

Ekologia i ekonomia Samochodów

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15.12.2020

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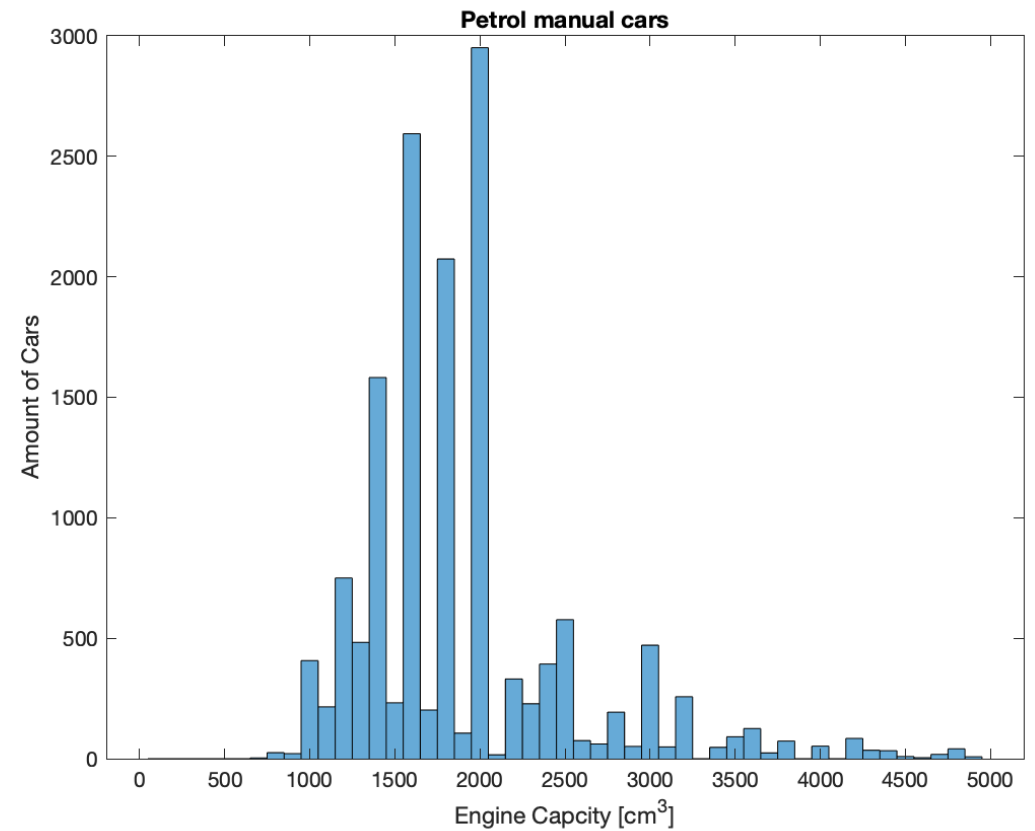
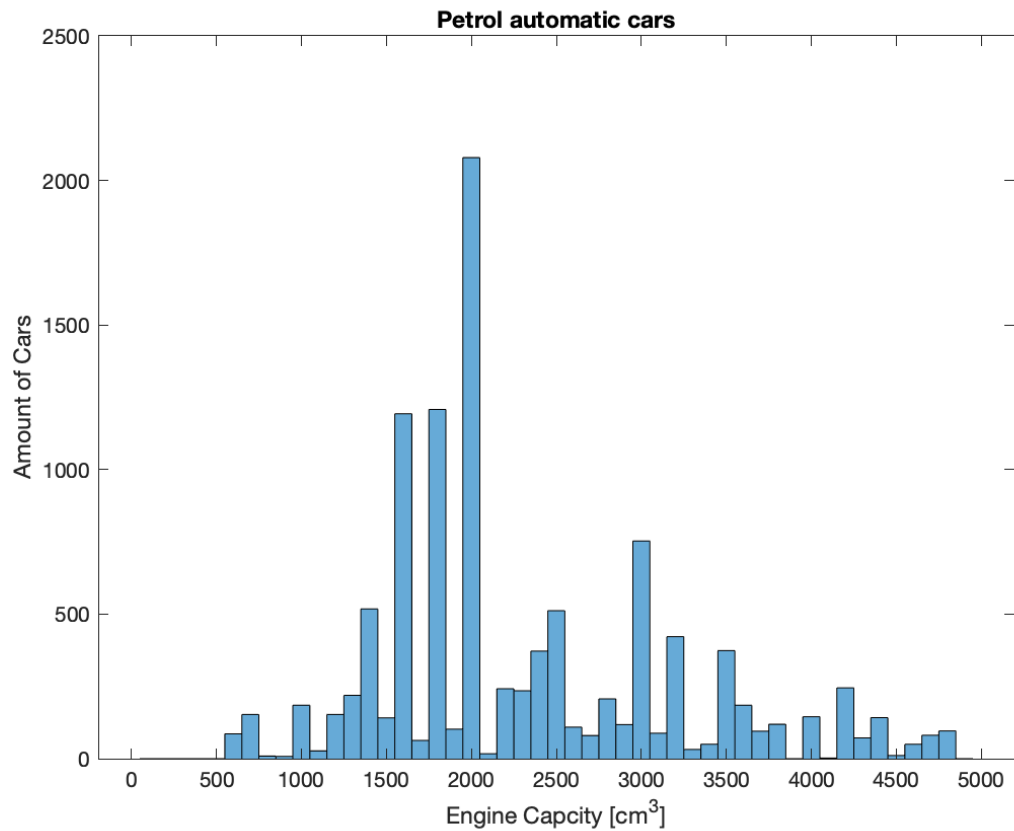
Zbiór danych

