Sztuczna inteligencja i inżynieria wiedzy – laboratorium  
  
Sprawozdanie: Algorytmy genetyczne  
  
  
Kajetan Pynka, 254495

Spis treści

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# Wstępne założenia implementacyjne

W ramach badań przeprowadzonych w kolejnych rozdziałach sprawozdania modyfikowane były następujące parametry:

* Rozmiar populacji
* Prawdopodobieństwo mutacji
* Prawdopodobieństwo krzyżowania
* Liczba pokoleń
* Rozmiar turnieju

Dla każdej sekcji badań (i każdego źródła danych) stosowałem te same parametry początkowe:

* Liczba pokoleń = 500
* Rozmiar populacji = 10
* Domyślnie selekcja turniejowa
* Rozmiar turnieju = 30% rozmiaru populacji (tutaj 3)
* Prawdopodobieństwo mutacji = 10%
* Prawdopodobieństwo krzyżowania = 60%

Zdaje sobie sprawę, że dla różnych źródeł danych te ustawienia mogą być albo odpowiednie albo nie, natomiast skupiłem się na porównaniu zmian poszczególnych parametrów (chciałem zapewnić wszędzie równe warunki startowe by móc kontrolować pojedynczą zmienną).

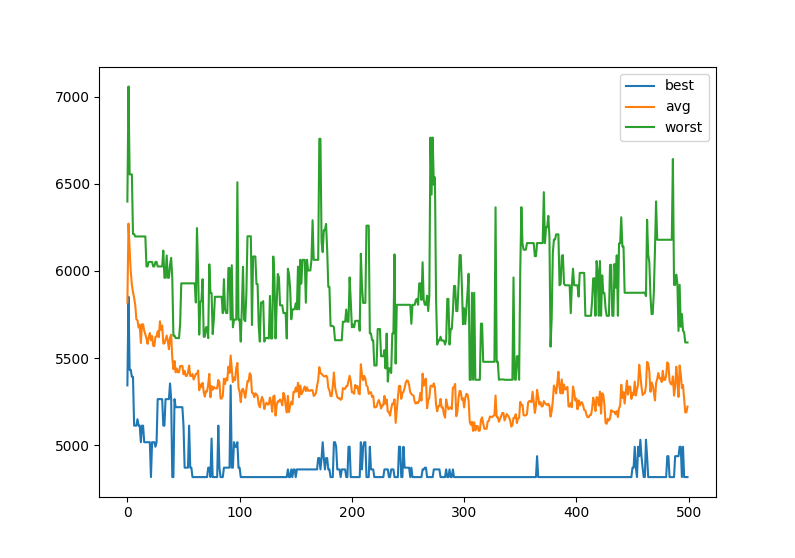
W ramach operatora krzyżowania zastosowałem krzyżowanie jednopunktowe.

W ramach operatora mutacji prawdopodobieństwo określa szansę na zmutowanie każdego pojedynczego genu (nie mam osobnego parametru na to czy osobnik powinien zmutować).

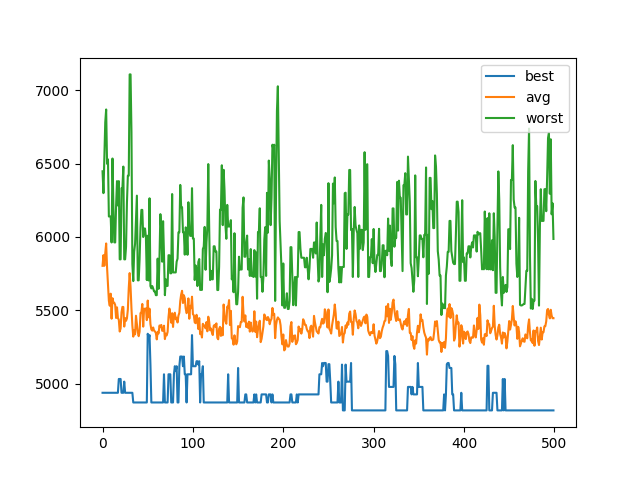
Następnie przedstawię wyniki przeprowadzonych badań. Best, worst, avg oraz std dotyczą ostatniego pokolenia algorytmu genetycznego (z jednej strony best powinien raczej dotyczyć najlepszej możliwej wartości ale z drugiej strony branie worst na samym początku algorytmu gdy jest kosmicznie duży uważam za bez sensu).

# Selekcja turniejowa vs selekcja ruletkowa

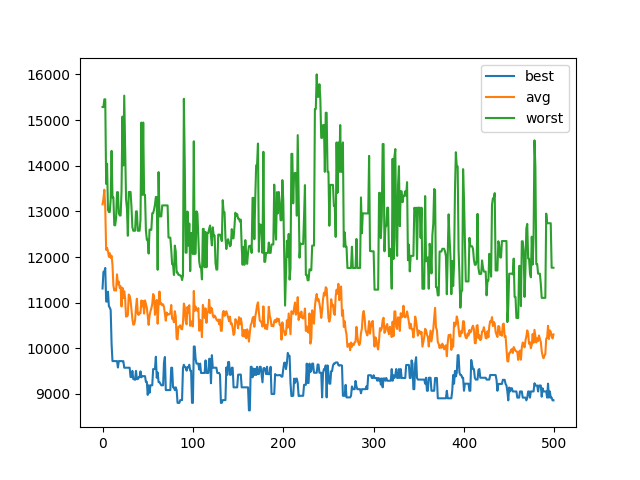
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| instancja | Alg. Ewolucyjny [10x] | | | | Metoda losowa [N] | | | |
|  | best | worst | avg | std | best | worst | avg | std |
| EASY/001 | 4818 | 5590 | 5222.5 | 232.4 | 4818 | 11730 | 7842.7 | 1051.4 |
| EASY/002 | 4818 | 11730 | 7842.7 | 348.1 | 4818 | 11730 | 7848.9 | 1054.5 |
| FLAT/001 | 8860 | 11765 | 10305.5 | 936.6 | 8940 | 25425 | 18087.3 | 2223.6 |
| FLAT/002 | 8605 | 12860 | 10107.5 | 1289.4 | 9245 | 24820 | 18093.2 | 2225.2 |
| HARD/001 | 15914 | 18831 | 17704.9 | 1066 | 15055 | 39553 | 26456.4 | 3175.2 |
| HARD/002 | 15707 | 20016 | 17779.9 | 1423.1 | 15588 | 39183 | 26460.2 | 3185.6 |



