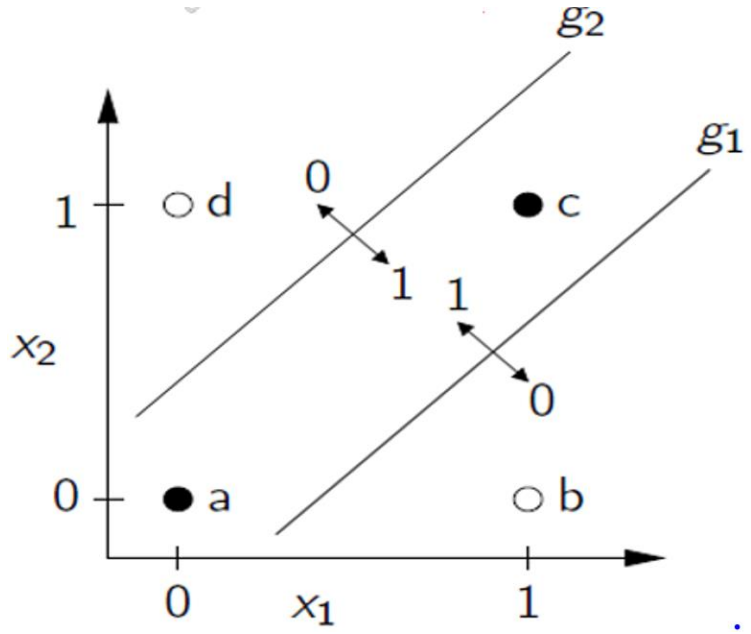
Train / Decision

Action / Change the environment

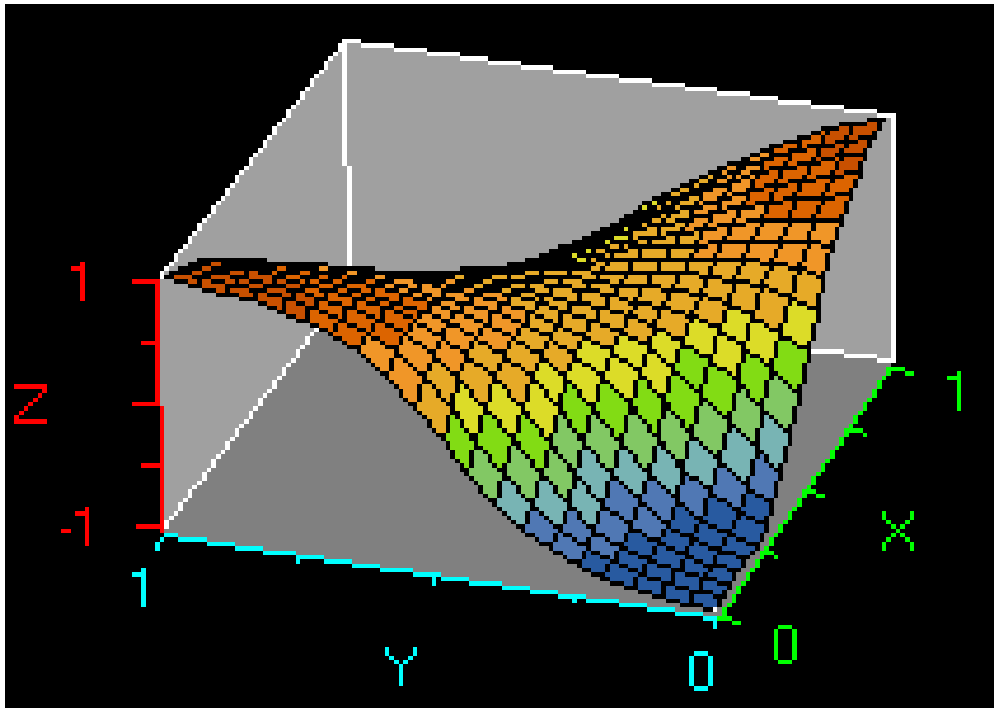
Data base / Knowledge

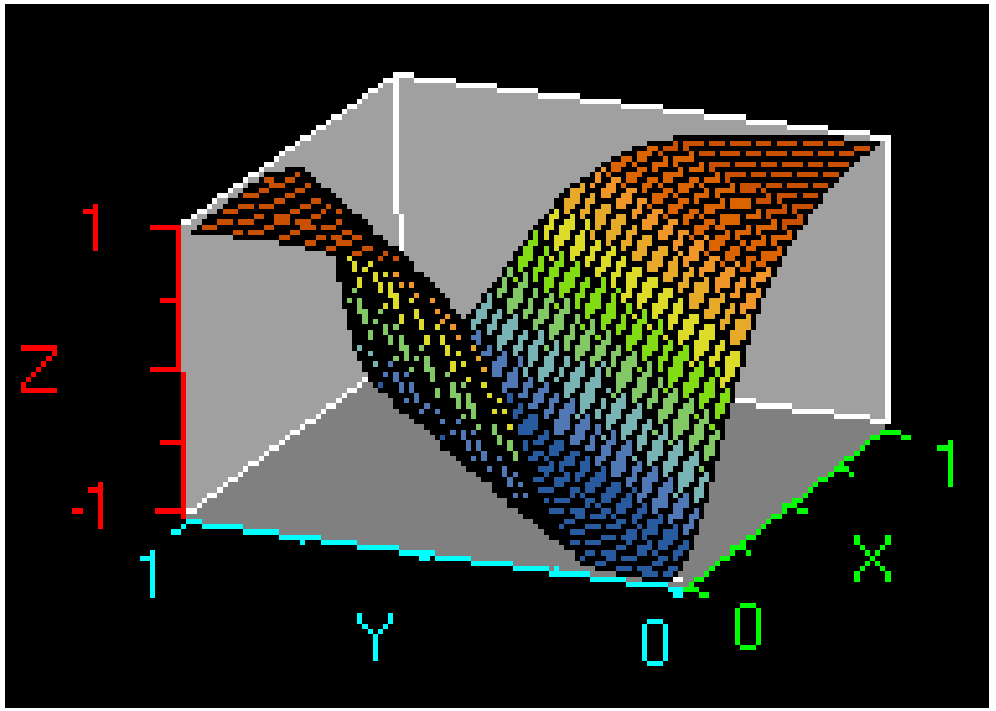
!

