PROGRAMMING WITH PYTHON
First Test Results with Fixed-Rule and Random-Rule Actors
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Gerd Doeben-Henisch
gerd@doeben-henisch.de

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Contents

Abstract

A first series of tests have been realized with fixed-rule actors and random-rule actors. The results show, that there is no clear correlation between the mean amount of energy and the death rate of an actor (-0.78 fixed rule Actor), (-0.71 random rule actor). Between the death rates of both actors we have a correlation of -0.18, and between the mean energy of both actors a little bit positive correlation of 0.05.

1 Discussion

A first experiment has been realized with the version of the program named *ae6-2-6-main.py*.

This program offers the following options for the user:

1. Which kind of behavior (fixed-rule, random-rule)
2. Size of grid (n x n)
3. Percentage of obstacles in the grid (default is 20)
4. Percentage of food in the grid (default is 5)
5. Amount of cycles for one run
6. Amount of repetitions of runs
7. Debug mode (clicking with the mouse after every step) or not
8. Duration of sleeping between steps (if no debug mode)(0 - 5 sec)
9. Manual or random determination of start position

The output is a graph showing the mean energy consumed, the death rate per run, the percentage of energy level per run, the percentage of obstacles and food to the grid area.

All these options of the program have been tested. Everything worked fine. Only in the complete automatic mode (with automatic start positions) the program crashed with spyder in the case of the random rule actor.

Repeating these tests directly from the Linux-Shell with the directory path ' /Dokumente/EMP/SW/PY-PROGRAMS/A-E-6-2$' and the command 'python3 ae6-2-6-main.py' everything worked fine. No problems. Thus it seems that the error is an artifact caused by the spyder-software.

1.1 Expectations

In this experiment the following options have been activated:

1. Either behavior type 1 or 2
2. Using the grid sizes 7 - 9 - 11 - 15

3. In parallel using the amount of cycles with 50 - 70 - 90 - 130
4. In all cases 10 repetitions
5. No-Debug, Sleep-time 0 sec, automatic determination of start position.
6. For every type of behavior with a certain amount of cycles the experiment has been done 3 times.

With these assumptions does the abbreviation 'T1-7-50-10-R1' mean that this experiment used type 1 of behavior, grid-size was 7x7, amount of cycles was 50 with 10 repetitions, and this was experiment 1 of three.

In case of the *fixed-rule* actor the amount of the death-rate depends directly from the fact, that the right-hand rule allows a path, where there is no single food object. The size of the grid and the percentage of objects and food does not matter. The only influence can be that the positive paths can have until 4 food interactions; this can increase the amount of mean energy.

In the case of the *random-rule* actor the death-rate depends from the fact, that a random path is completely open. Even if a random actor hits lots of food-objects this does not guarantee a death-free path. The only influence can be that the length of the path increases the probability to hit a food object.

1.2 Results

The results show, that there is no clear correlation between the mean amount of energy and the death rate of an actor (-0.78 fixed rule Actor), (-0.71 random rule actor). This confirms the expectation above.

Between the death rates of both actors we have a correlation of -0.18, and between the mean energy of both actors a little bit positive correlation of 0.05. That there are slight correlations between the death-rates of both actors and even more between the mean energies is also confirming the expectations. Because both actors depend from the same configuration and where the proportion between objects and food is stable with regard to the whole grid it is only the length of the path which varies, and this can increase the amount of energy while the death-rate keeps its uncertainty.

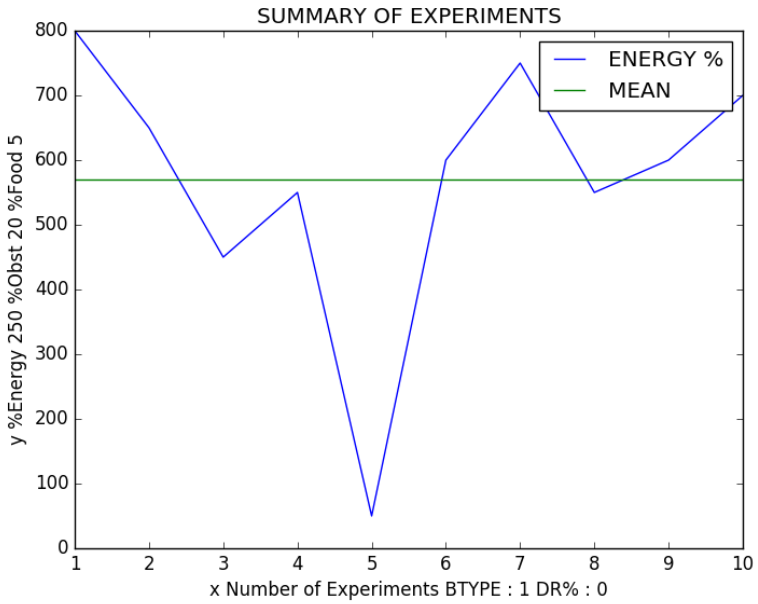

Figure 1: T1-7-50-R1

1.3 Consequences

This simple setting demonstrates that an input output system whose only interactions with the environment are *fixed or random movements* which occur *independent* of the actual context as well as *interaction with food* when the actor *hits the food directly* is highly uncertain in its overall outcome.

To *improve* the success of an actor one has to provide some kind of an internal representation of the environment *inside* the actor in a way which allows an exploitation of those properties of the environment which support more success in terms of energy and low death-rates.