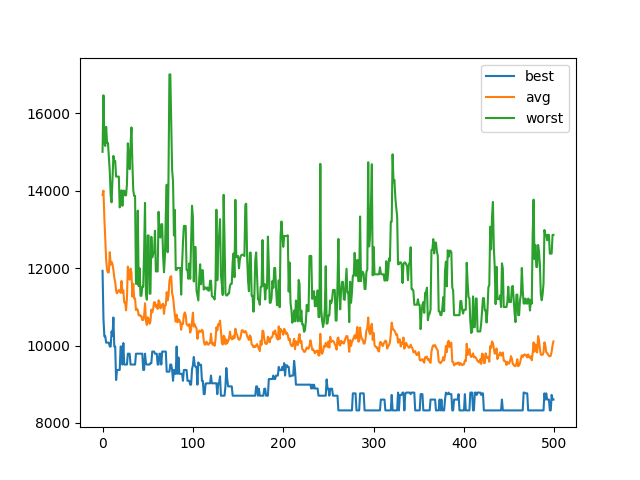
*EASY/001*



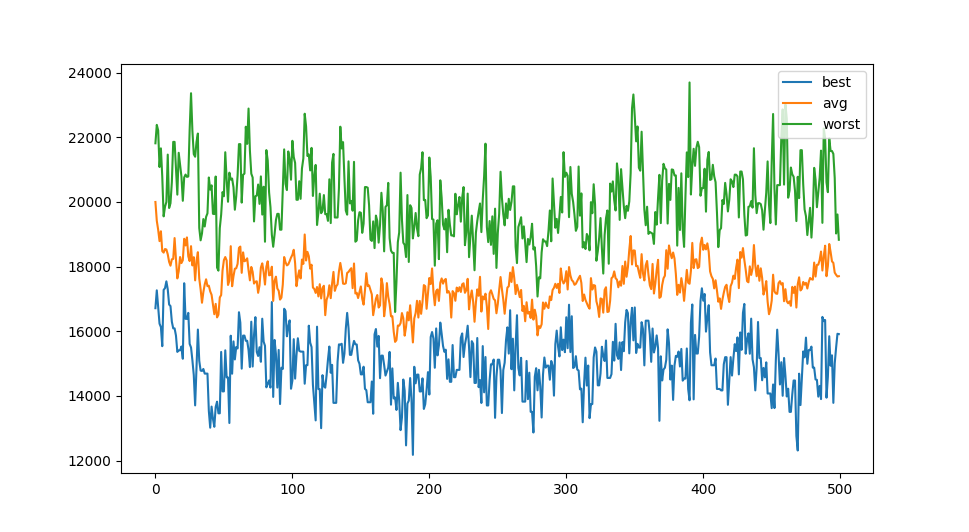
EASY/002



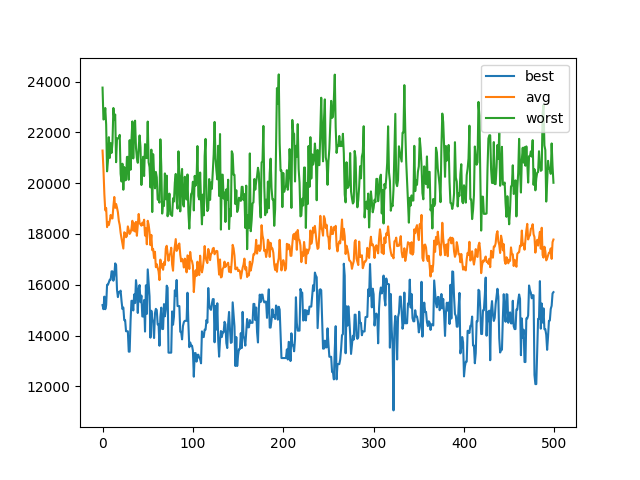
FLAT/001



FLAT/002



HARD/001

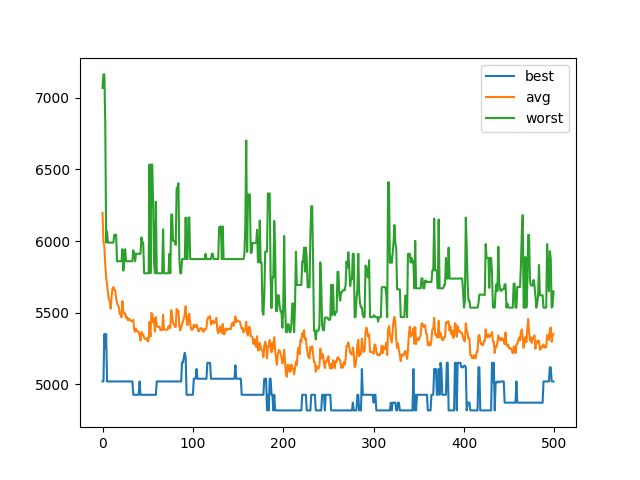


HARD/002

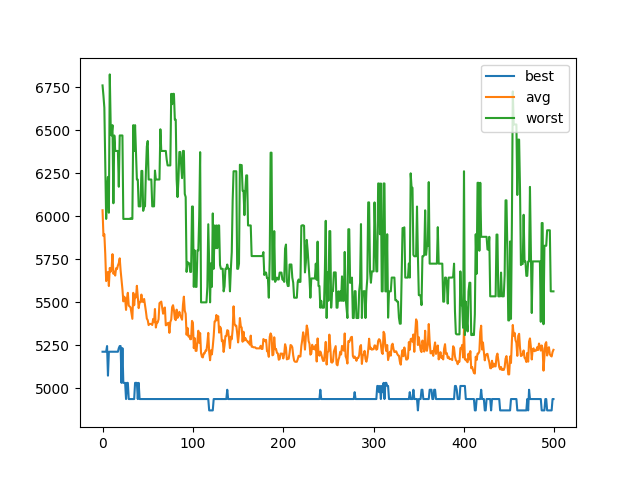
**WNIOSKI:**

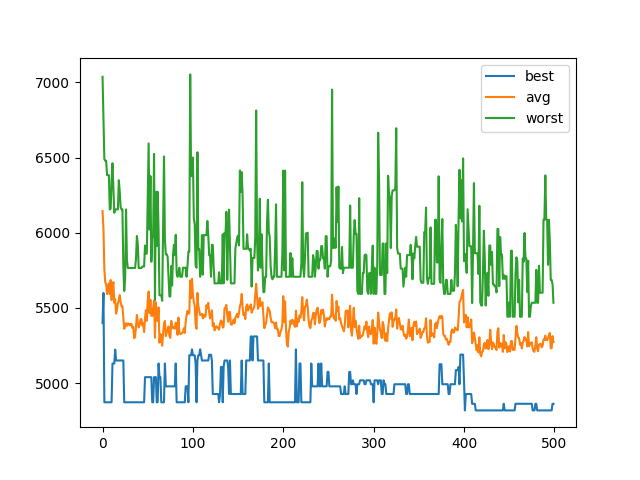
# Krzyżowanie

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| instancja | Alg. Ewolucyjny [10x] | | | | Metoda losowa [N] | | | |
|  | best | worst | avg | std | best | worst | avg | std |
| EASY/003 | 5020 | 5649 | 5352.5 | 180 | 4818 | 11730 | 7847.3 | 1051.7 |
| EASY/004 | 4938 | 5564 | 5224.1 | 198.1 | 4818 | 11730 | 7851 | 1055.6 |
| EASY/005 | 4862 | 5534 | 5272.8 | 205.9 | 4818 | 11730 | 7851.4 | 1048.8 |
| FLAT/003 | 8945 | 12665 | 10729 | 1182.2 | 9130 | 24975 | 18091.1 | 2220.1 |
| FLAT/004 | 8930 | 13475 | 10522.5 | 1386.8 | 9295 | 25035 | 18099.6 | 2230.8 |
| FLAT/005 | 9505 | 11065 | 10187.5 | 641.7 | 9025 | 25345 | 18080.7 | 2234.2 |
| HARD/003 | 15021 | 19297 | 17571.8 | 1491.5 | 14357 | 38772 | 26460.4 | 3170.4 |
| HARD/004 | 15744 | 19353 | 17217.4 | 1223.9 | 14133 | 38660 | 26459.3 | 3150.8 |
| HARD/005 | 14308 | 19118 | 17549.6 | 1332.4 | 14702 | 39527 | 26478 | 3166.7 |