- » Dane opublikowane przez departament transportu w Wielkiej Brytanii
- » Samochody z lat 2000 – 2013
- » Dostępne parametry:
 - Marka oraz model
 - Rozmiar silnika
 - Paliwo (benzyna, diesel)
 - Skrzynia biegów (manualna, automatyczna)
 - Emisje spalin (emisje CO₂ oraz norma EURO)
 - Spalanie (cykl miejski, pozamiejski oraz mieszany)
- » Zbiór danych: <https://www.kaggle.com/mrmorj/car-fuel-emissions>

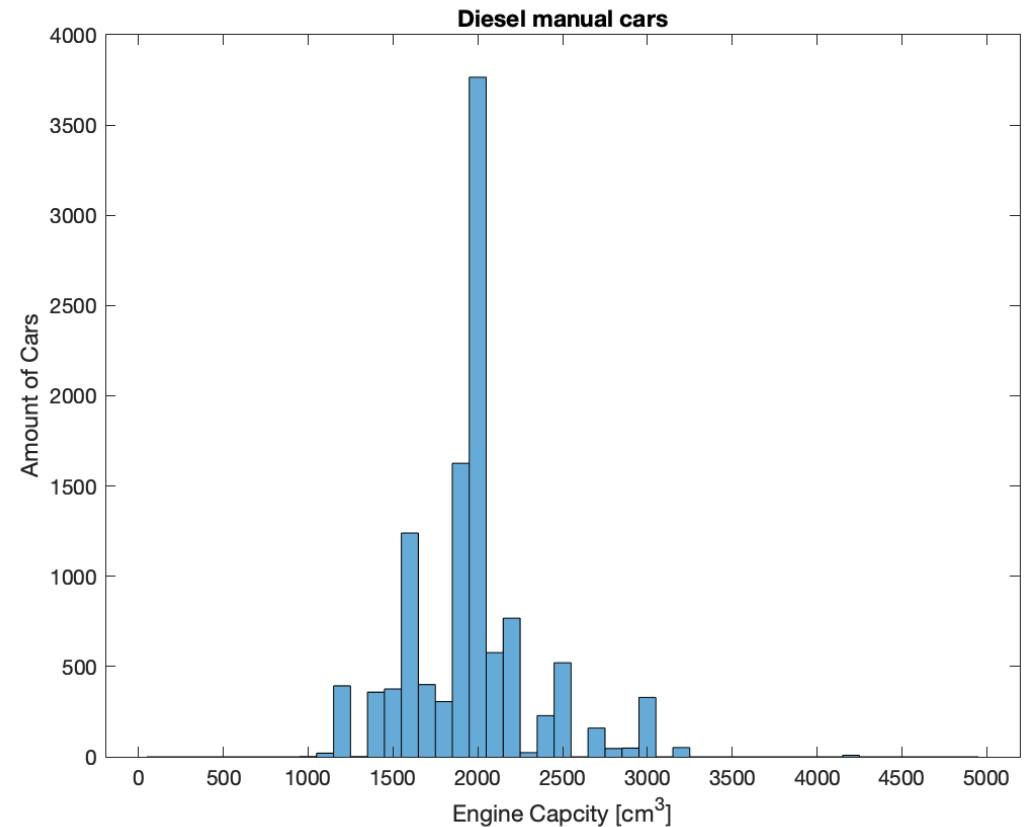
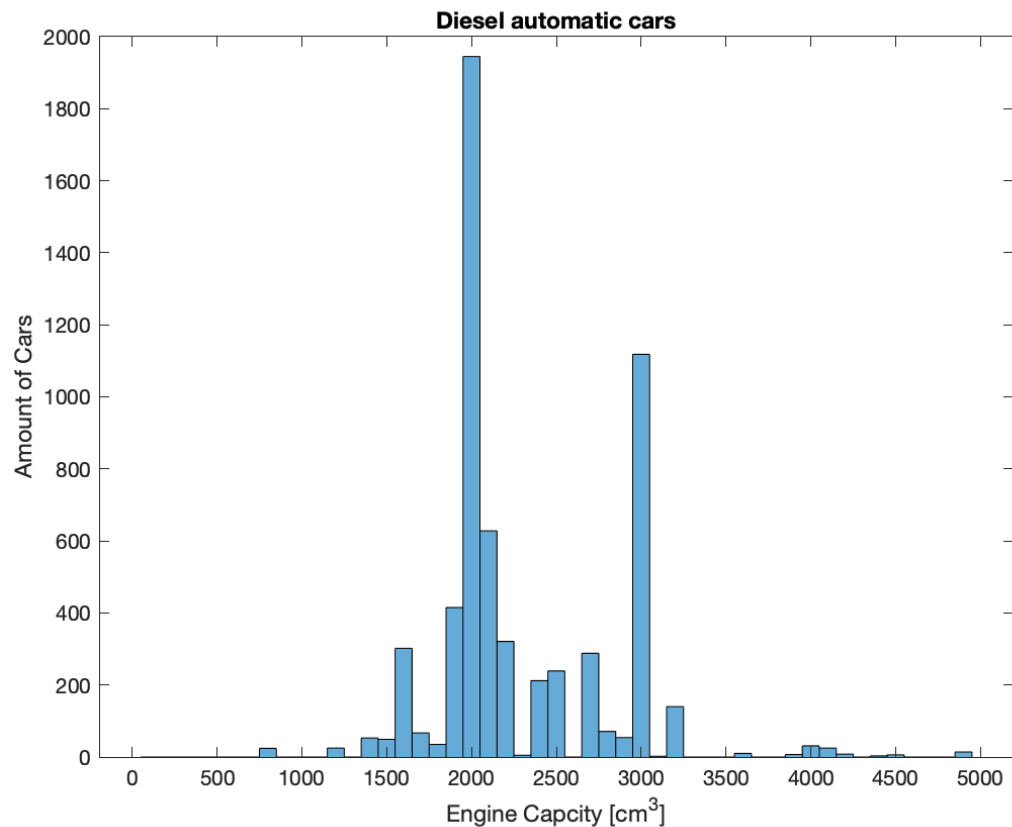
Wstępna analiza danych