Another dimension could be the generation of *offspring* under certain successful runs. Offspring would generate some kind of a population which implies new kinds of constraints.

2 Data Fixed-Rule Actor

2.1 EXPERIMENT 1

1. **T1-7-50-R1:**

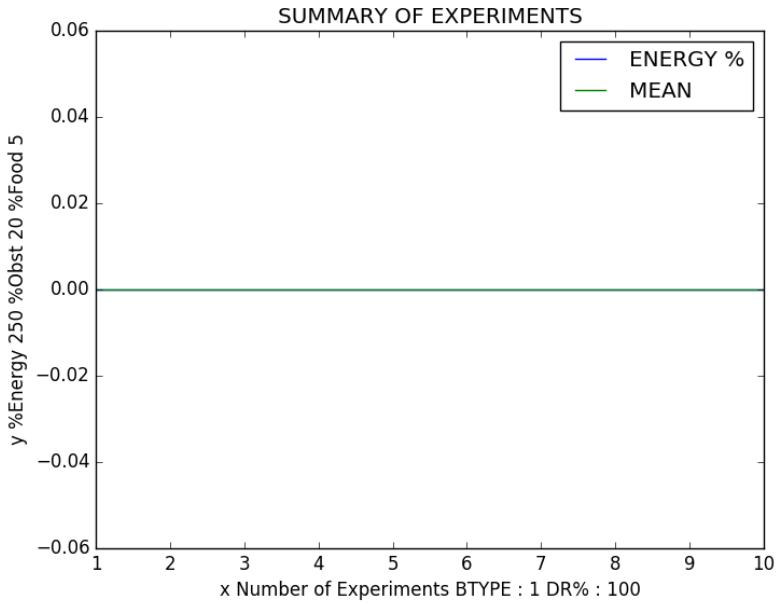

Figure 2: T1-7-50-10-R2

2. **T1-7-50-R2:**
3. **T1-7-50-R3:**