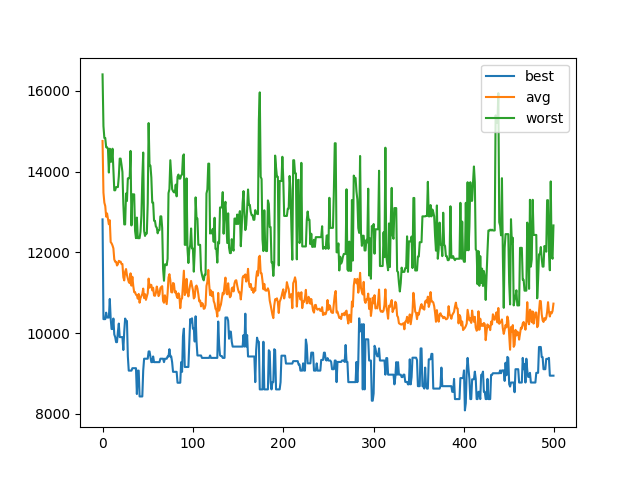


EASY/003

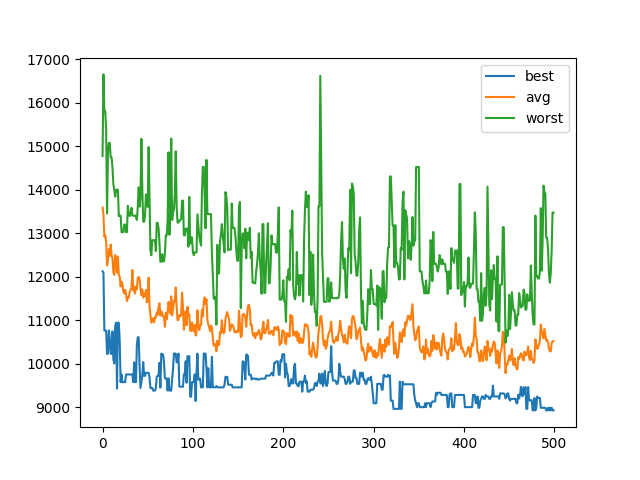


EASY/004

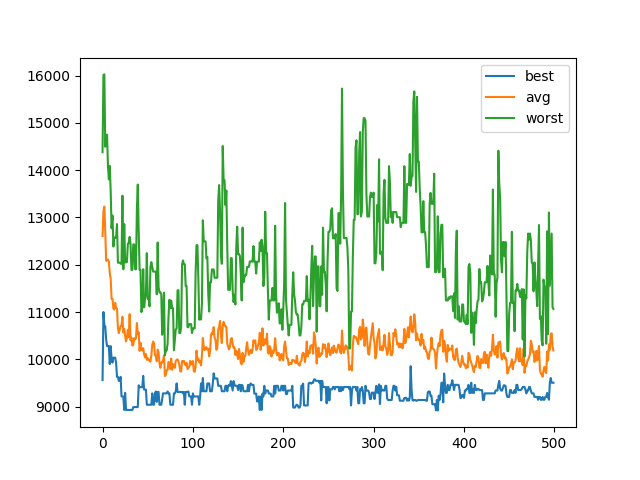
EASY/005



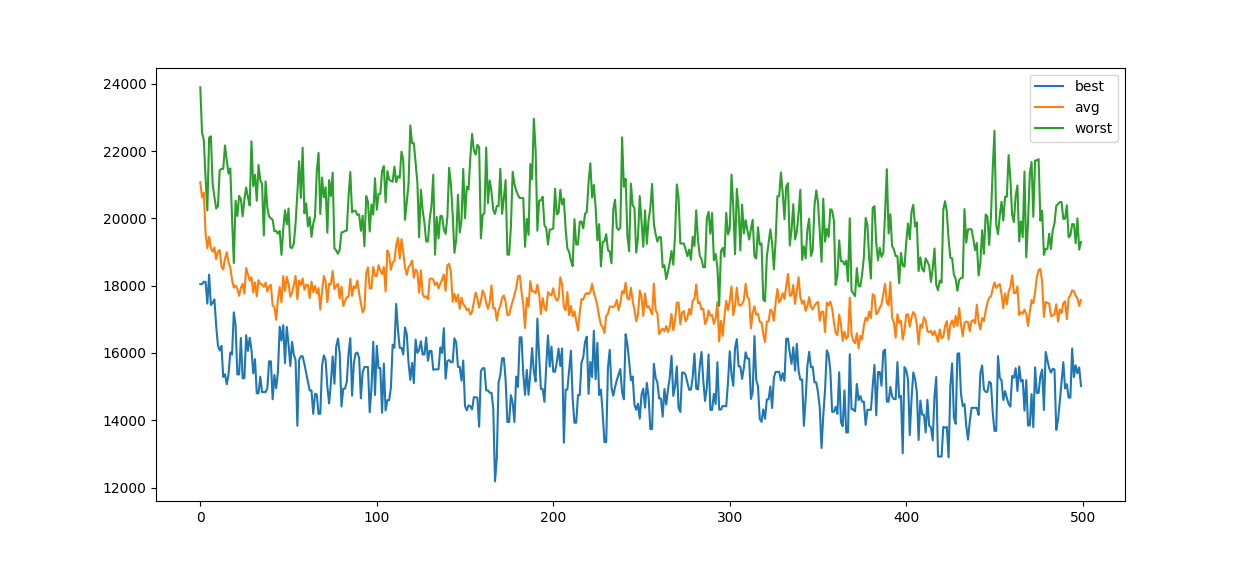
FLAT/003



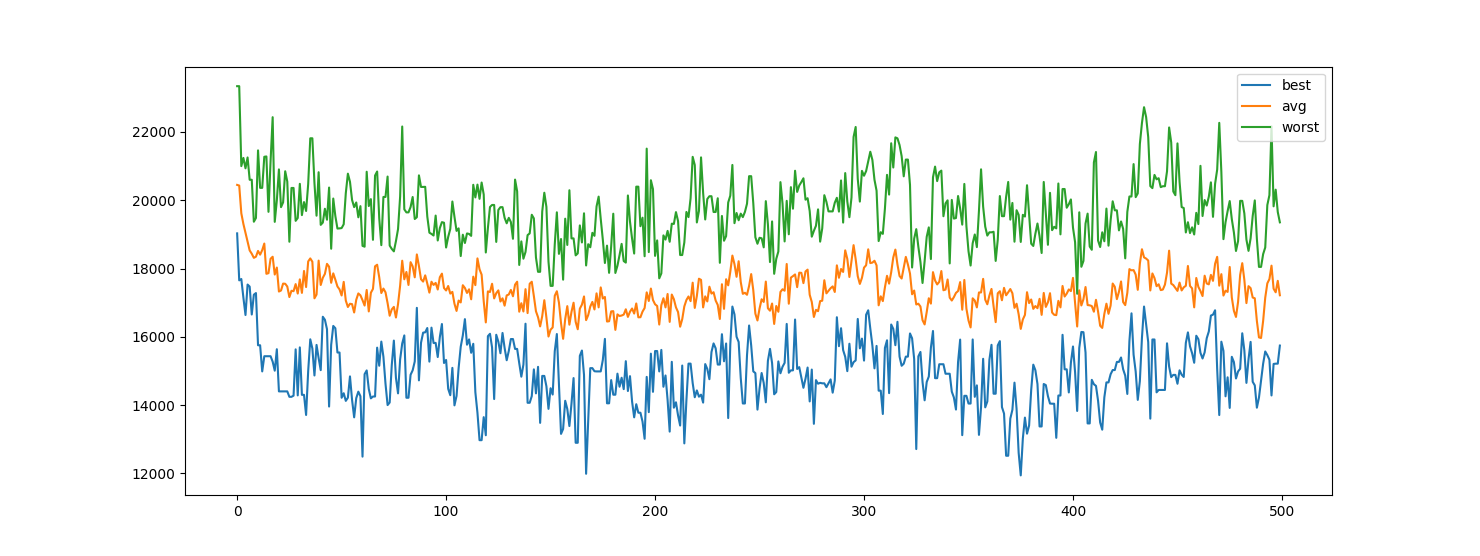
FLAT/004



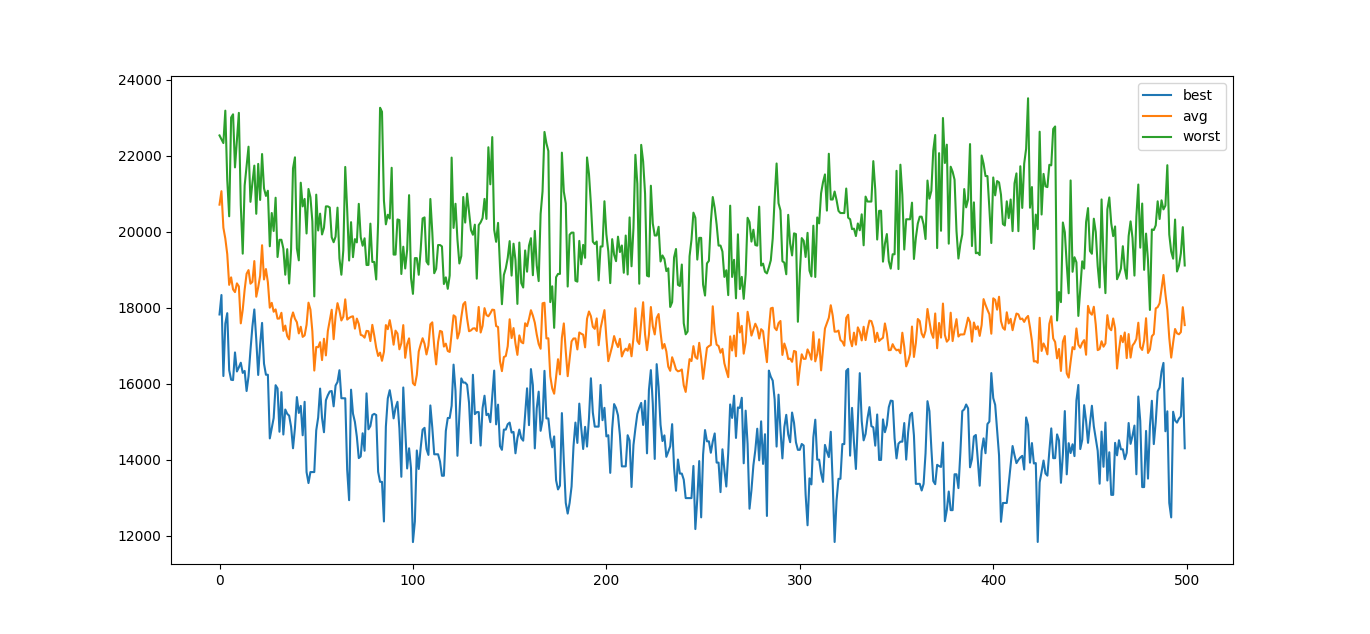
FLAT/005



HARD/003



HARD/004

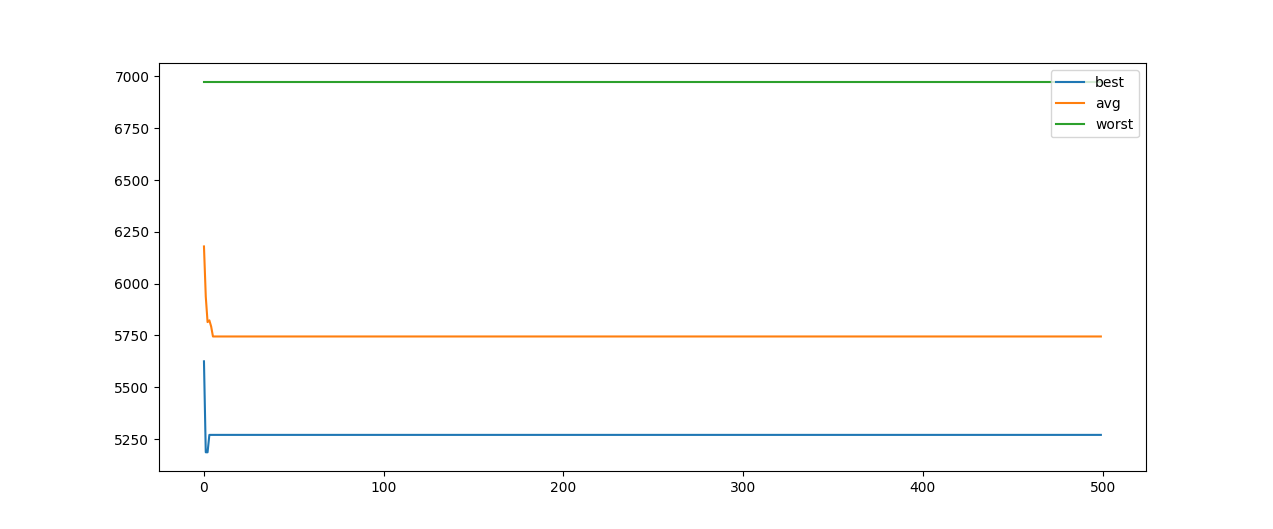


HARD/005

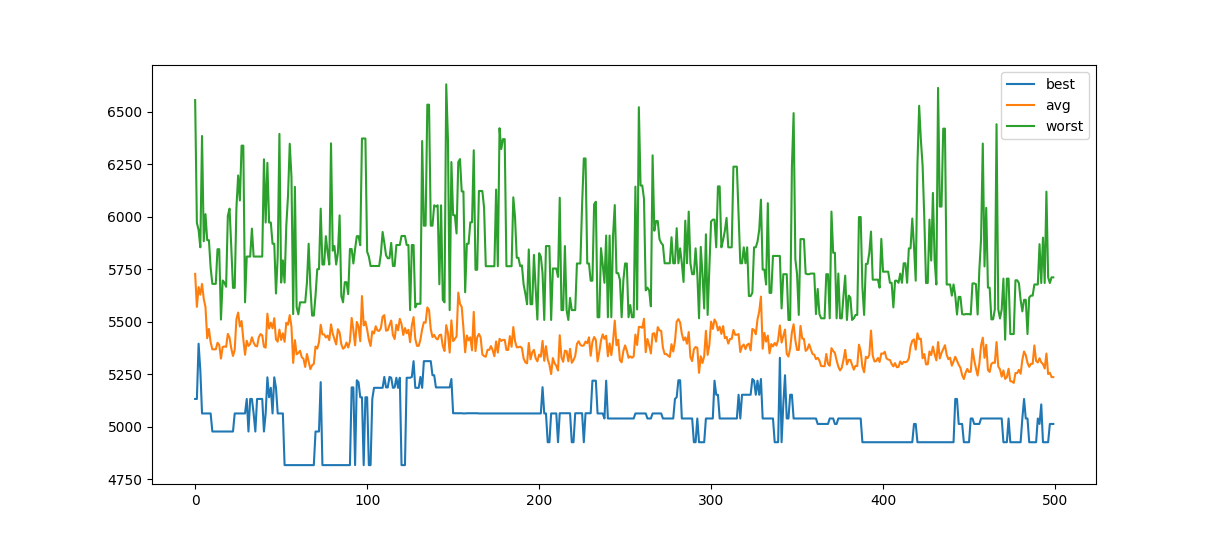
**WNIOSKI:**

# Mutacja

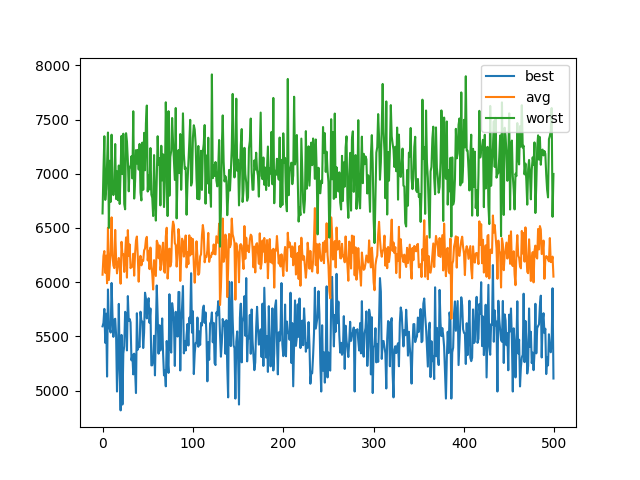
|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| instancja | Alg. Ewolucyjny [10x] | | | | Metoda losowa [N] | | | |
|  | best | worst | avg | std | best | worst | avg | std |
| EASY/006 | 5270 | 6973 | 5744.9 | 455.1 | 4818 | 11730 | 7850 | 1057.87 |
| EASY/007 | 5014 | 5712 | 5236.8 | 200.4 | 4862 | 11730 | 7849.3 | 1052.2 |
| EASY/008 | 5112 | 6998 | 6051.6 | 645 | 4862 | 11730 | 7856.6 | 1047.6 |