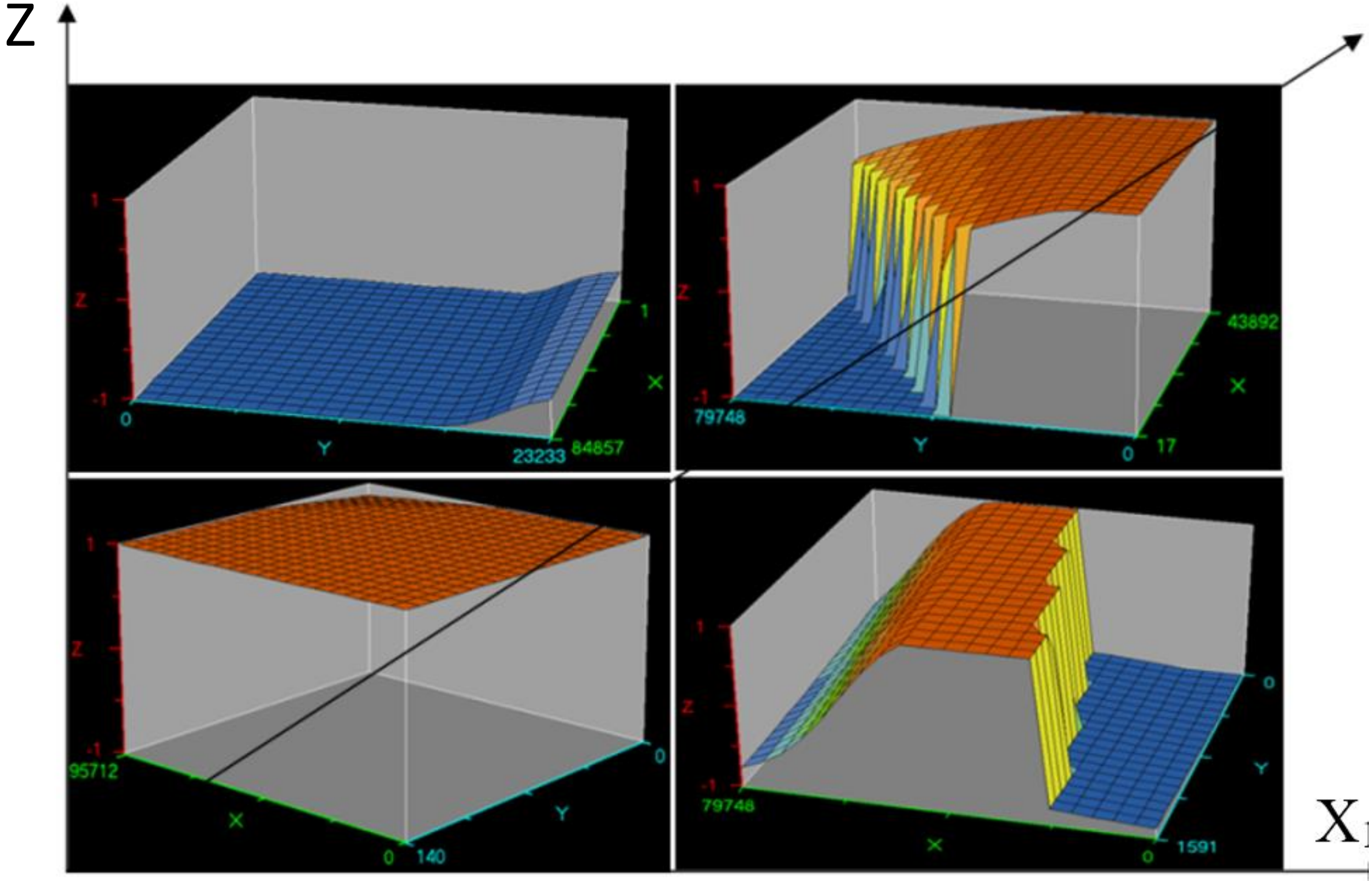
XOR - Problem



Supervised learning






Z
Y
X
1
Z
-1
0
Y
23233
84857
1
X
1
Z
-1
79748
Y
0
17
43892
X
1
Z
-1
95712
X
0
140
Y
0
1
Z
-1
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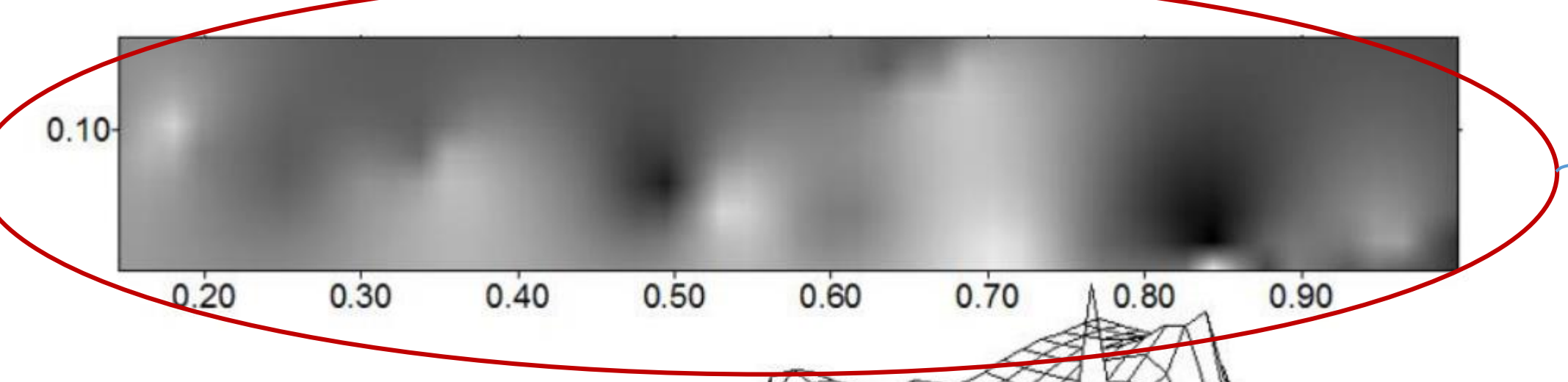
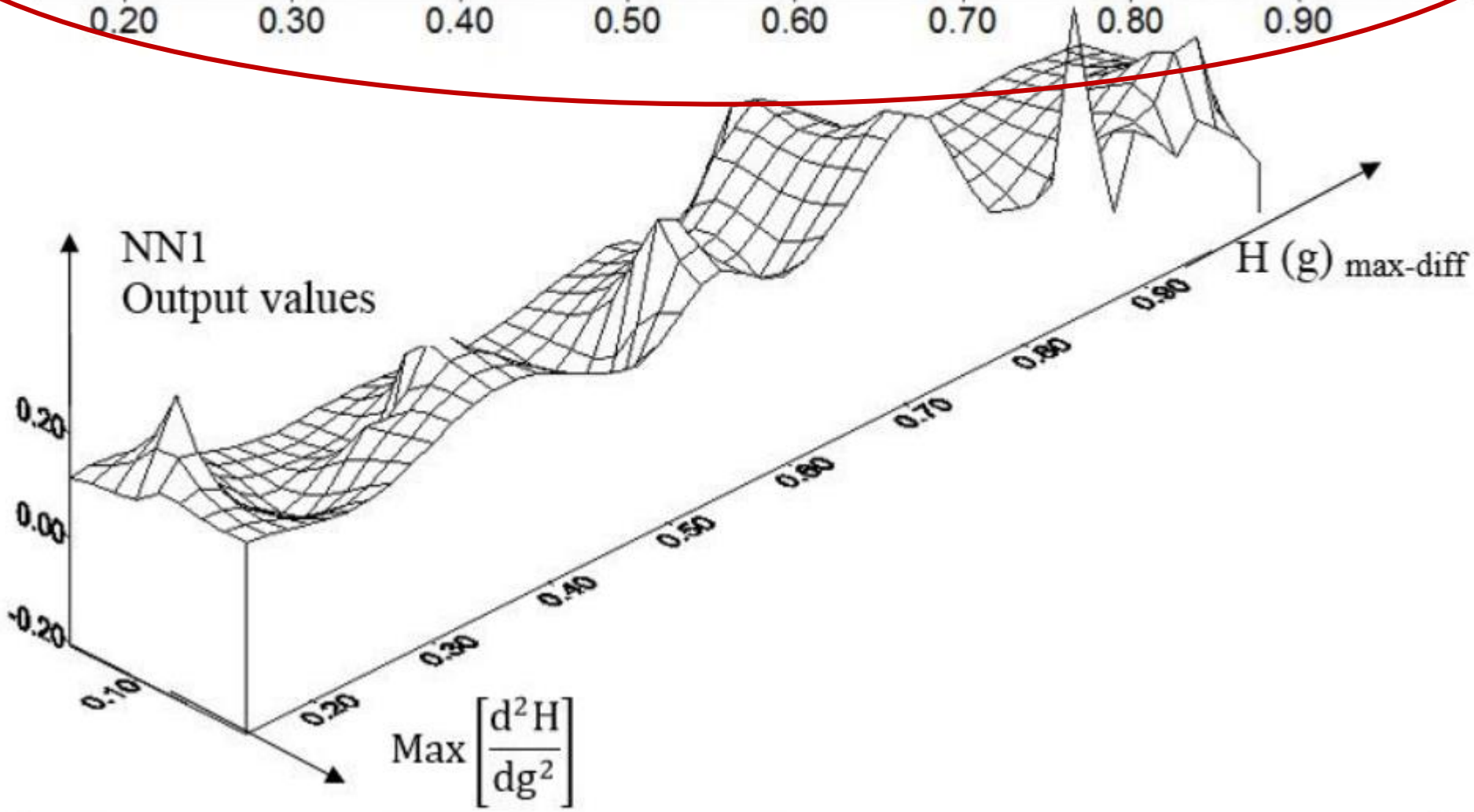
X
0
1591
Y
0