2.2 EXPERIMENT 2

1. **T1-9-70-10-R1:**
2. **T1-9-70-10-R2:**
3. **T1-9-70-10-R3:**

2.3 EXPERIMENT 3

1. **T1-11-90-10-R1:**
2. **T1-11-90-10-R2:**
3. **T1-11-90-10-R3:**

2.4 EXPERIMENT 4

1. **T1-15-130-10-R1:**
2. **T1-15-130-10-R2:**

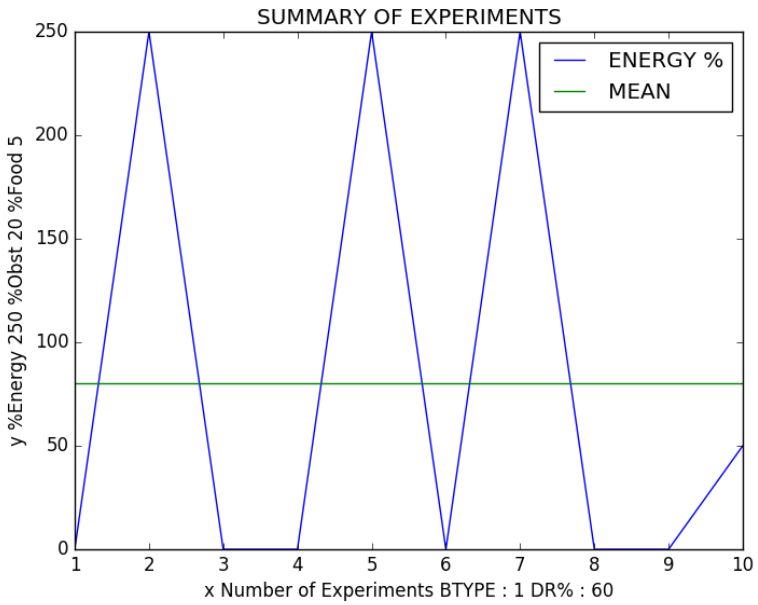

Figure 3: T1-7-50-10-R3

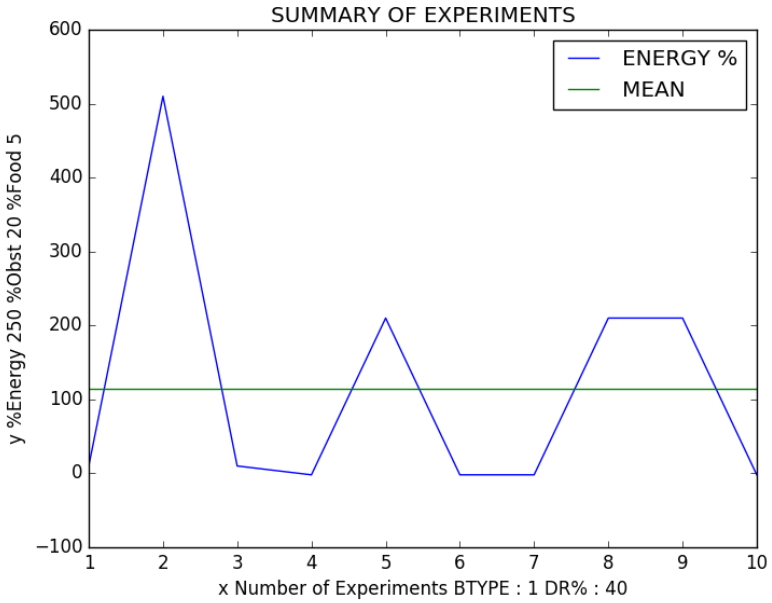

Figure 4: T1-9-70-10-R1