| EASY/009 | 5930 | 8688 | 7281.6 | 787 | 4862 | 11730 | 7854.9 | 1052.2 |
| FLAT/006 | 10830 | 16275 | 14301.5 | 1536.7 | 9145 | 24880 | 18090.9 | 2222.8 |
| FLAT/007 | 9700 | 13570 | 10892 | 1068.8 | 8845 | 25085 | 18104 | 2236.8 |
| FLAT/008 | 11225 | 15275 | 13473.5 | 1580.6 | 9185 | 25200 | 18081.7 | 2233.5 |
| FLAT/009 | 11495 | 18280 | 15637.5 | 1695 | 8820 | 25215 | 18084.6 | 2230.9 |
| HARD/006 | 15761 | 23092 | 20664 | 2233.3 | 15169 | 39825 | 26450 | 3160.4 |
| HARD/007 | 14866 | 21281 | 17640.1 | 2122.4 | 14823 | 39186 | 26437.3 | 3185.1 |
| HARD/008 | 15744 | 19353 | 17217.4 | 1223.9 | 14133 | 38660 | 26459.3 | 3150.8 |
| HARD/009 | 21725 | 30622 | 25980.7 | 2548.2 | 14469 | 39169 | 26461 | 3156.8 |



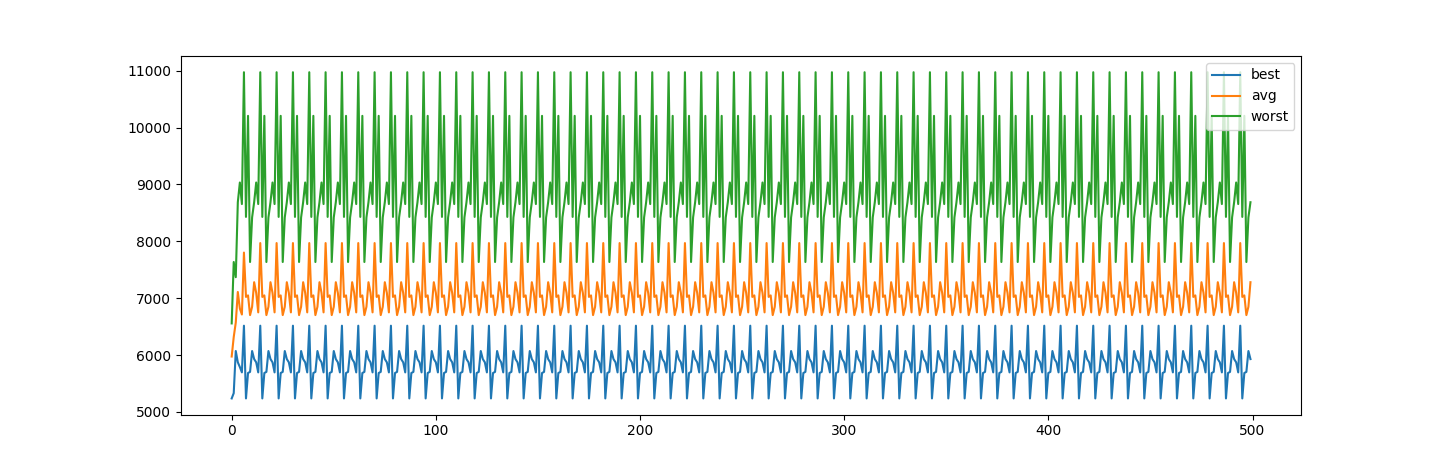
EASY/006



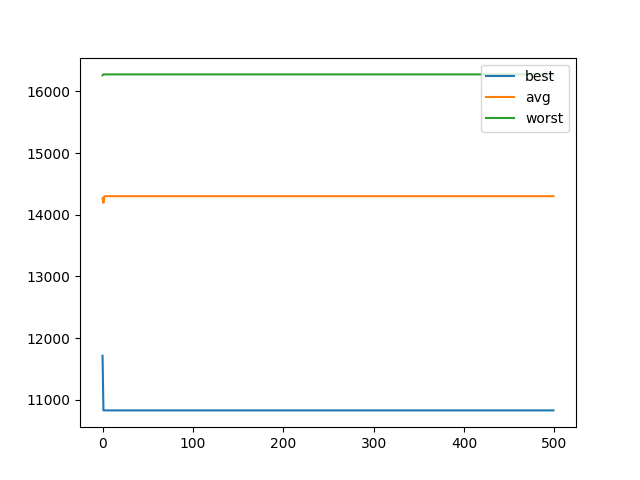
EASY/007



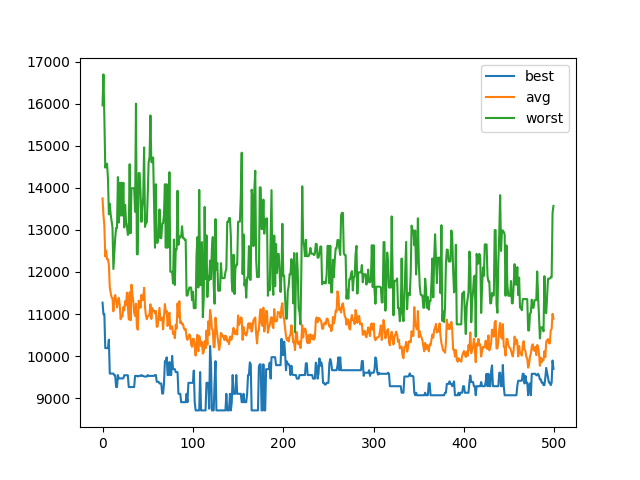
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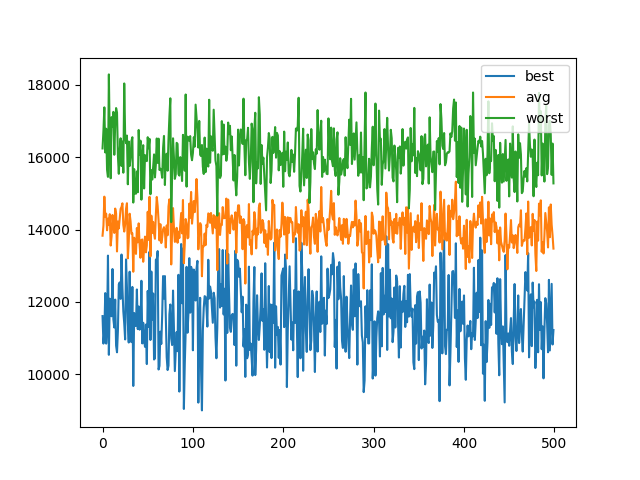
EASY/009