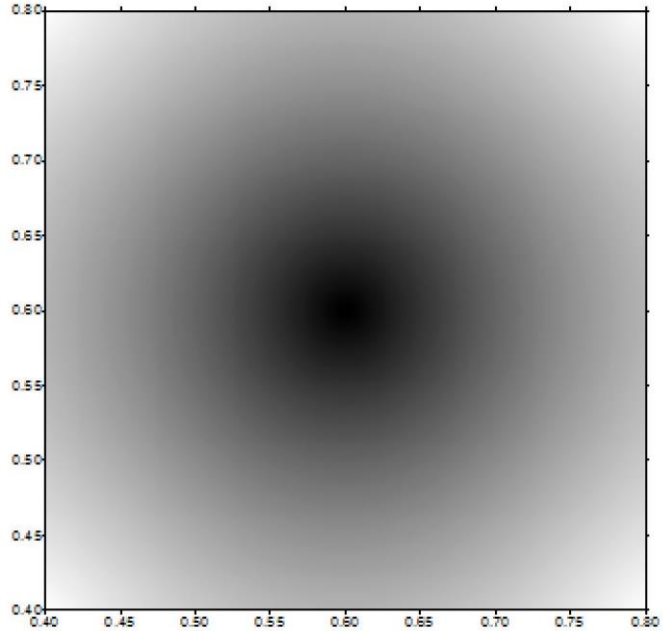


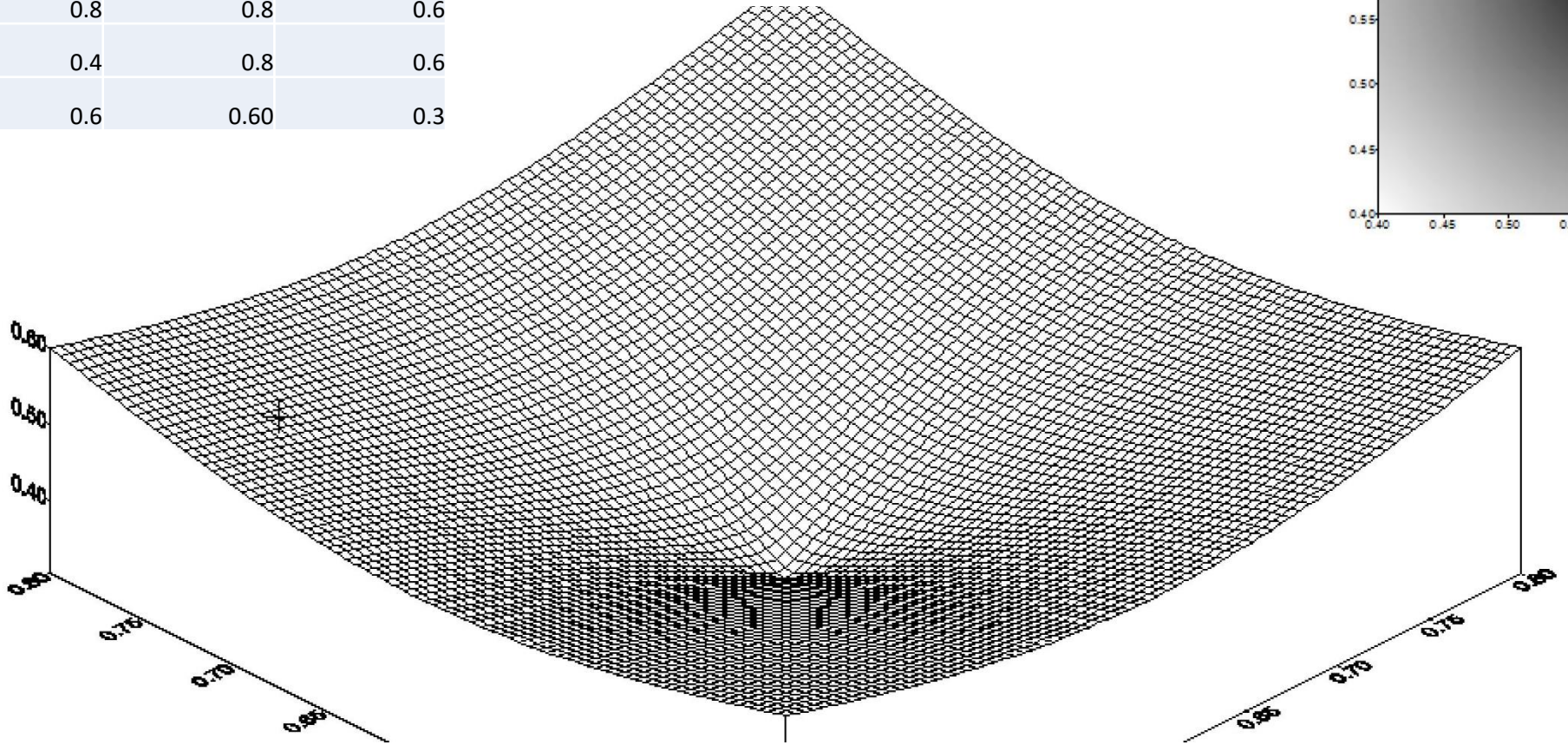


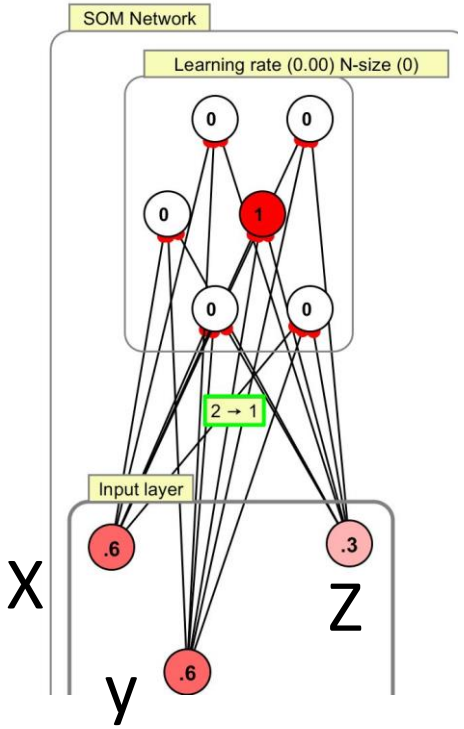
Decision/
Action

Unsupervised

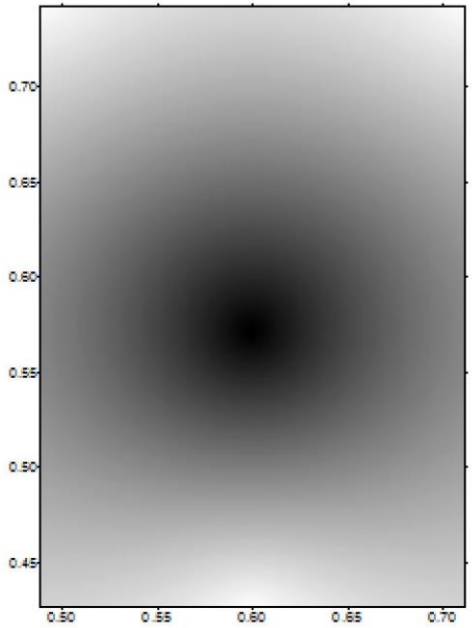
0.4	0.4	0.6
0.8	0.4	0.6
0.8	0.8	0.6
0.4	0.8	0.6
0.6	0.60	0.3