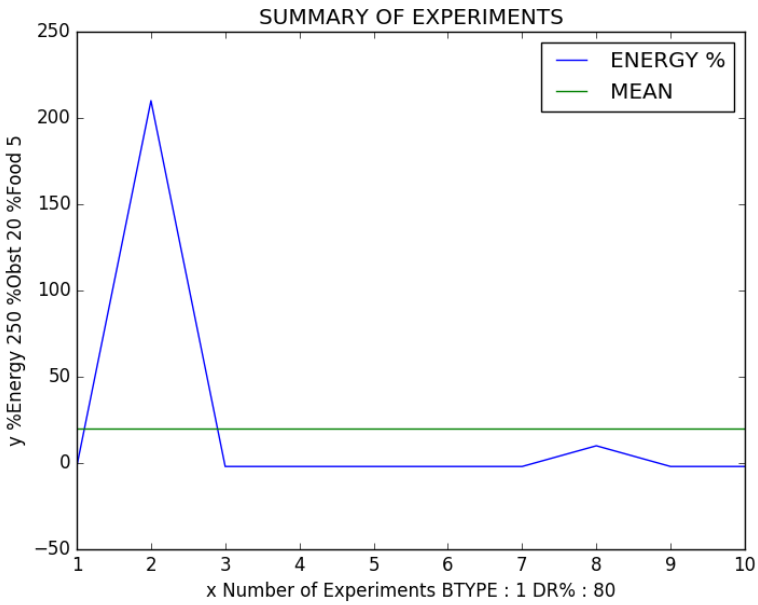

Figure 5: T1-9-70-10-R2

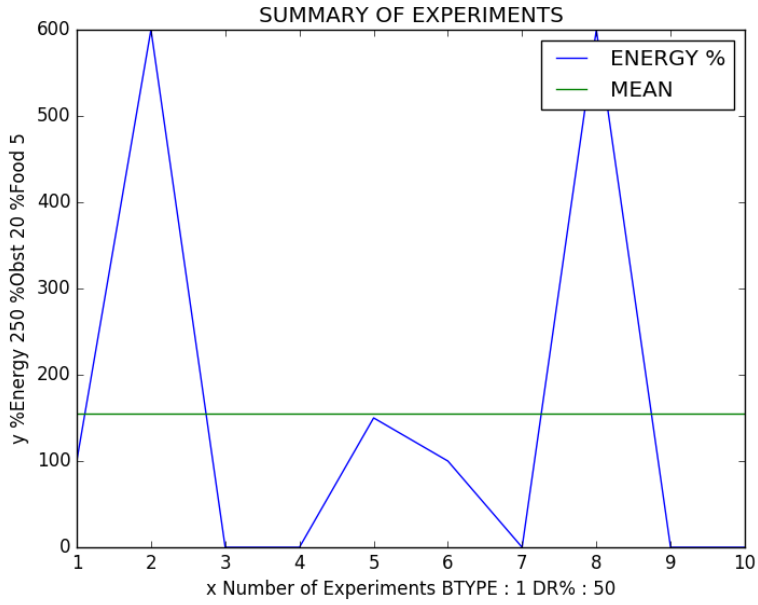

Figure 6: T1-9-70-10-R3

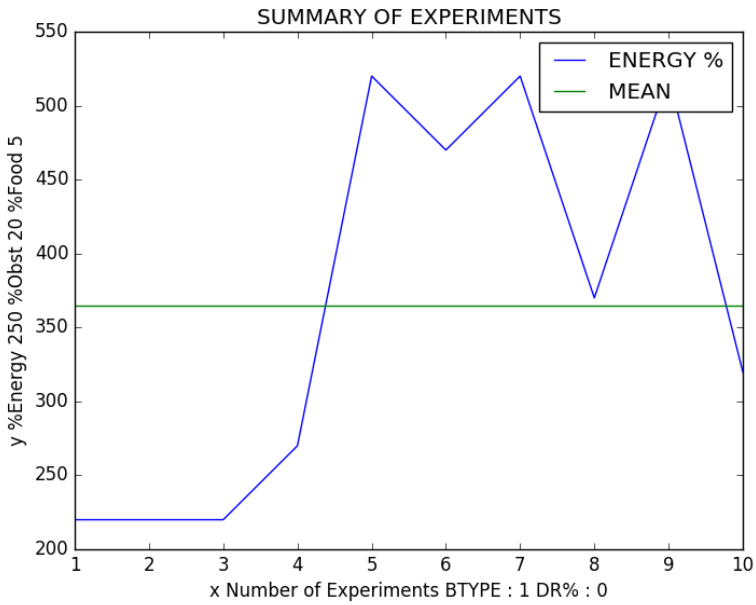

Figure 7: T1-11-90-10-R1

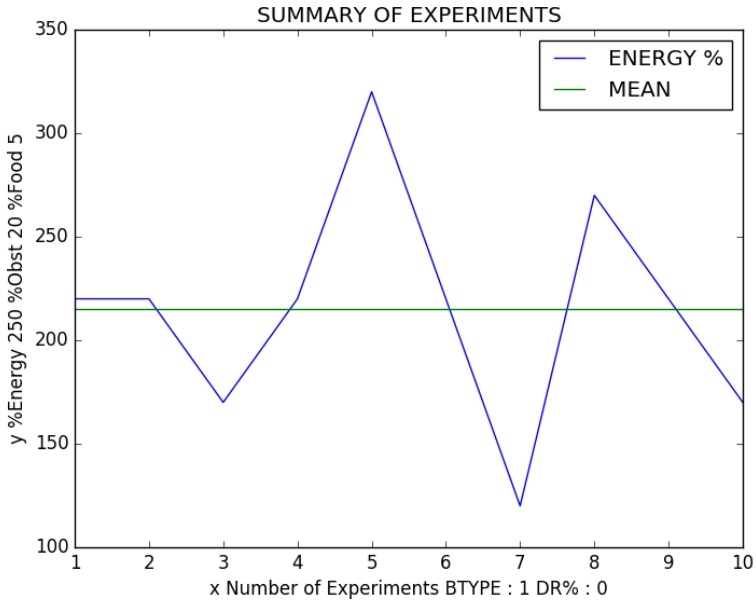

Figure 8: T1-11-90-10-R2

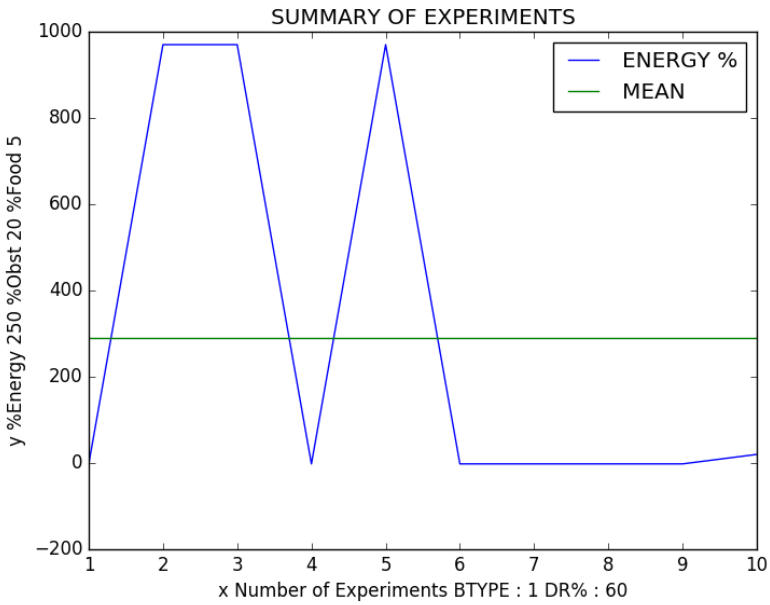

Figure 9: T1-11-90-10-R3