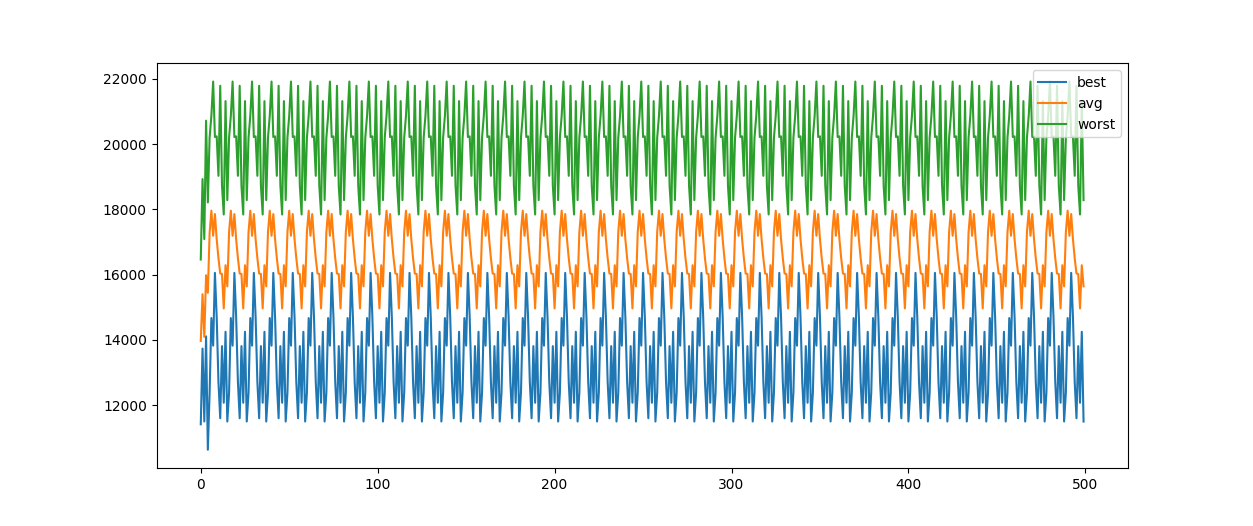
FLAT/006



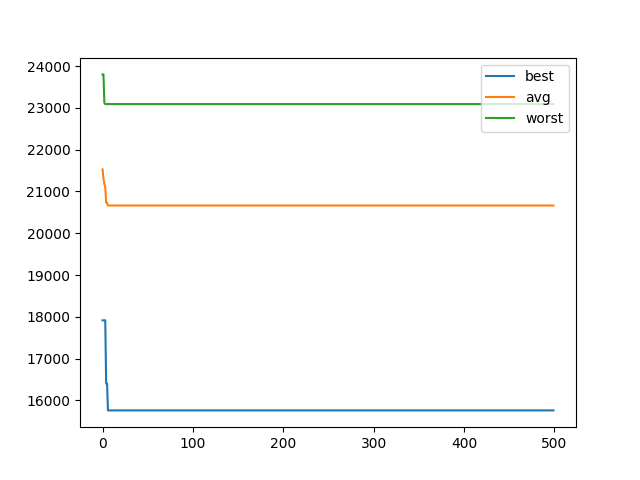
FLAT/007



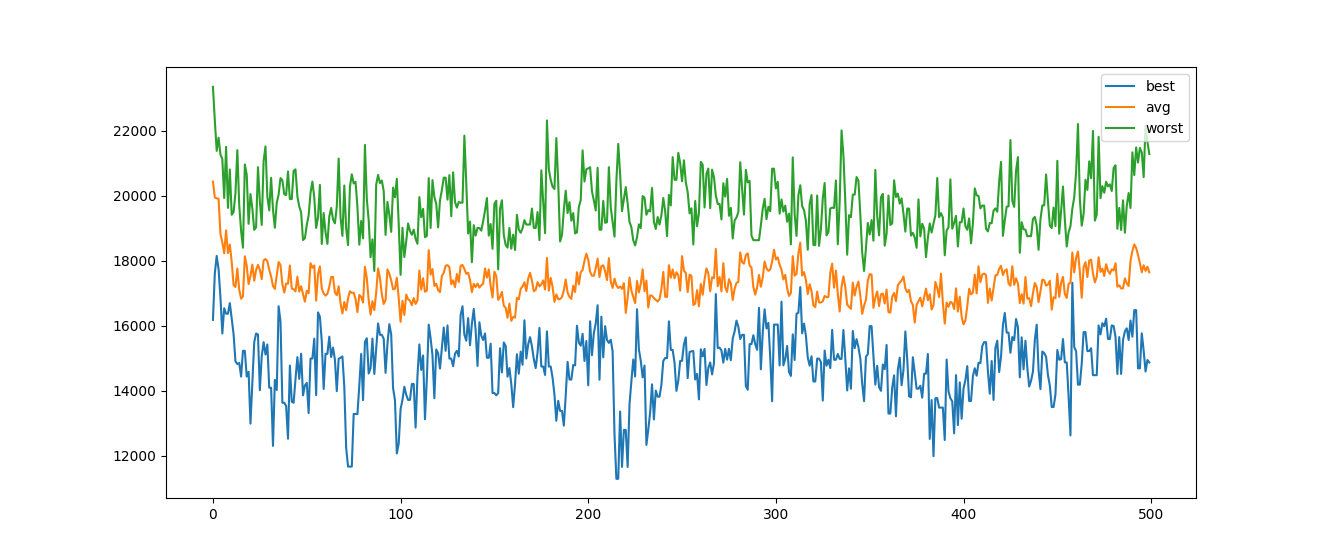
FLAT/008



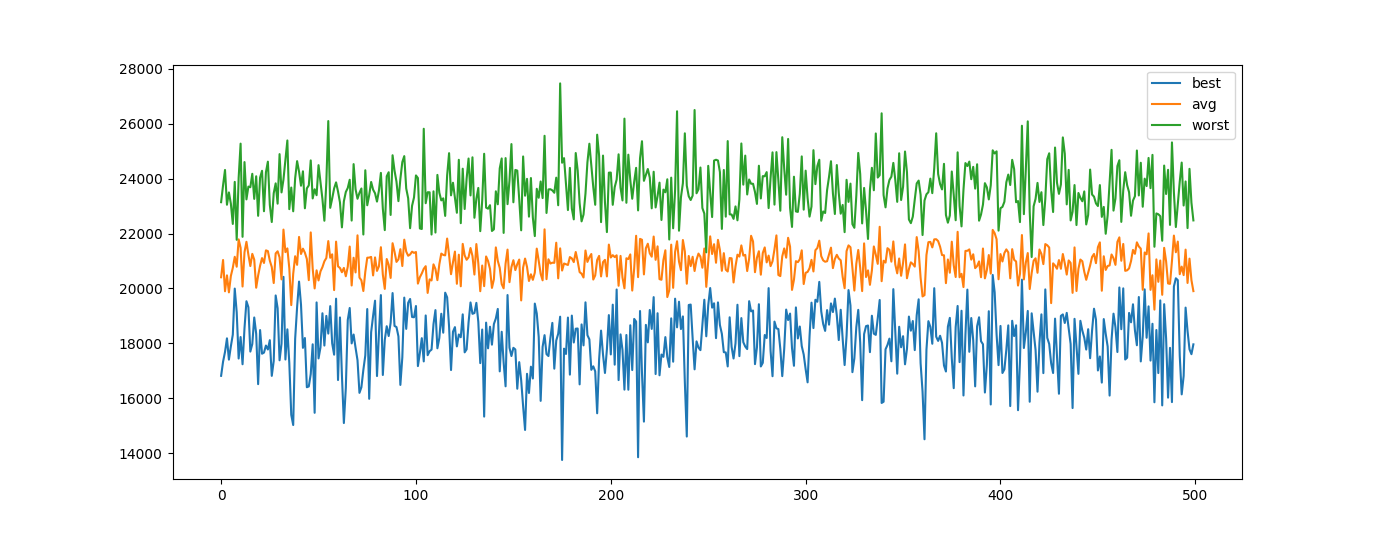
FLAT/009



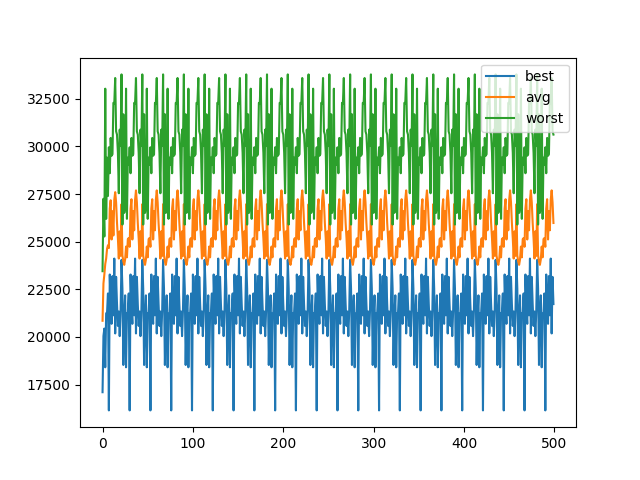
HARD/006



HARD/007



HARD/008

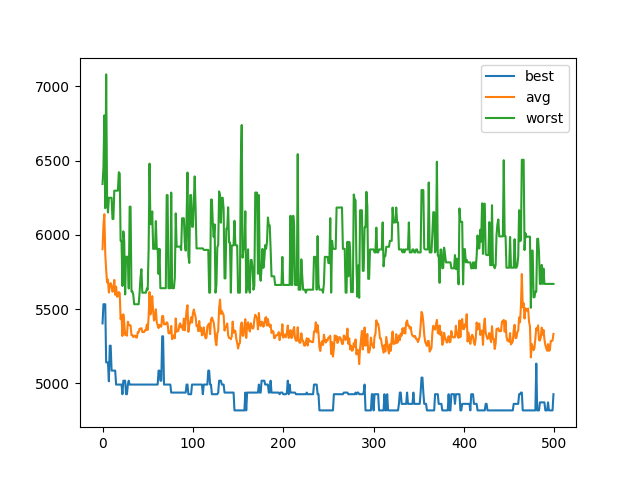


HARD/009

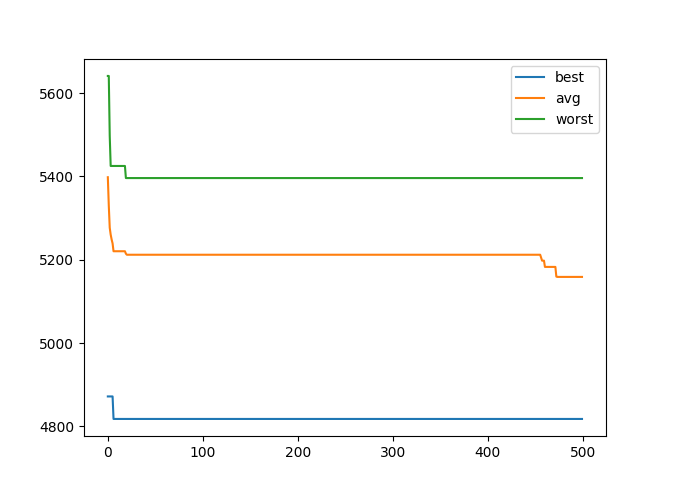
**WNIOSKI:**

# Liczba osobników

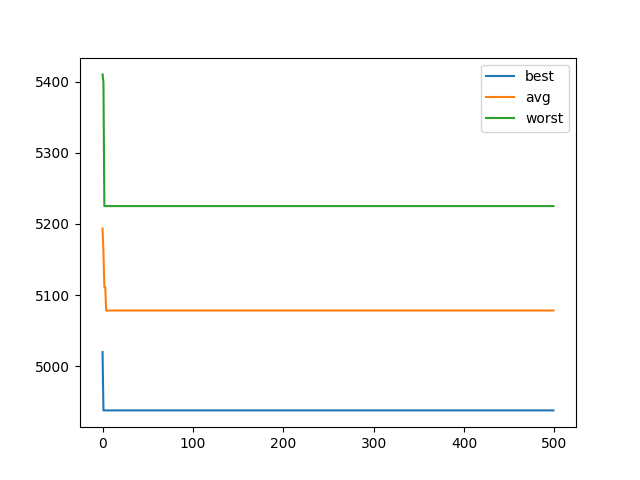
|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| instancja | Alg. Ewolucyjny [10x] | | | | Metoda losowa [N] | | | |
|  | best | worst | avg | std | best | worst | avg | std |
| EASY/010 | 4927 | 5670 | 5333 | 250.3 | 4818 | 11730 | 7851.3 | 1053.8 |
| EASY/011 | 4818 | 5396 | 5158.8 | 194 | 4818 | 11730 | 7848.1 | 1051.7 |
| EASY/012 | 4938 | 5225 | 5078.3 | 108.9 | 4818 | 11730 | 7849.2 | 1052.9 |
| FLAT/010 | 9405 | 11205 | 10341.5 | 478.5 | 9290 | 24945 | 18093.6 | 2217.6 |
| FLAT/011 | 8445 | 9485 | 9033.5 | 360.1 | 8770 | 25195 | 18094 | 2225.4 |
| FLAT/012 | 8115 | 8930 | 8669.5 | 305.1 | 8625 | 25475 | 18090.5 | 2224.1 |
| HARD/010 | 15759 | 20147 | 17355.4 | 1238.9 | 14256 | 39321 | 26461 | 3165.7 |
| HARD/011 | 10439 | 14046 | 12163.3 | 1092.4 | 13429 | 41082 | 26451 | 3166.7 |
| HARD/012 | 11319 | 13779 | 12314.6 | 681.5 | 12330 | 41110 | 26449.7 | 3163.5 |