- » Porównanie względem rodzaju paliwa oraz skrzyni biegów
- » Porównanie spalania w zależności od rodzaju spalania
- » Porównanie samochodów z różnych krajów (niemieckie samochody vs francuskie itd.)
- » Zestawienie Średnich emisji spalin w zależności od wielkości silnika, rodzaju paliwa oraz skrzyni biegów
- » Usuwanie elementów nietypowych i błędnych danych
- » Klasteryzacja
- » Klasyfikacja

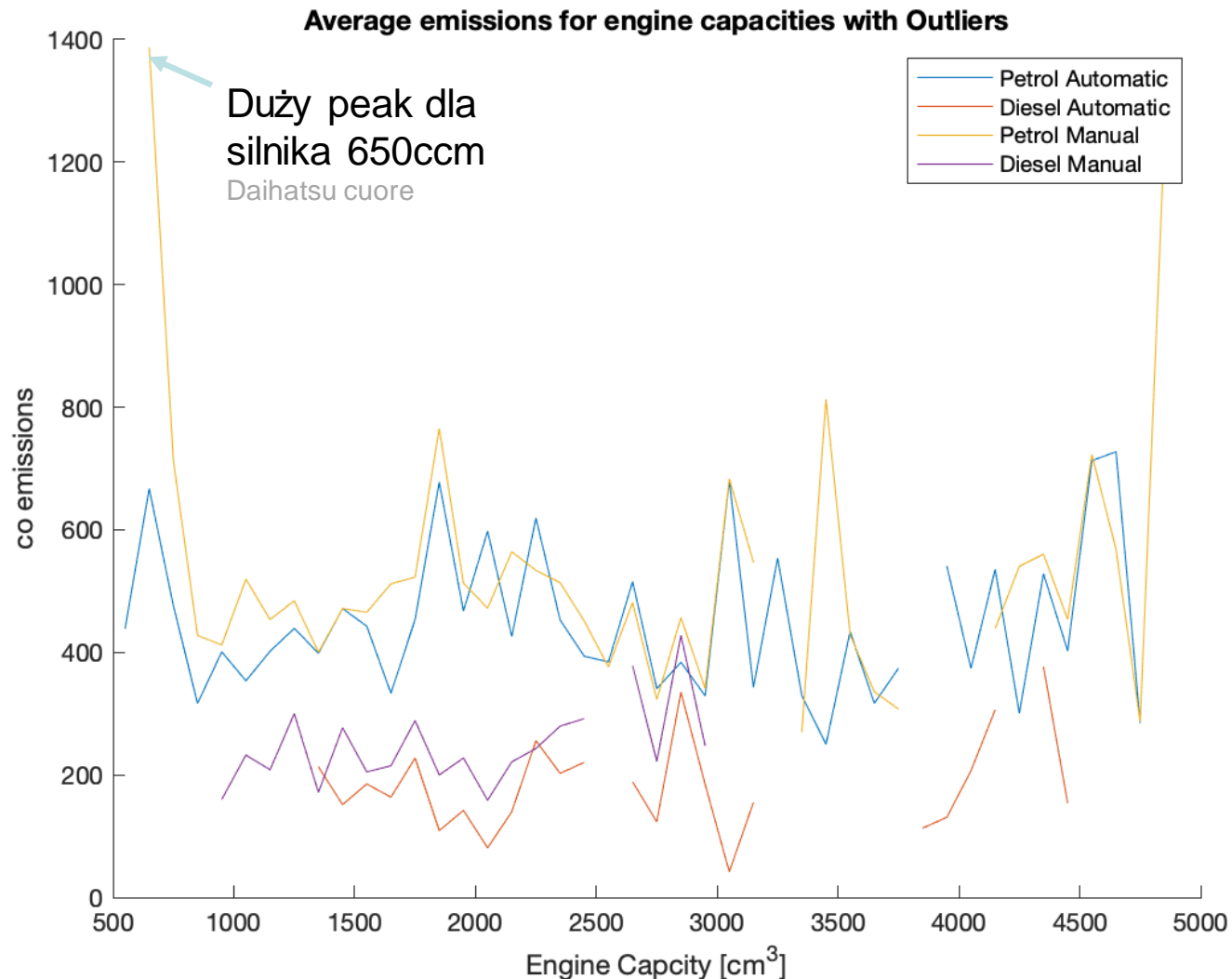
Samochody benzynowe



Samochody z silnikiem diesla

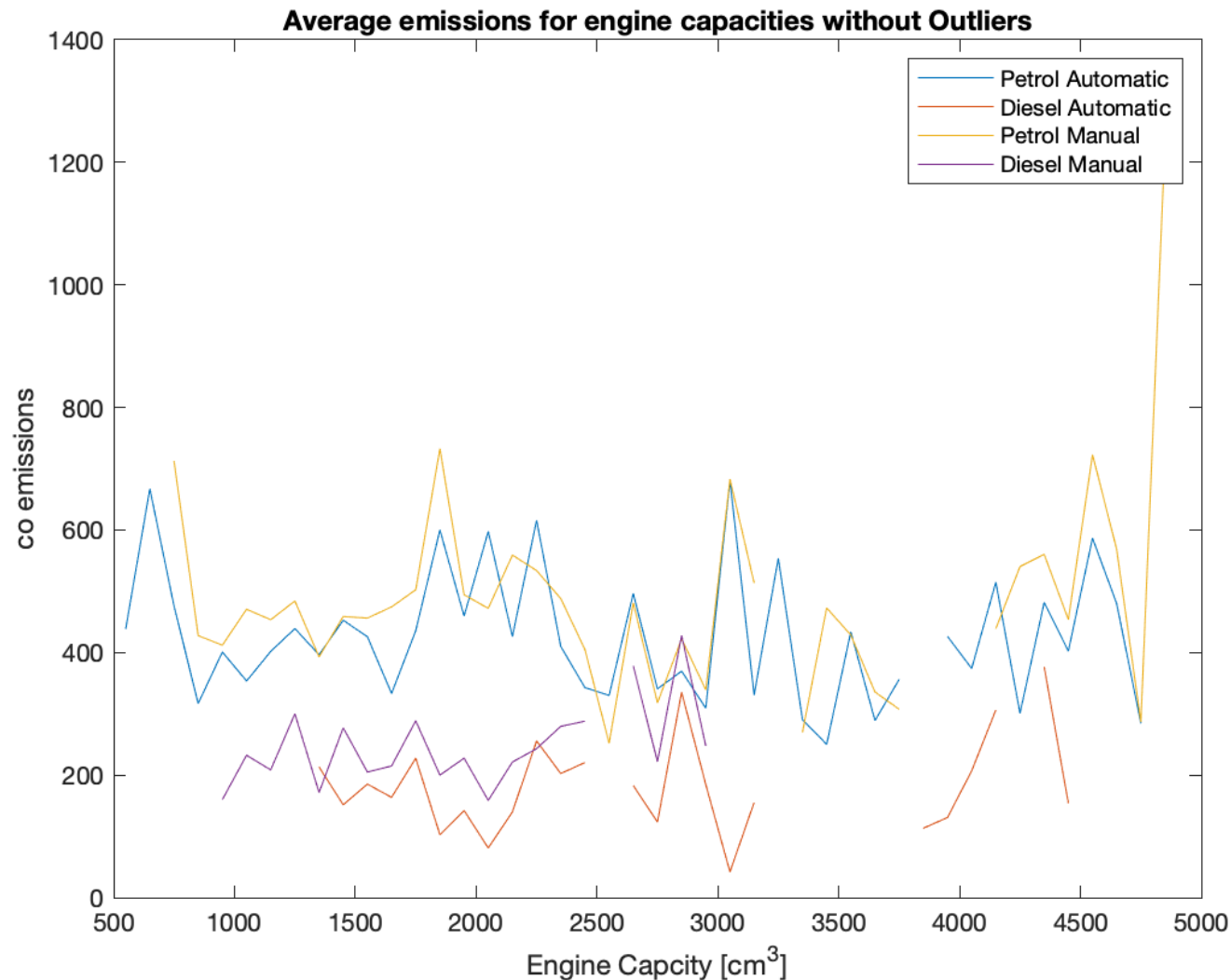


Emisje spalin dla całego zbioru danych



Emisje spalin dla całego zbioru danych

z usuniętymi elementami odstającymi oraz błędnymi danymi



Usunięte dane:

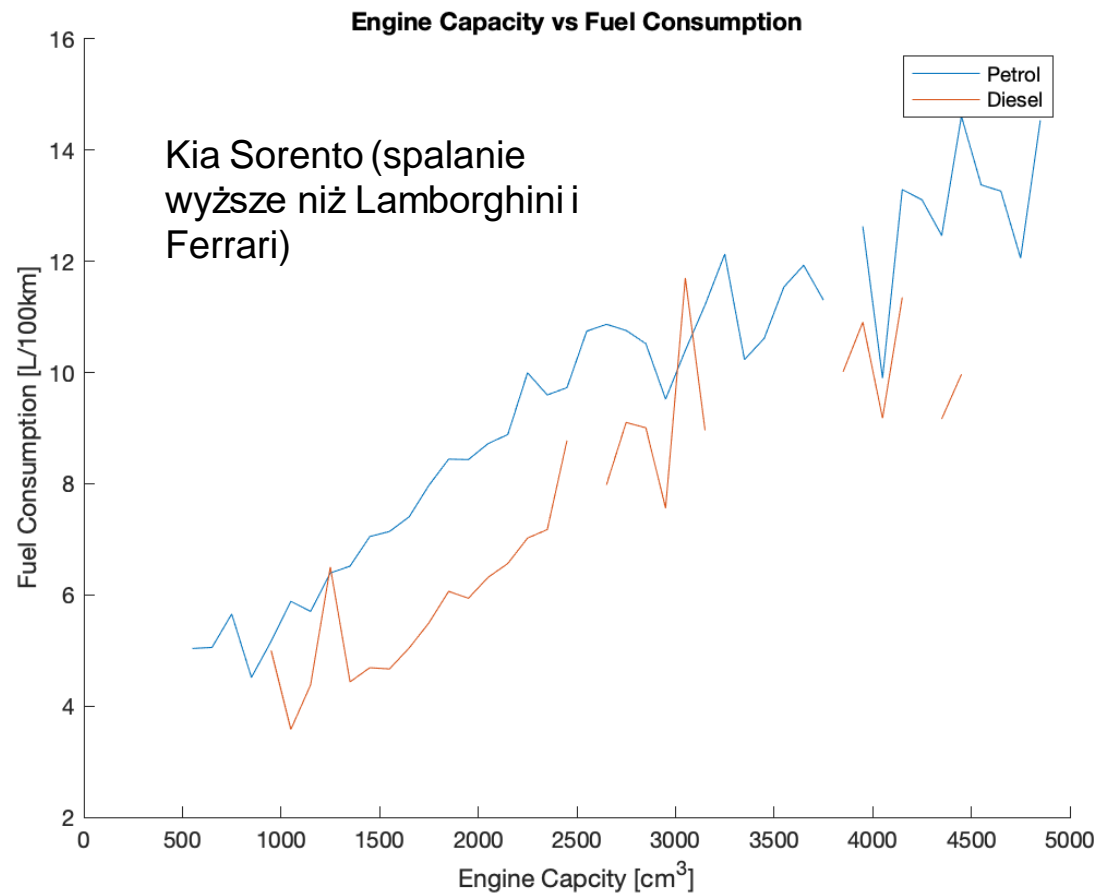