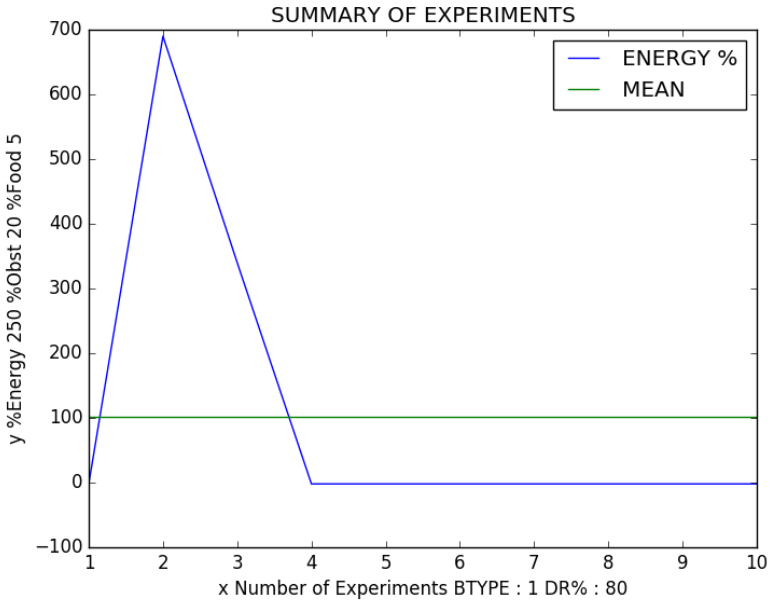

Figure 10: T1-15-130-10-R1

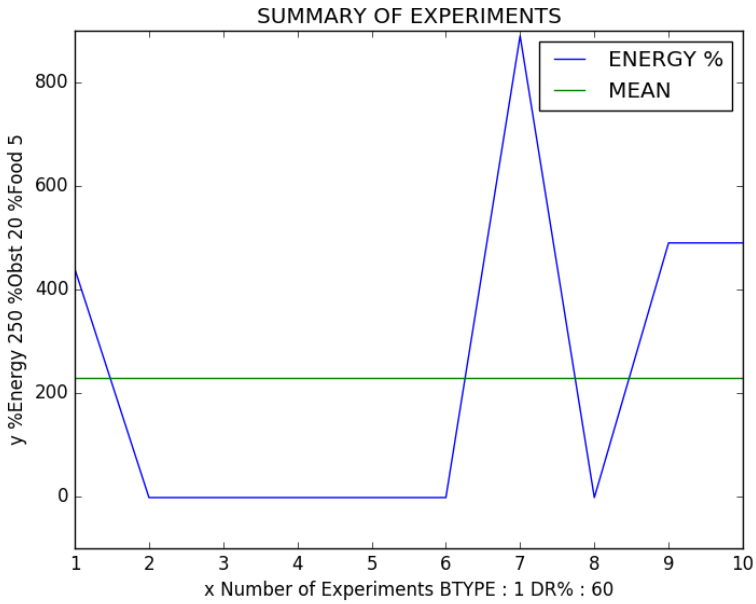

Figure 11: T1-15-130-10-R2

3. **T1-15-130-10-R3:**

3 Data Random-Rule Actor

3.1 EXPERIMENT 1

1. **T2-7-50-10-R1:**
2. **T2-7-50-10-R2:**
3. **T2-7-50-10-R3:**

3.2 EXPERIMENT 2

1. **T2-9-70-10-R1:**
2. **T2-9-70-10-R2:**
3. **T2-9-70-10-R3:**