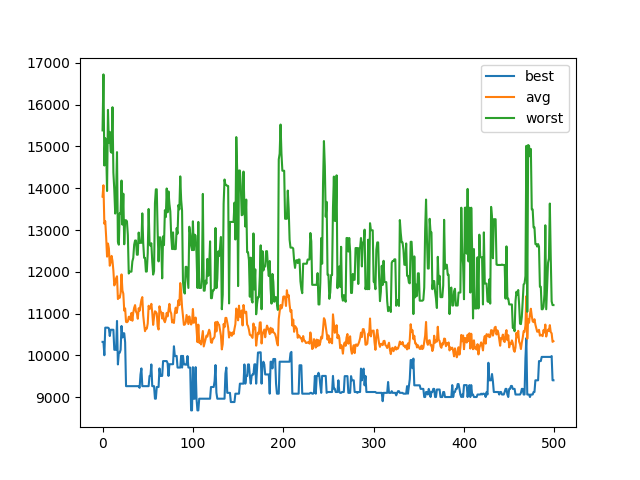
EASY/010



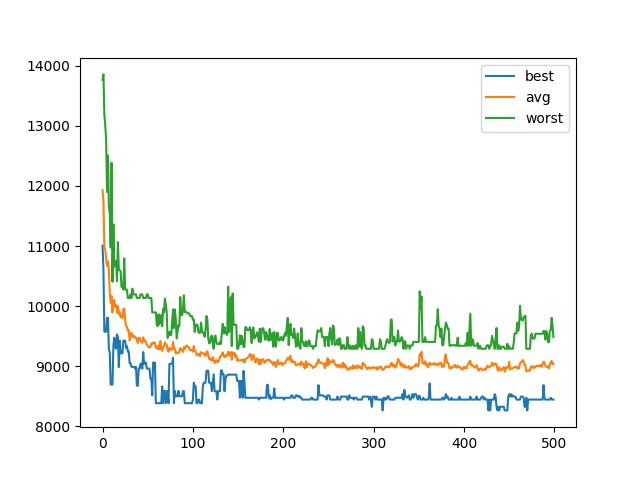
EASY/011



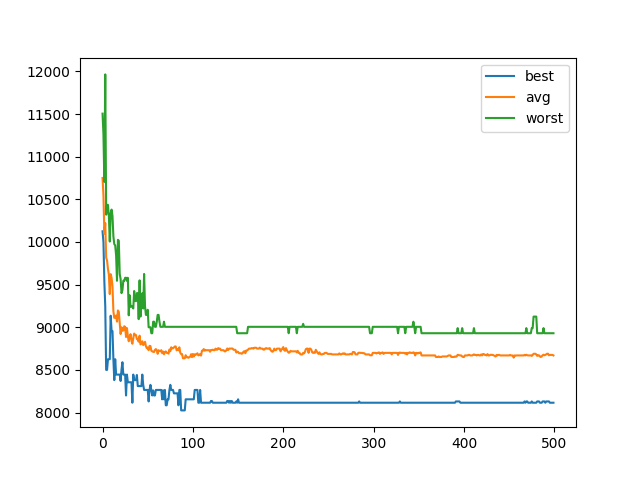
EASY/012



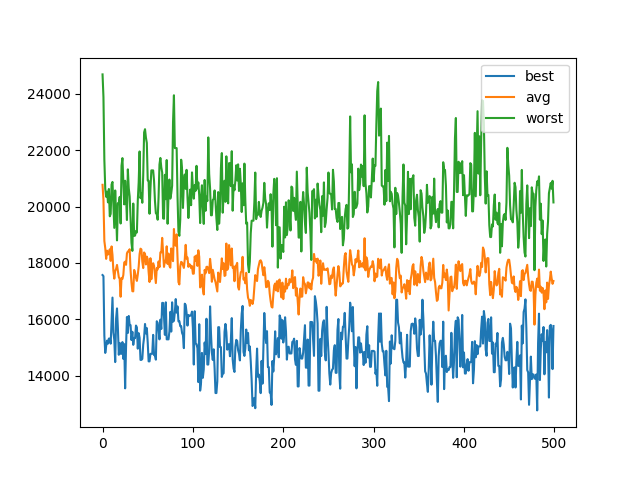
FLAT/010



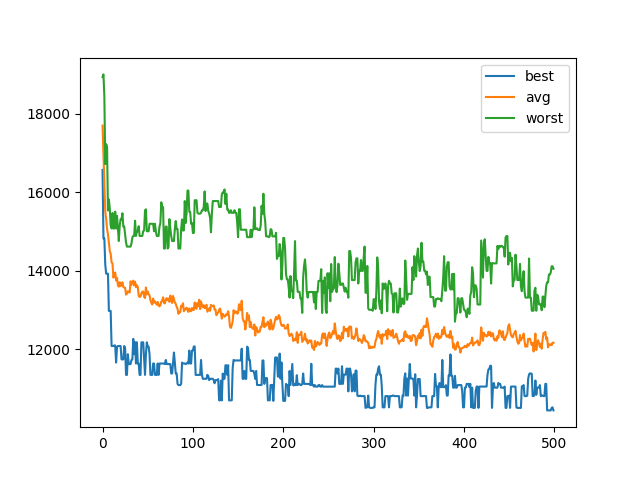
FLAT/011



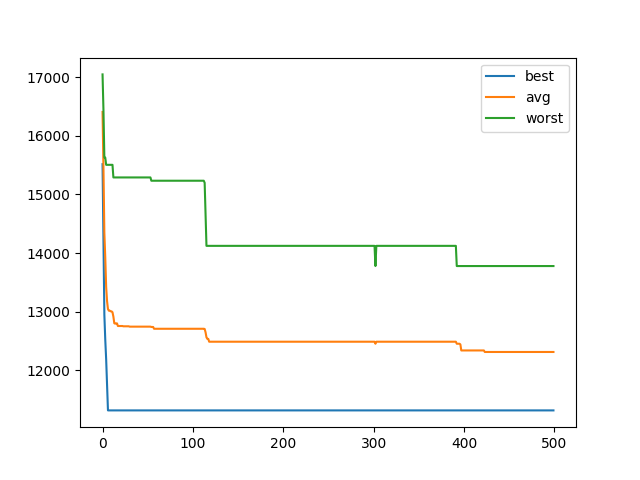
FLAT/012



HARD/010



HARD/011

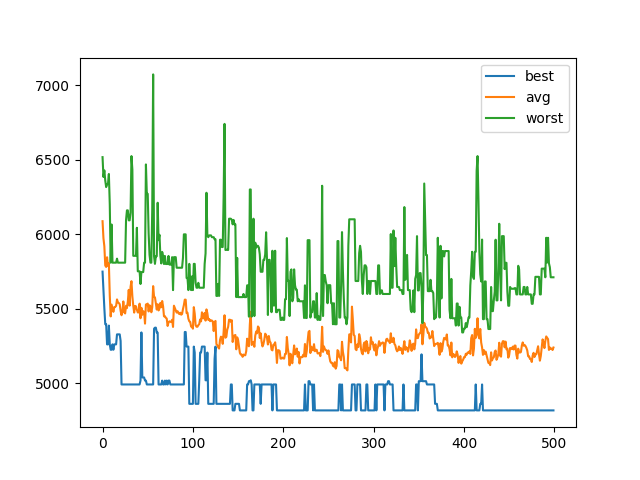


HARD/012

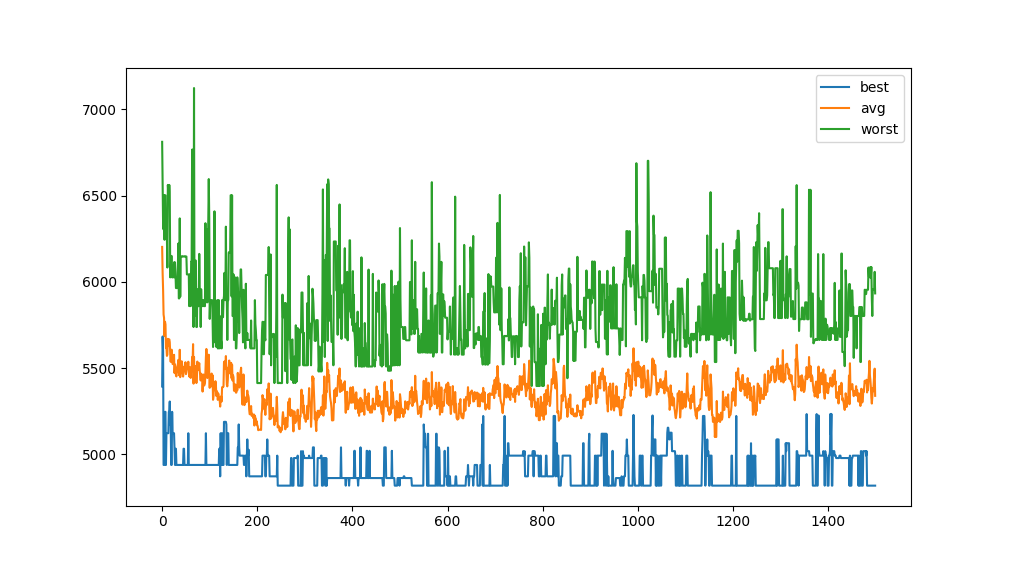
**WNIOSKI:**

# Liczba pokoleń

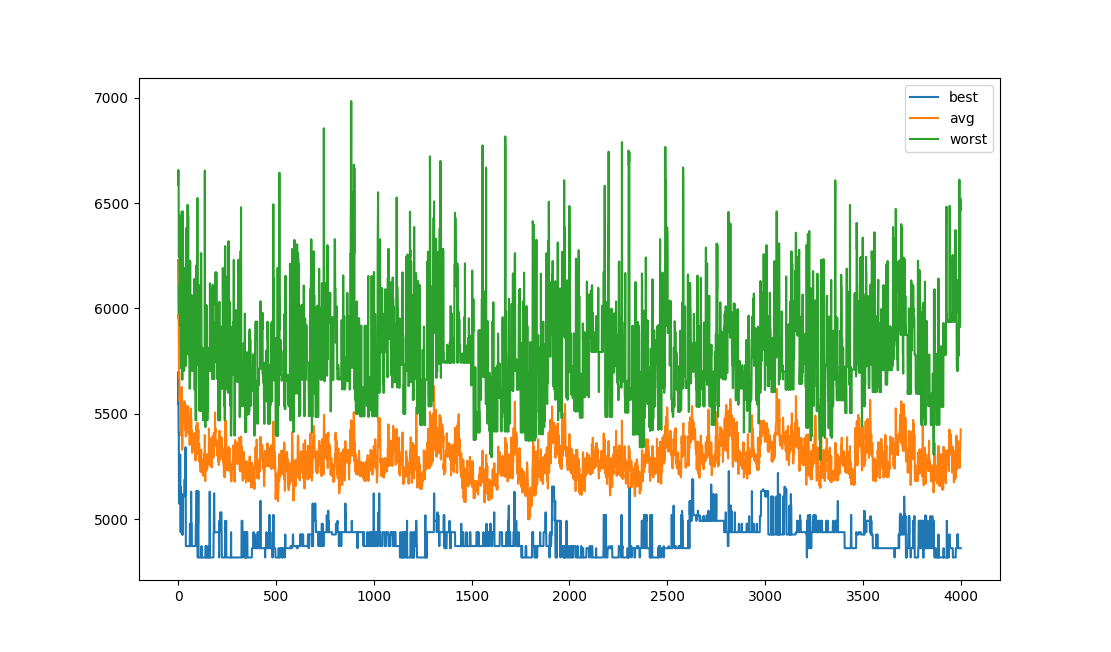
|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| instancja | Alg. Ewolucyjny [10x] | | | | Metoda losowa [N] | | | |
|  | best | worst | avg | std | best | worst | avg | std |
| EASY/013 | 4818 | 5711 | 5239.8 | 287.7 | 4818 | 11724 | 7838.7 | 1052.1 |
| EASY/014 | 4818 | 5933 | 5338.8 | 357 | 4818 | 11730 | 7852.2 | 1054.7 |
| EASY/015 | 4862 | 6497 | 5425.5 | 456.9 | 4818 | 11730 | 7848.3 | 1052.7 |