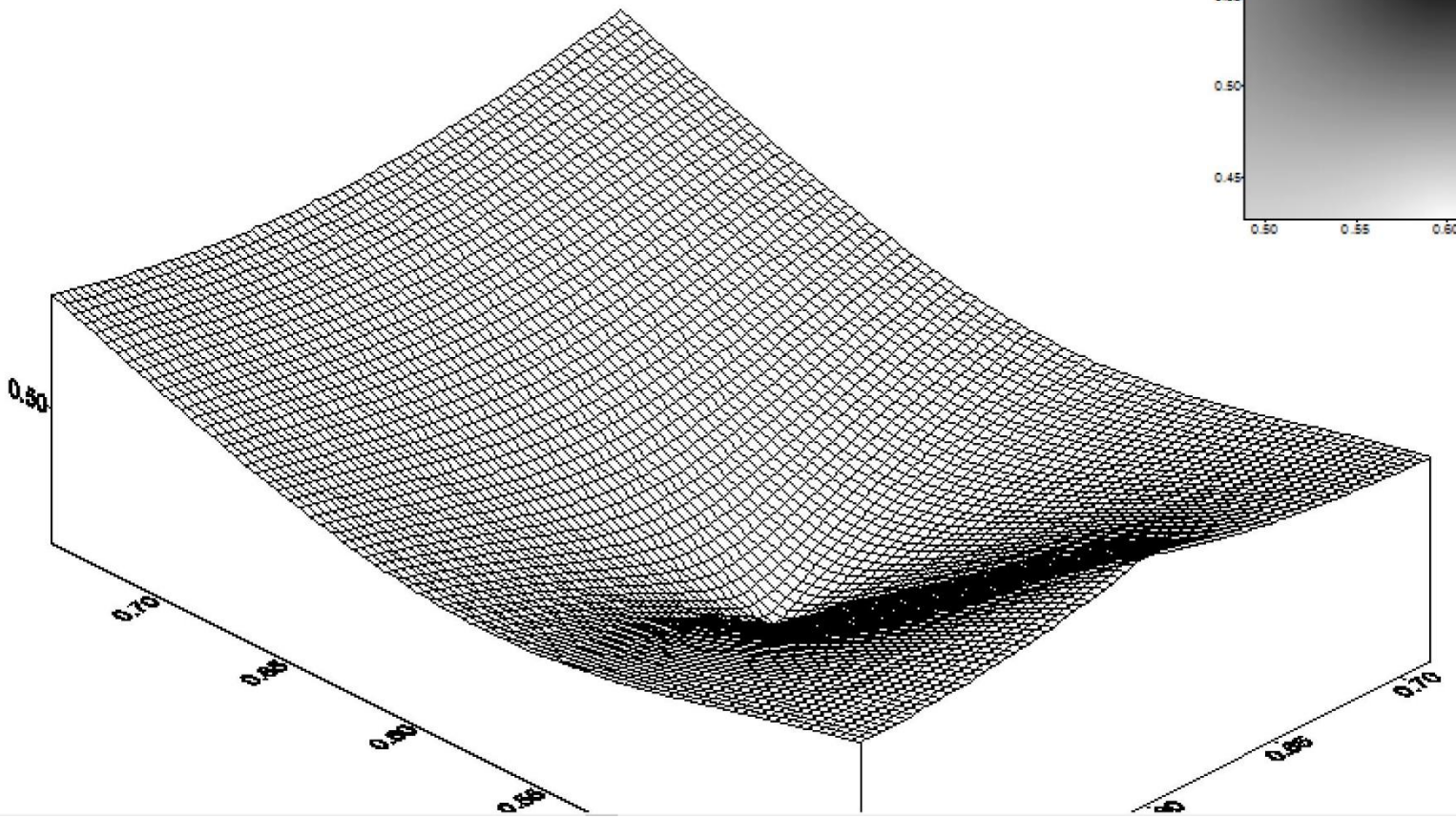


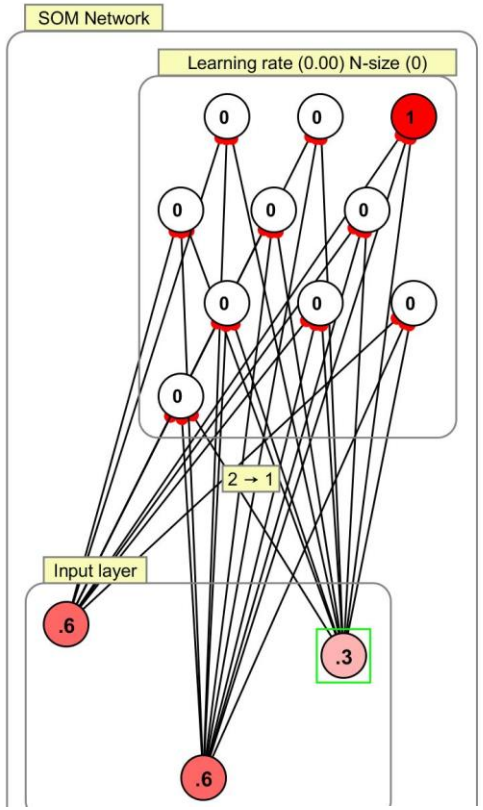


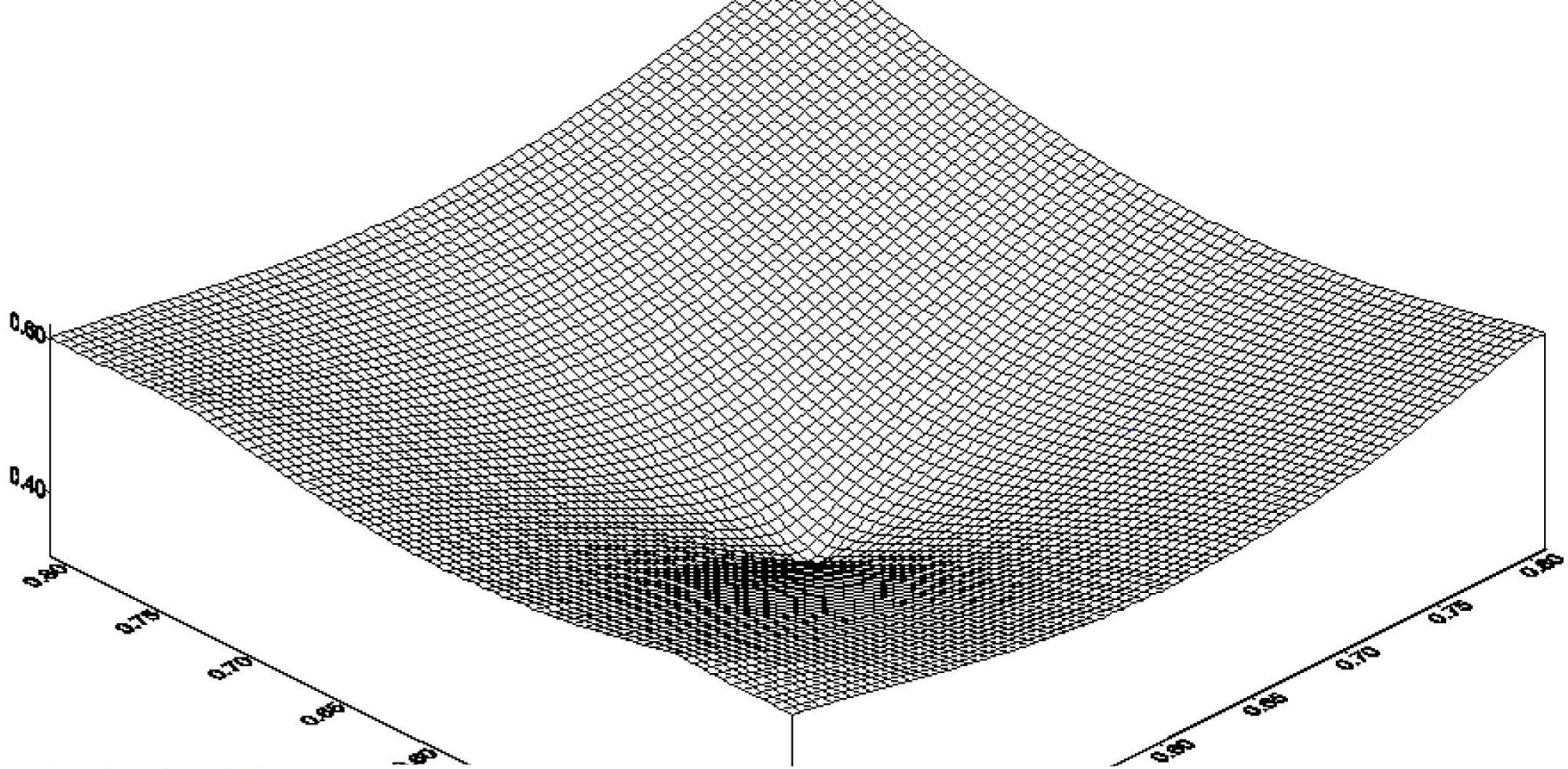


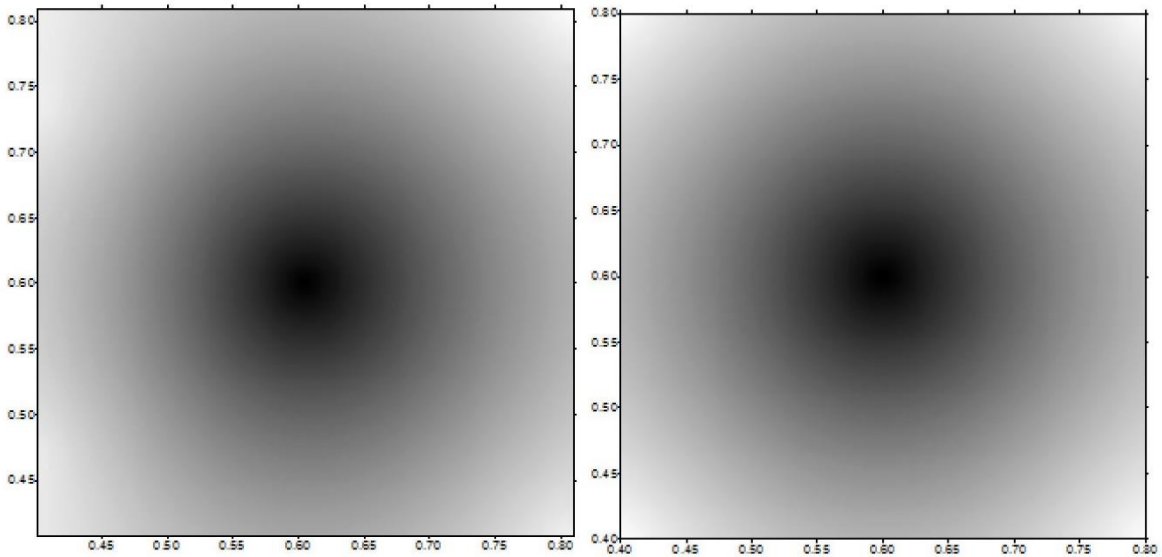
Approximation error calculation and self-adaptation of the topology






SOM Network
Learning rate (0.00) N-size (0)
0
0
1
0
0
0
0
0
0
0
2 → 1
Input layer
.6
.3
.6


0.60
0.40
0.80
0.75
0.70
0.65
0.60
0.55
0.50


0.80
0.75
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0.55
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0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80