3.3 EXPERIMENT 3

1. **T2-11-90-10-R1:**

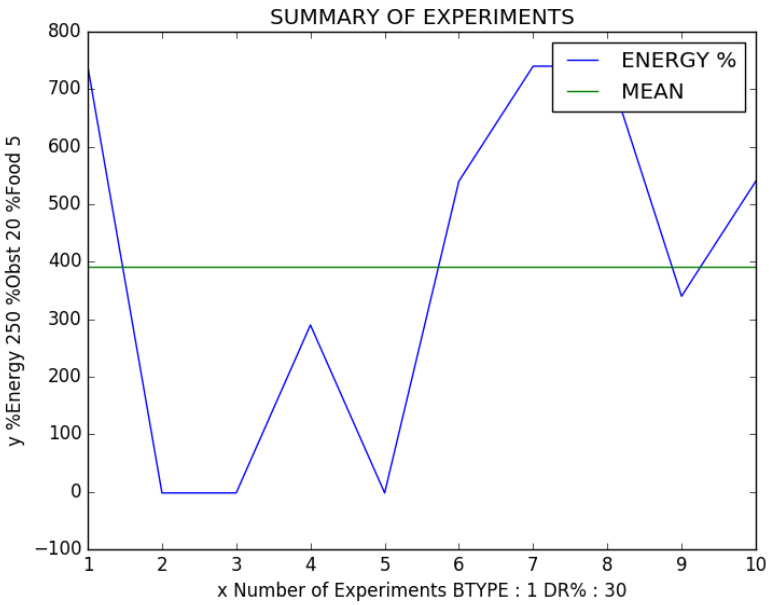

Figure 12: T1-15-130-10-R3

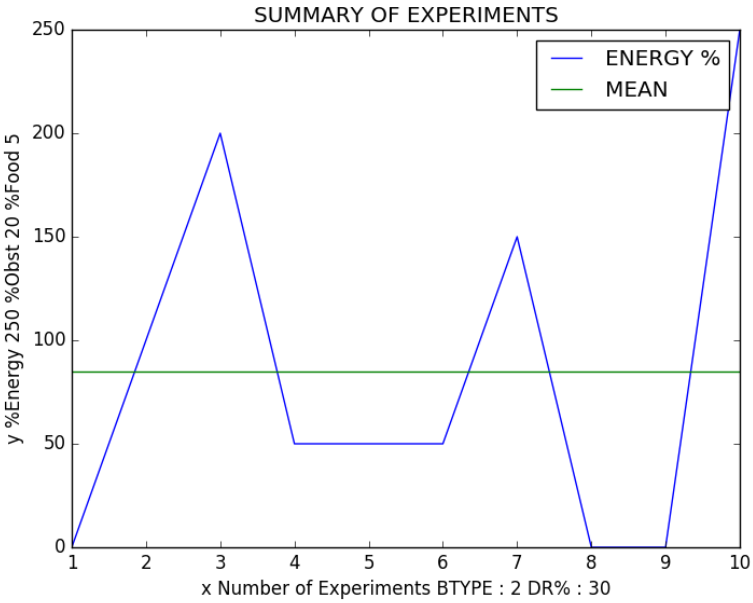

Figure 13: T2-7-50-R1

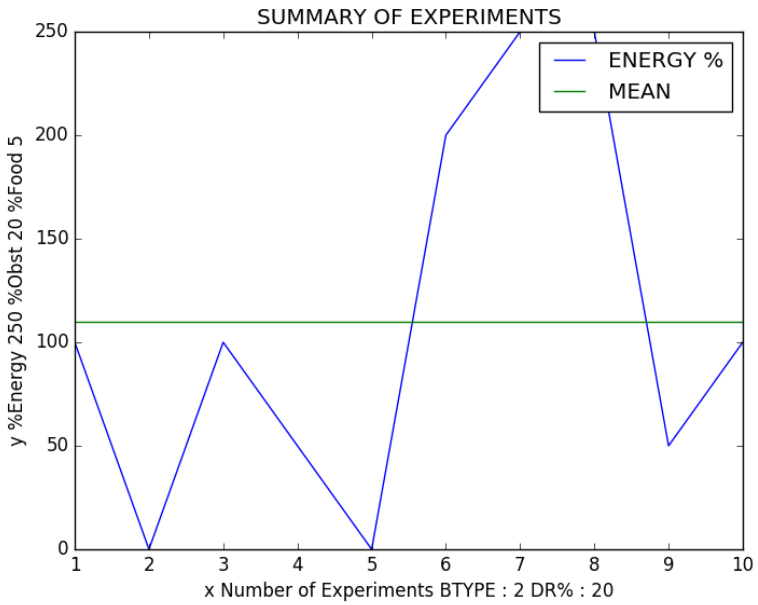

Figure 14: T2-7-50-10-R2

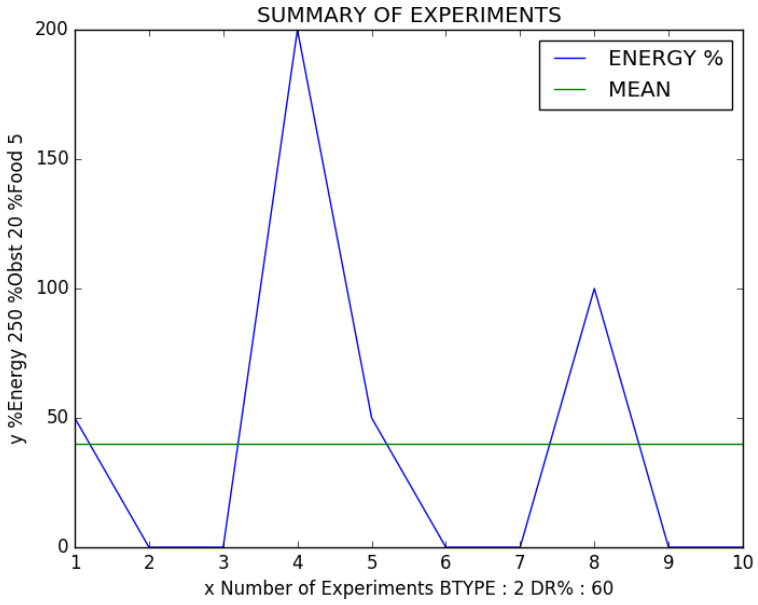

Figure 15: T2-7-50-10-R3

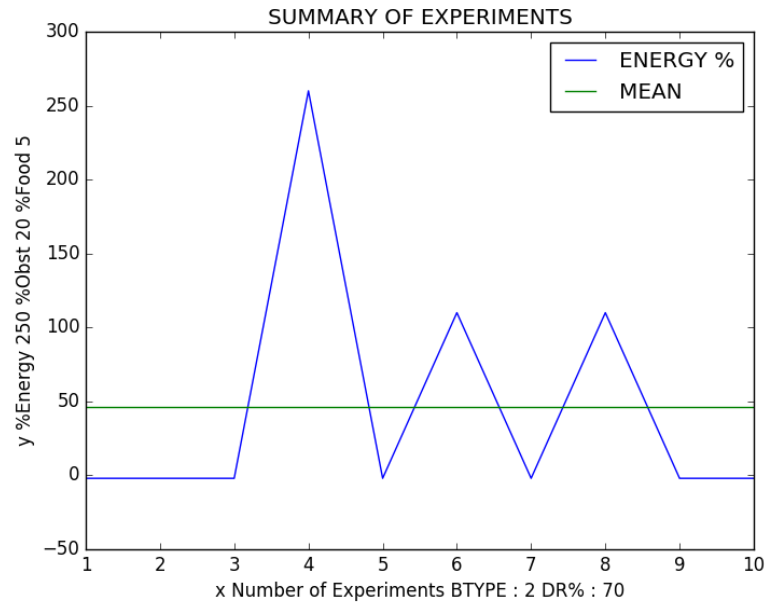