| FLAT/013 | 9590 | 12595 | 10902 | 868.7 | 8820 | 25030 | 18085.3 | 2220.3 |
| FLAT/014 | 9340 | 11585 | 10060.5 | 653.8 | 8130 | 25185 | 18081 | 2224.6 |
| FLAT/015 | 9325 | 11305 | 10081.5 | 572.4 | 8960 | 25205 | 18095.3 | 2222.2 |
| HARD/013 | 16257 | 20003 | 17603.6 | 1122.8 | 14905 | 39920 | 26431.5 | 3172.9 |
| HARD/014 | 16012 | 20930 | 17842.6 | 1471.6 | 13800 | 41481 | 26437.2 | 3166.5 |
| HARD/015 | 15014 | 20530 | 18358.6 | 1659.1 | 12985 | 40362 | 26444.1 | 3164.8 |



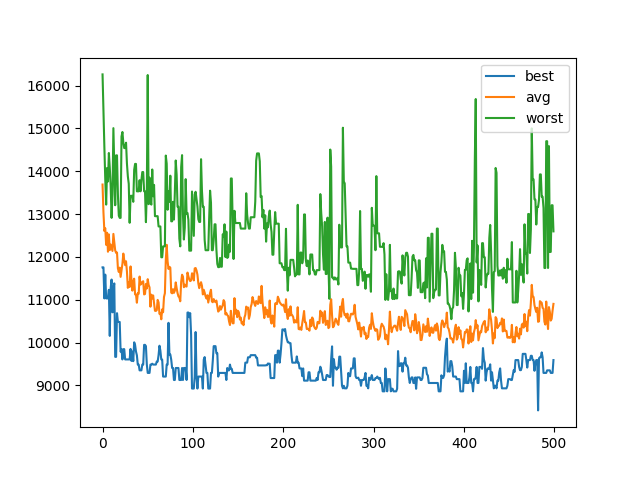
EASY/013



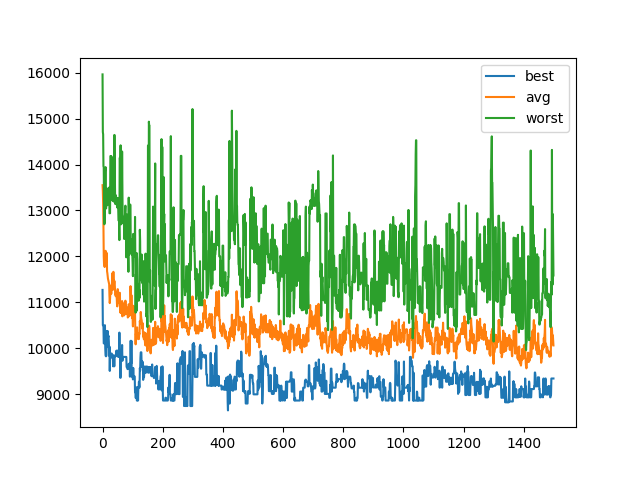
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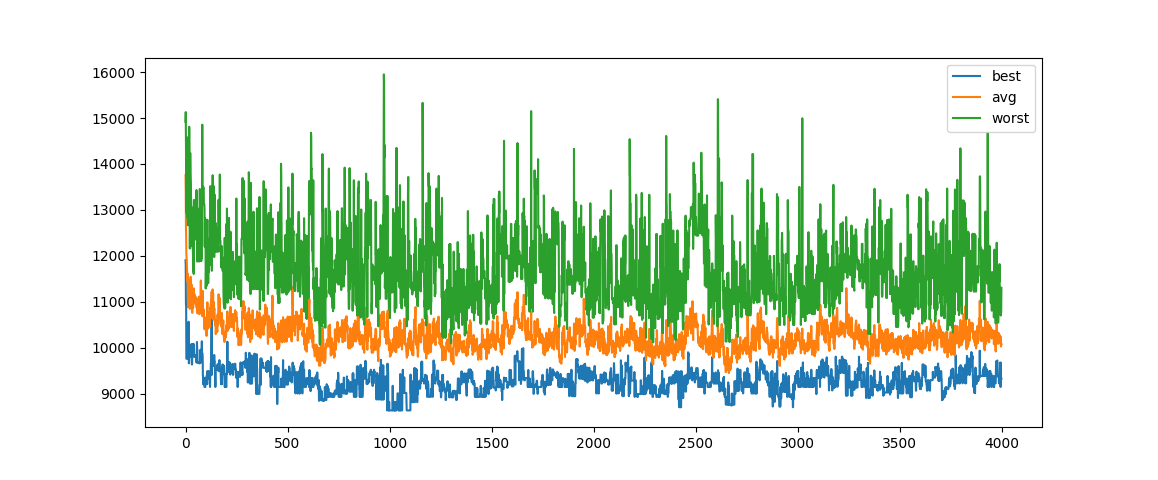
EASY/015



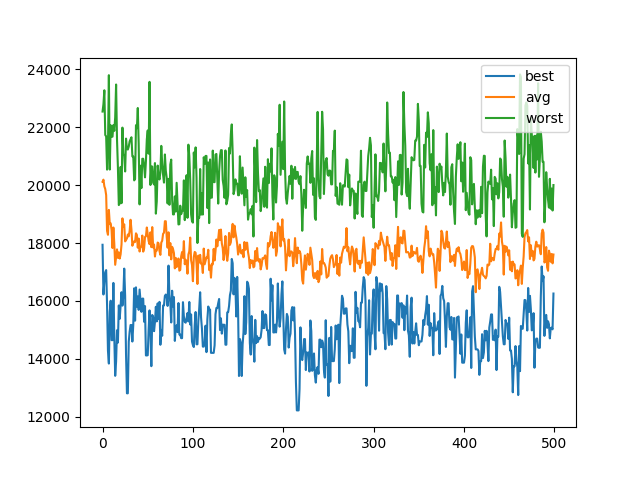
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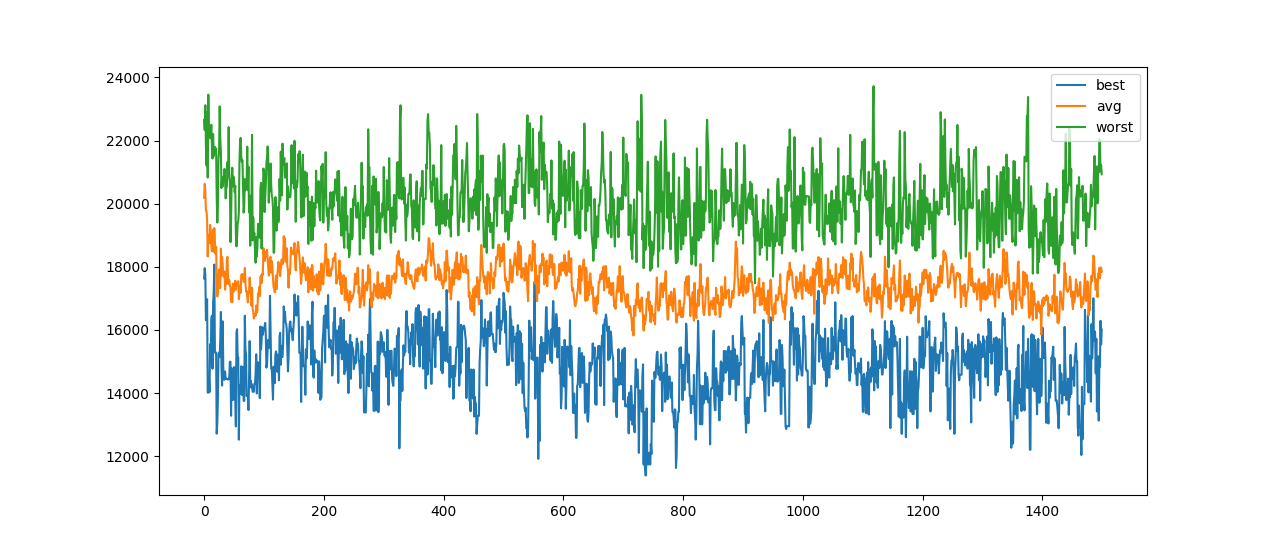
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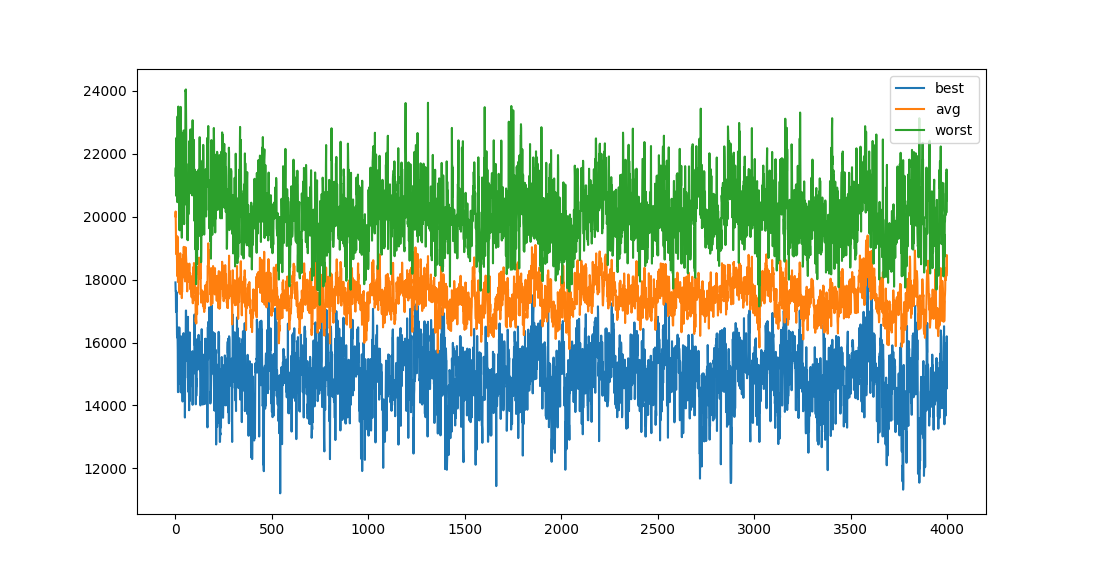
FLAT/015