0.80
0.75
0.70
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0.60
0.55
0.50
0.45
0.40
0.40
0.45
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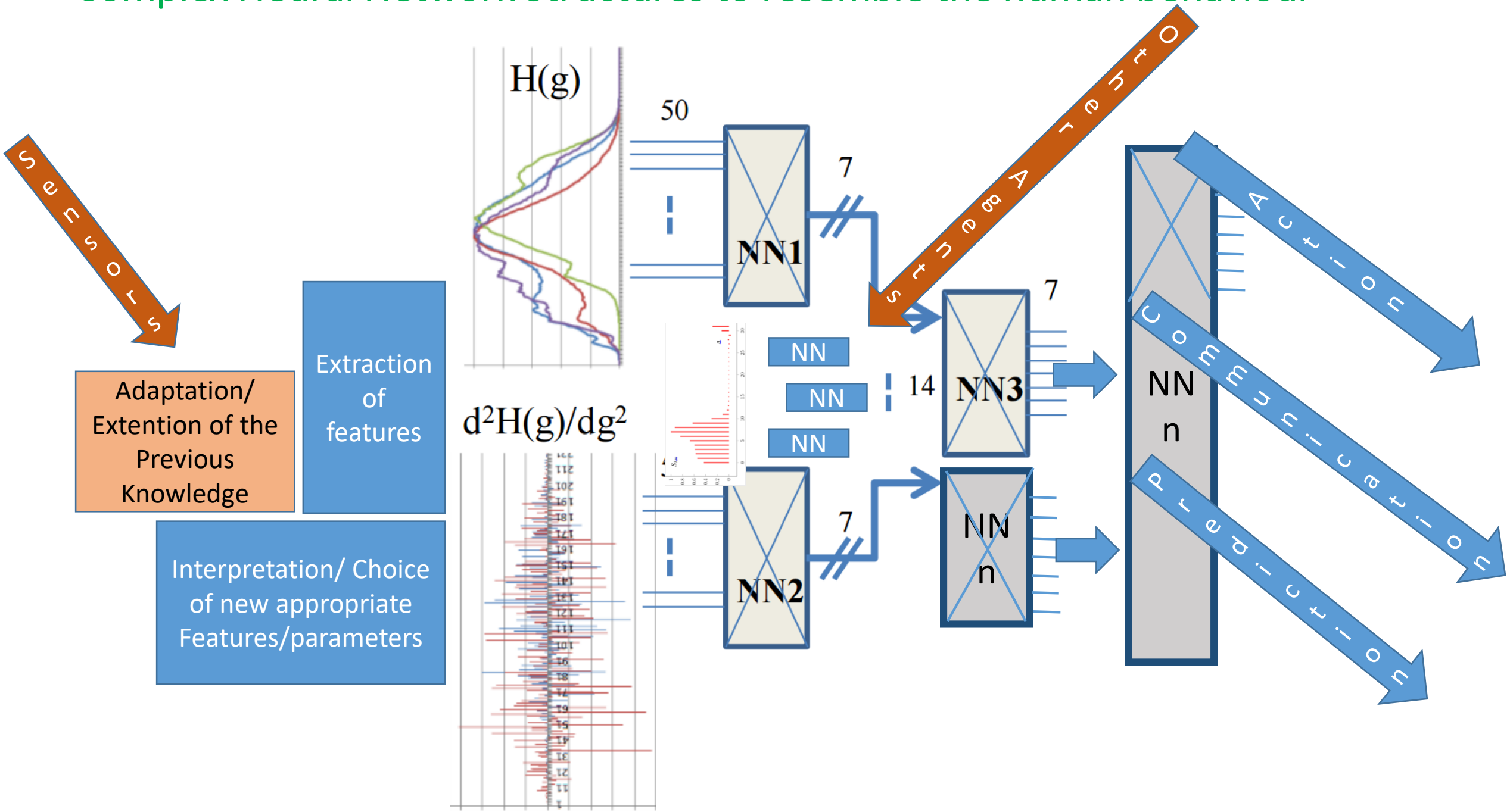
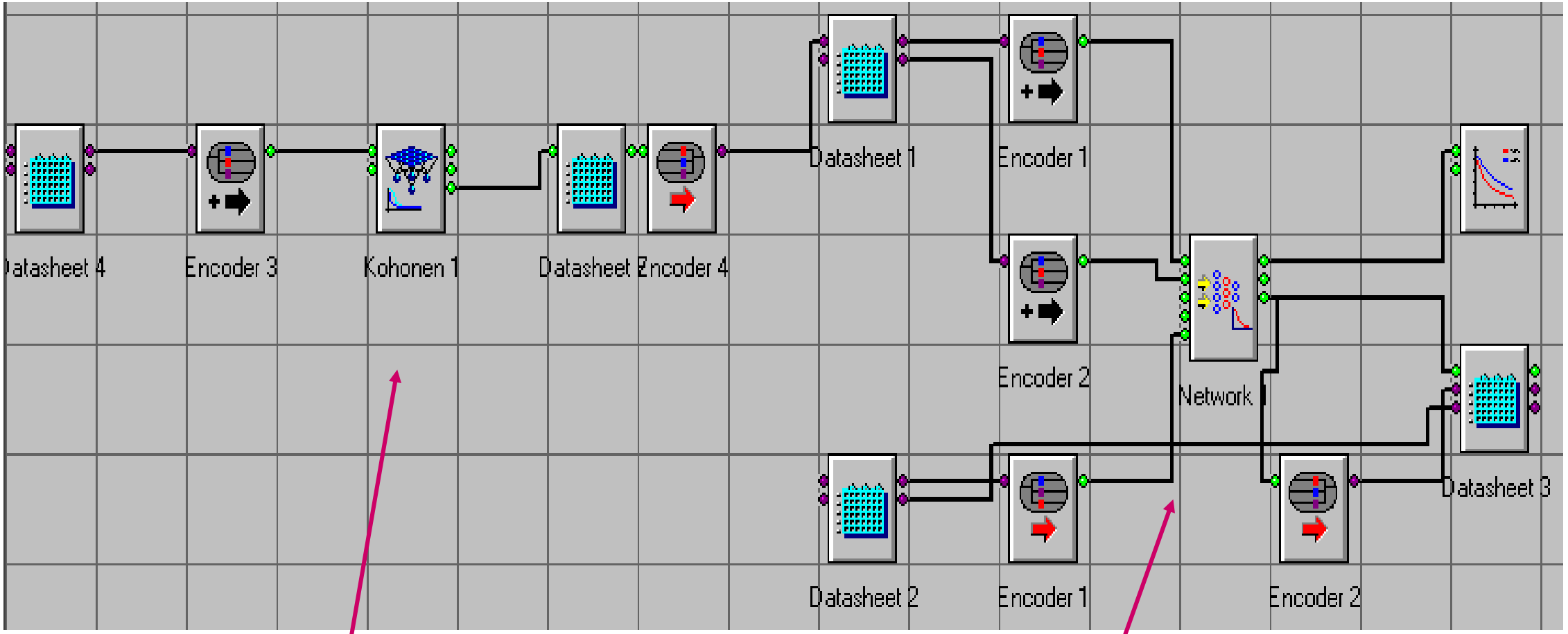
0.55
0.60
0.65
0.70
0.75
0.80