Figure 16: T2-9-70-10-R1

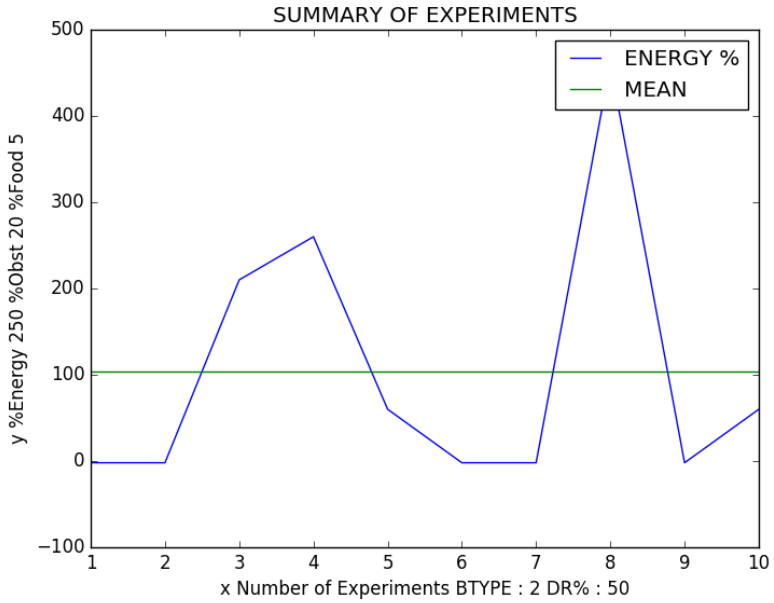

Figure 17: T2-9-70-10-R2

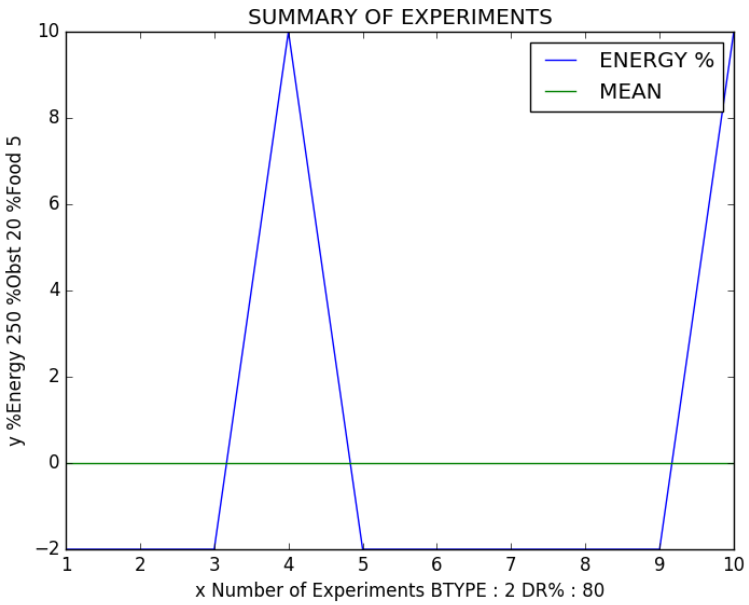

Figure 18: T2-9-70-10-R3

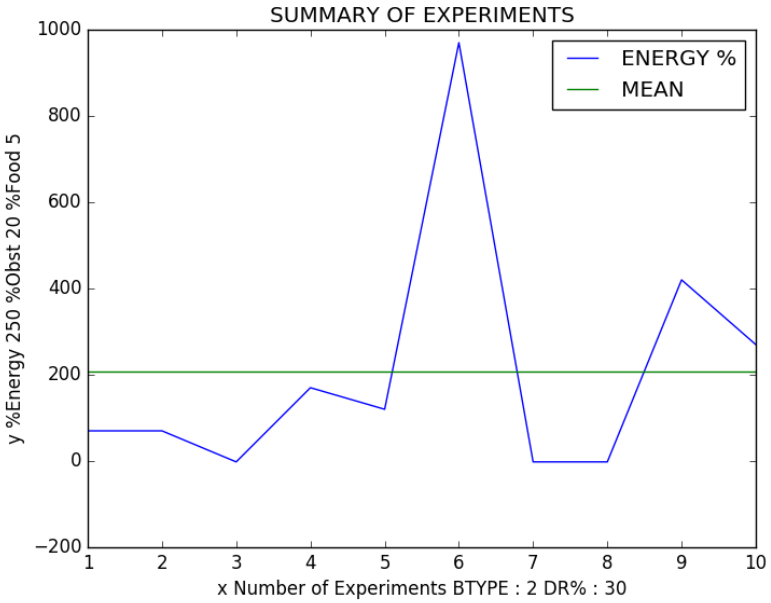

Figure 19: T2-11-90-10-R1

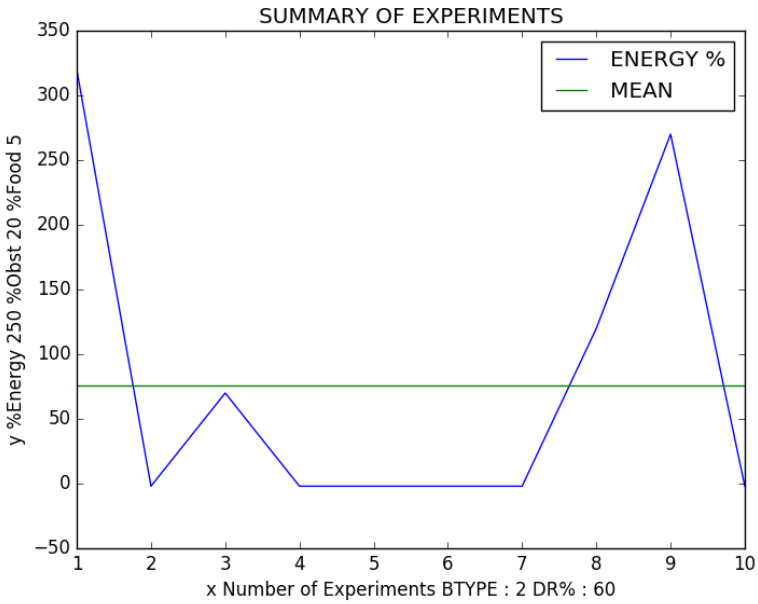

Figure 20: T2-11-90-10-R2

2. **T2-11-90-10-R2:**
3. **T2-11-90-10-R3:**

3.4 EXPERIMENT 4