HARD/013



HARD/014



HARD/015

**WNIOSKI:**

# Próby wyznaczenia rozwiązania optymalnego

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| instancja | Alg. Ewolucyjny [10x] | | | | Metoda losowa [N] | | | |
|  | best | worst | avg | std | best | worst | avg | std |
| SOL/001 | 9464 | 12045 | 10760.2 | 728.1 | 13357 | 42331 | 26451.4 | 3164.2 |
| SOL/002 | 9314 | 11842 | 10803.4 | 673.5 | 14273 | 40692 | 26449.5 | 3163.6 |
| SOL/003 | 9862 | 12542 | 10905.7 | 943.7 | 12619 | 41207 | 26451.5 | 3164.6 |

**PARAMETRY:**

num\_of\_generations = 500

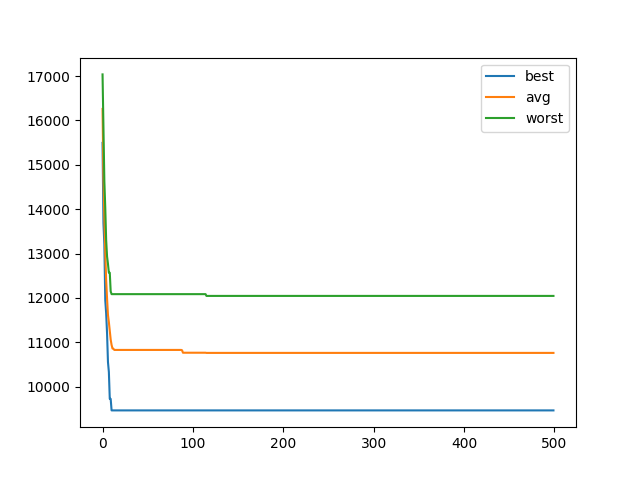
is\_tournament = True

num\_of\_pop = 500

select\_n = 25

mut\_prob = 0.07

cross\_prob = 0.7



HARD\_SOLVING\_1

**PARAMETRY:**

num\_of\_generations = 50

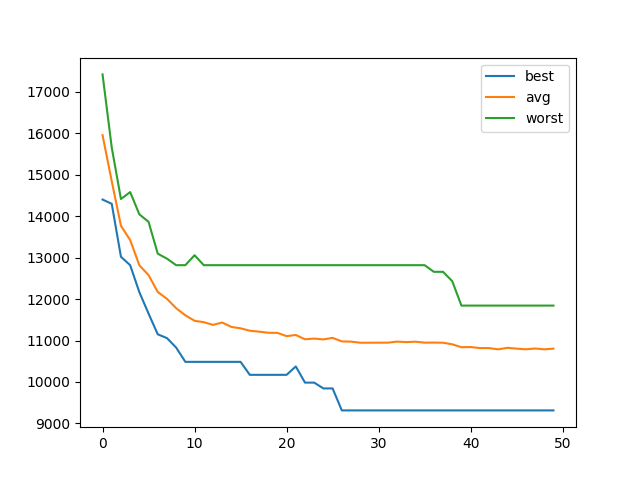
is\_tournament = True

num\_of\_pop = 500

select\_n = 50

mut\_prob = 0.15

cross\_prob = 0.7



HARD\_SOLVING\_2

**PARAMETRY:**

num\_of\_generations = 500

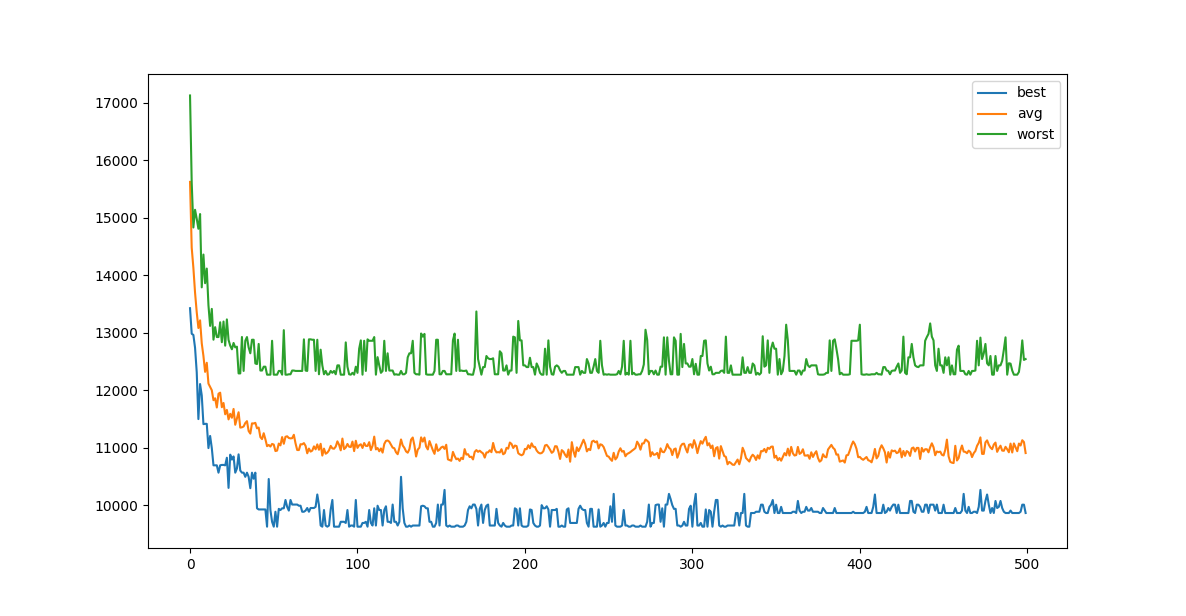
is\_tournament = True

num\_of\_pop = 500

select\_n = 50

mut\_prob = 0.18

cross\_prob = 0.7



HARD\_SOLVING\_3

**PARAMETRY:**

num\_of\_runs = 1

num\_of\_generations = 500

is\_tournament = True

no\_progress\_for = 250

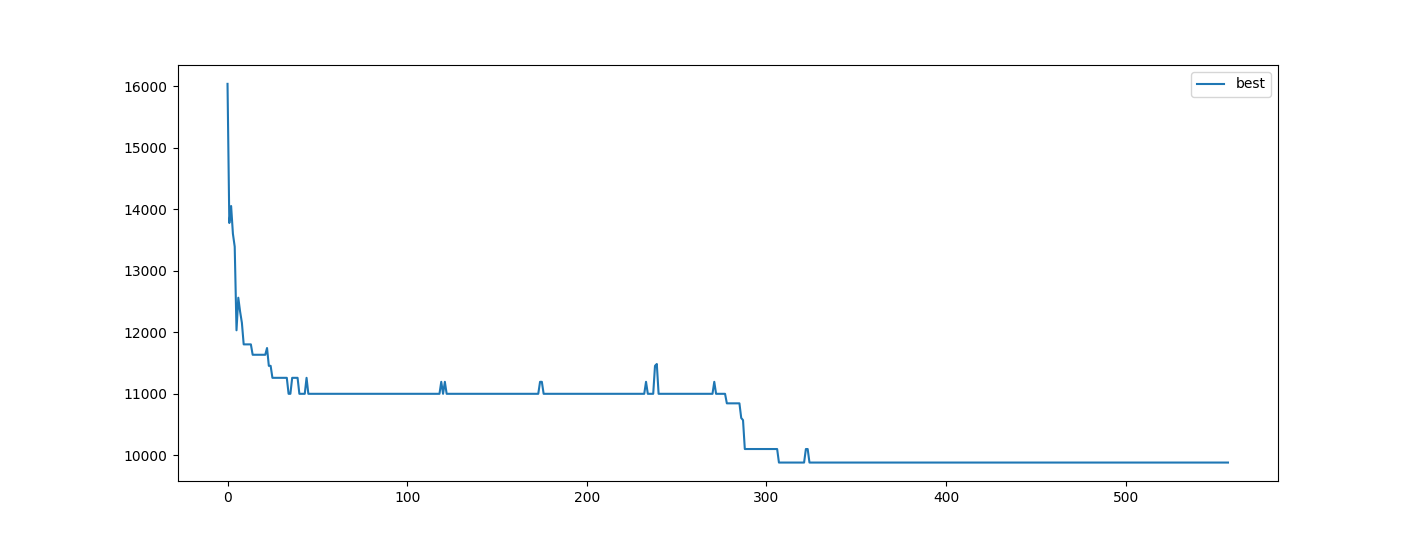
is\_end\_cond\_dynamic = True

num\_of\_pop = 500

select\_n = 50

mut\_prob = 0.15

cross\_prob = 0.75



HARD\_SOLVING\_4

**WNIOSKI:**