Complex Neural Network Structures to resemble the human behaviour

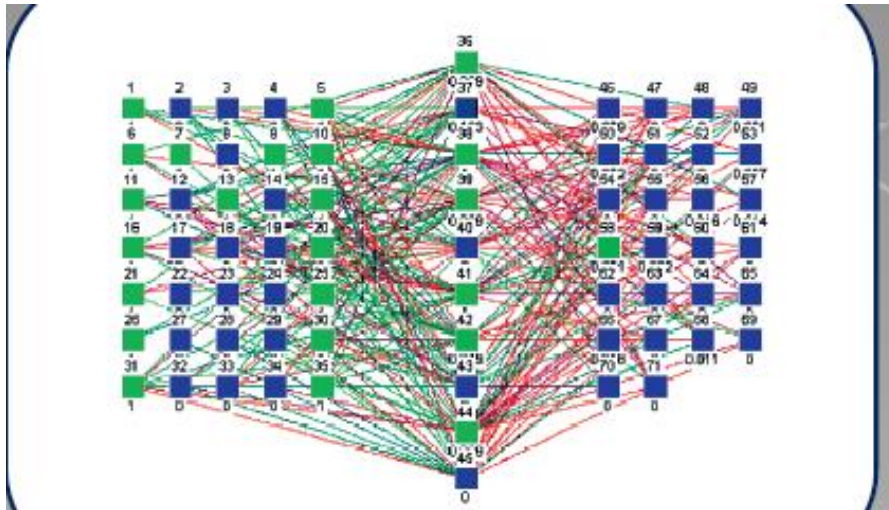


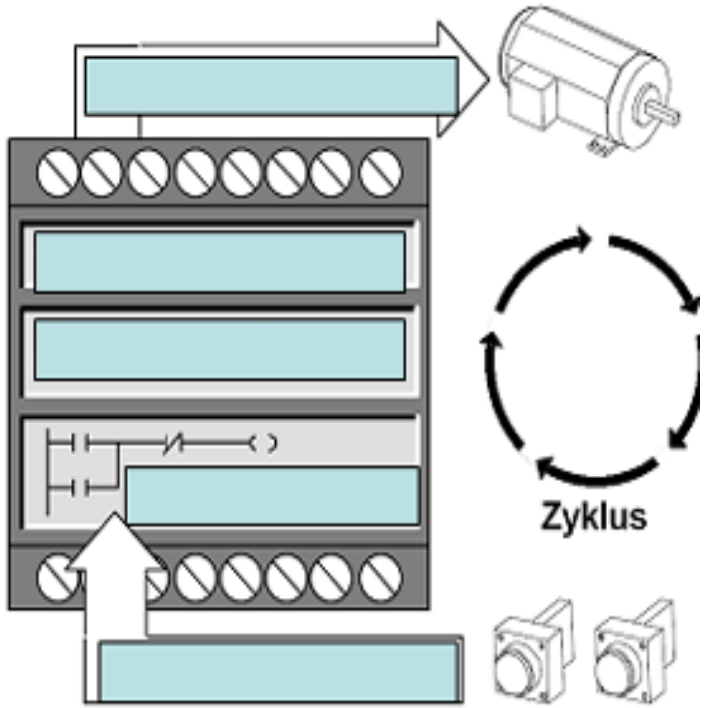


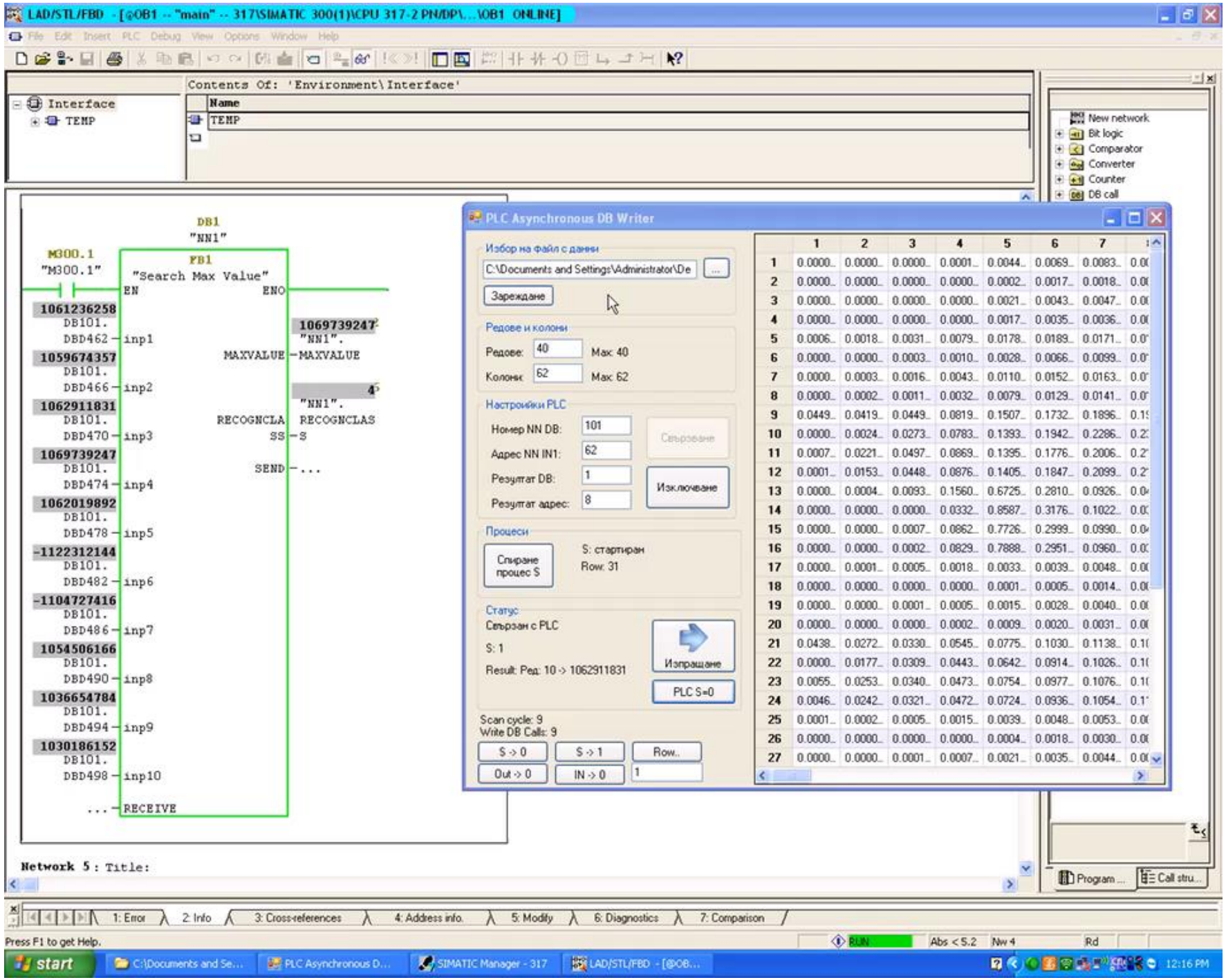
Kohonen Map

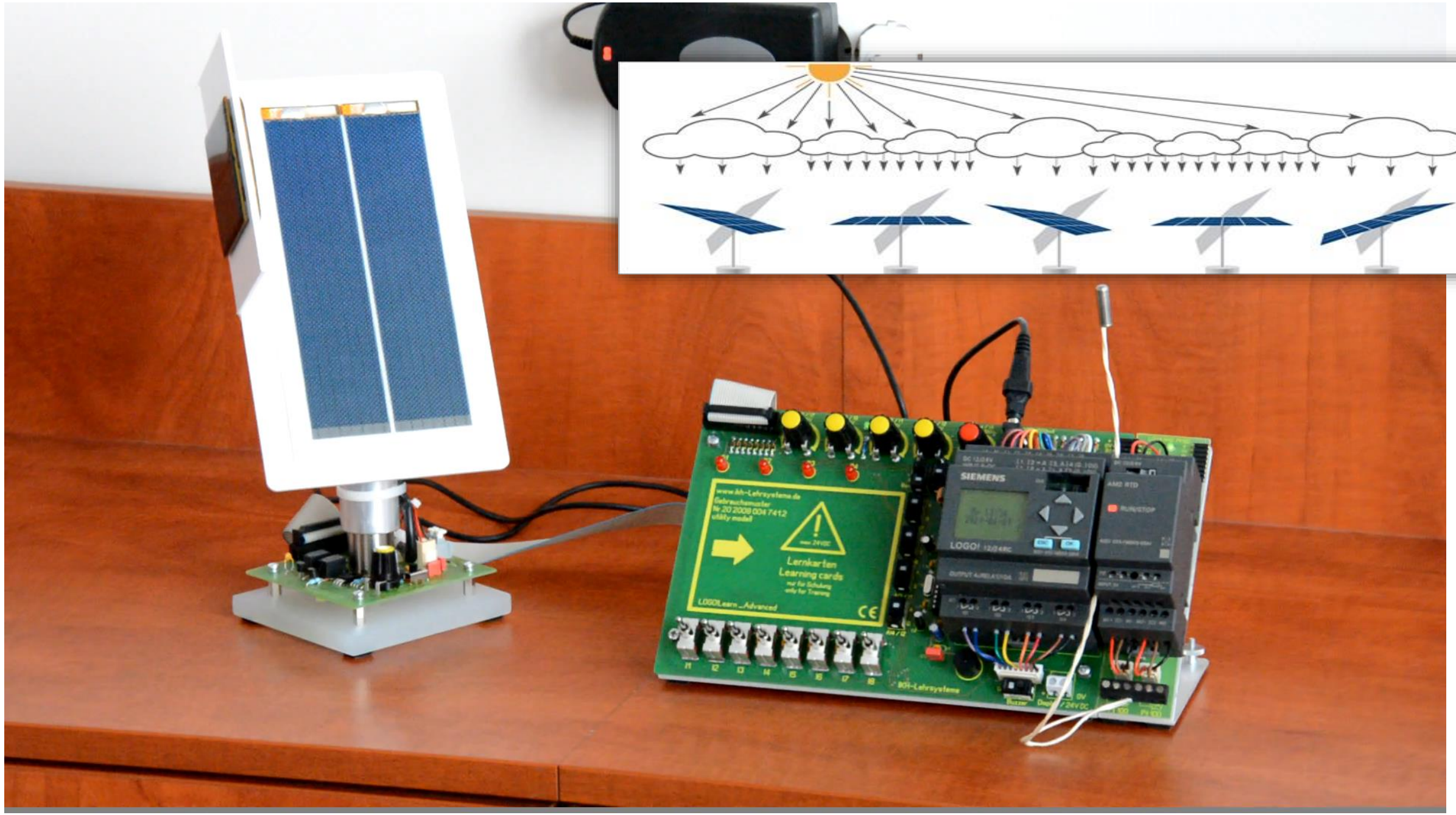
BPG MLP

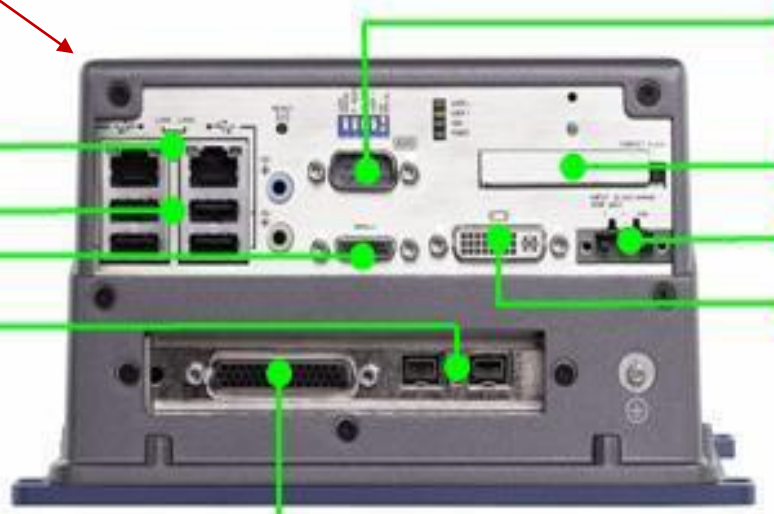
Intelligent Systems – Examples with integrated cognition




Zyklus


LAD/STL/FBD - [@OB1 -- "main" -- 317\SIMATIC 300(1)\CPU 317-2 PN/DP\...\OB1 ONLINE]
Contents Of: 'Environment\Interface'
Interface
TEMP
Name
TEMP
New network
Bit logic
Comparator
Converter
Counter
DB call
DB1
"NN1"
M300.1
"M300.1"
FB1
"Search Max Value"
EN
ENO
1061236258
DB101.
DBD462
inp1
1059674357
DB101.
DBD466
inp2
1062911831
DB101.
DBD470
inp3
1069739247
DB101.
DBD474
inp4
1062019892
DB101.
DBD478
inp5
-1122312144
DB101.
DBD482
inp6
-1104727416
DB101.
DBD486
inp7
1054506166
DB101.
DBD490
inp8
1036654784
DB101.
DBD494
inp9
1030186152
DB101.
DBD498
inp10
...
RECEIVE
MAXVALUE
RECOGNCLASS
SEND
1069739247
"NN1".
MAXVALUE
4
"NN1".
RECOGNCLASS