1. **T2-15-130-10-R1:**
2. **T2-15-130-10-R2:**
3. **T2-15-130-10-R3:**

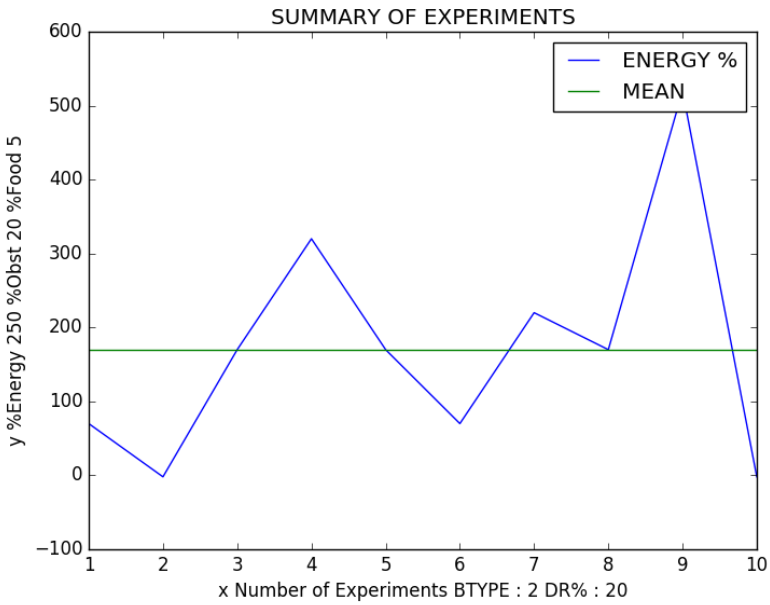

Figure 21: T2-11-90-10-R3

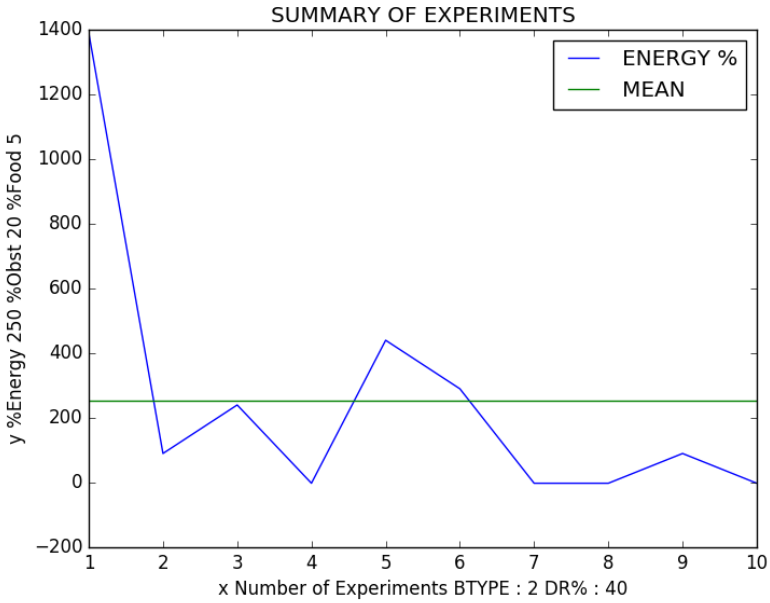

Figure 22: T2-15-130-10-R1

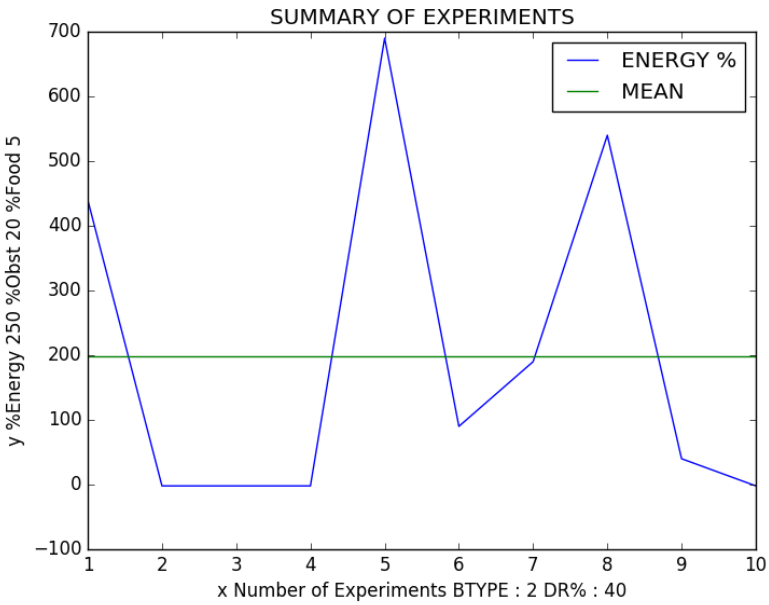

Figure 23: T2-15-130-10-R2

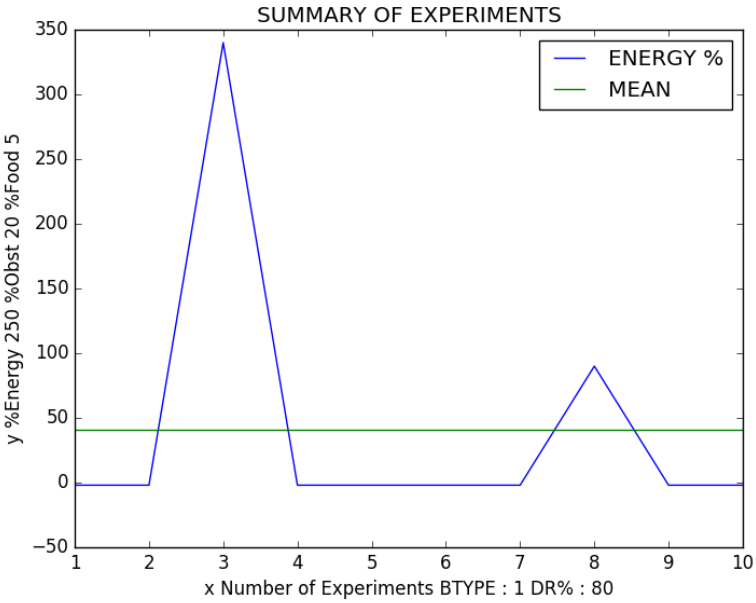

Figure 24: T2-15-130-10-R3