Network 5 : Title:
PLC Asynchronous DB Writer
Избор на файл с данни
C:\Documents and Settings\Administrator\De
Зареждане
Редове и колони
Редове: 40
Max: 40
Колонк 62
Max: 62
Настройки PLC
Номер NN DB: 101
Адрес NN IN1: 62
Резултат DB: 1
Резултат адрес: 8
Свързване
Изключване
Процеси
Спиране процес S
S: стартиран
Row: 31
Статус
Свързан с PLC
S: 1
Result: Ред: 10 -> 1062911831
Изпращане
PLC S=0
Scan cycle: 9
Write DB Calls: 9
S -> 0
S -> 1
Row..
Out -> 0
IN -> 0
1
Program ...
Call stru...
1: Error
2: Info
3: Cross-references
4: Address info.
5: Modify
6: Diagnostics
7: Comparison
Press F1 to get Help.
RUN
Abs < 5.2
Nw 4
Rd
start
C:\Documents and Se...
PLC Asynchronous D...
SIMATIC Manager - 317
LAD/STL/FBD - [@OB...
12:16 PM


SIEMENS
LOGO! 12/24RC
Lernkarten
Learning cards
LOGOLearn_Advanced


RS232 Serial
External Flash
10 to 30 VDC Power
DVI Video Output
(2) Gigabit Ethernet
(4) Hi-Speed USB
(1) MXI-Express
(2) IEEE 1394b
Bilingual Ports
(29) Reconfigurable
Digital I/O Lines

Thanks for your attention !