| | year | manufacturer | model | description | euro_standard | transmission_type | engine_capacity | fuel_type | combined_metric | co2 | co_emissions |
|-------|------|---------------|--------------------------------|--|---------------|-------------------|-----------------|-----------|-----------------|-----|--------------|
| 45356 | 2013 | Chrysler Jeep | Jeep Compass, MY2014 | 2.4 4x4 | 6 | NaN | 209.0 | Petrol | 9.0 | 209 | 366.0 |
| 3574 | 2001 | Toyota | Landcruiser | 4.2 24v TD Auto | 2 | Automatic | 4164.0 | Diesel | 12.6 | 340 | 170.0 |
| 1390 | 2000 | Toyota | Landcruiser | 4.2 TD Auto | 2 | Automatic | 4164.0 | Diesel | 12.6 | 340 | 170.0 |
| 25497 | 2008 | Volkswagen | Touareg | 5.0 TDI V10 (313 PS) Tiptronic with DPF | 4 | Automatic | 4921.0 | Diesel | 12.6 | 333 | 424.0 |
| 20390 | 2007 | Kia | Sorento | 2.5 CRDi | 4 | Manual | 2497.0 | Diesel | <u>35.8</u> | 209 | 302.0 |
| 42908 | 2013 | Mercedes-Benz | B-Class, Model Year 2013 | B 180 CDI with 16" rear wheels | 5 | Manual | 1796.0 | Diesel | <u>44.0</u> | 114 | 348.0 |
| 12370 | 2005 | Audi | Audi TT (Coupé) | 1.8 T quattro (225 PS) | 3 | Manual | 1781.0 | Petrol | 9.4 | 226 | 73000.0 |
| 12376 | 2005 | Audi | Audi TT (Roadster) | 1.8 T quattro (225 PS) | 3 | Manual | 1781.0 | Petrol | 9.5 | 228 | 73000.0 |
| 12369 | 2005 | Audi | Audi TT (Coupé) | 1.8 T quattro (180 PS) | 3 | Manual | 1781.0 | Petrol | 9.5 | 228 | 74000.0 |
| 12375 | 2005 | Audi | Audi TT (Roadster) | 1.8 T quattro (180 PS) | 3 | Manual | 1781.0 | Petrol | 9.6 | 230 | 74000.0 |

Usunięte dane:

| | year | manufacturer | model | description | euro_standard | transmission_type | engine_capacity | fuel_type | combined_metric | co2 | co_emissions |
|-------|------|--------------|--------------------------------|---|---------------|-------------------|-----------------|-----------|-----------------|-----|--------------|
| 12339 | 2005 | Audi | A8 | 4.0 TDI V8 quattro (275 PS) LWB | 3 | Automatic | 3936.0 | Diesel | 9.8 | 265 | 70000.0 |
| 12340 | 2005 | Audi | A8 | 4.0 V8 TDI quattro (275 PS) | 3 | Automatic | 3936.0 | Diesel | 9.8 | 265 | 70000.0 |
| 12352 | 2005 | Audi | Audi Allroad (Up to June 2005) | 2.5 TDI V6 quattro (180 PS) | 3 | Automatic | 2496.0 | Diesel | 9.5 | 257 | 71000.0 |
| 12353 | 2005 | Audi | Audi Allroad (Up to June 2005) | 2.5 TDI V6 quattro (180 PS)(Low & High Ratio T... | 3 | Manual | 2496.0 | Diesel | 8.8 | 238 | 72000.0 |

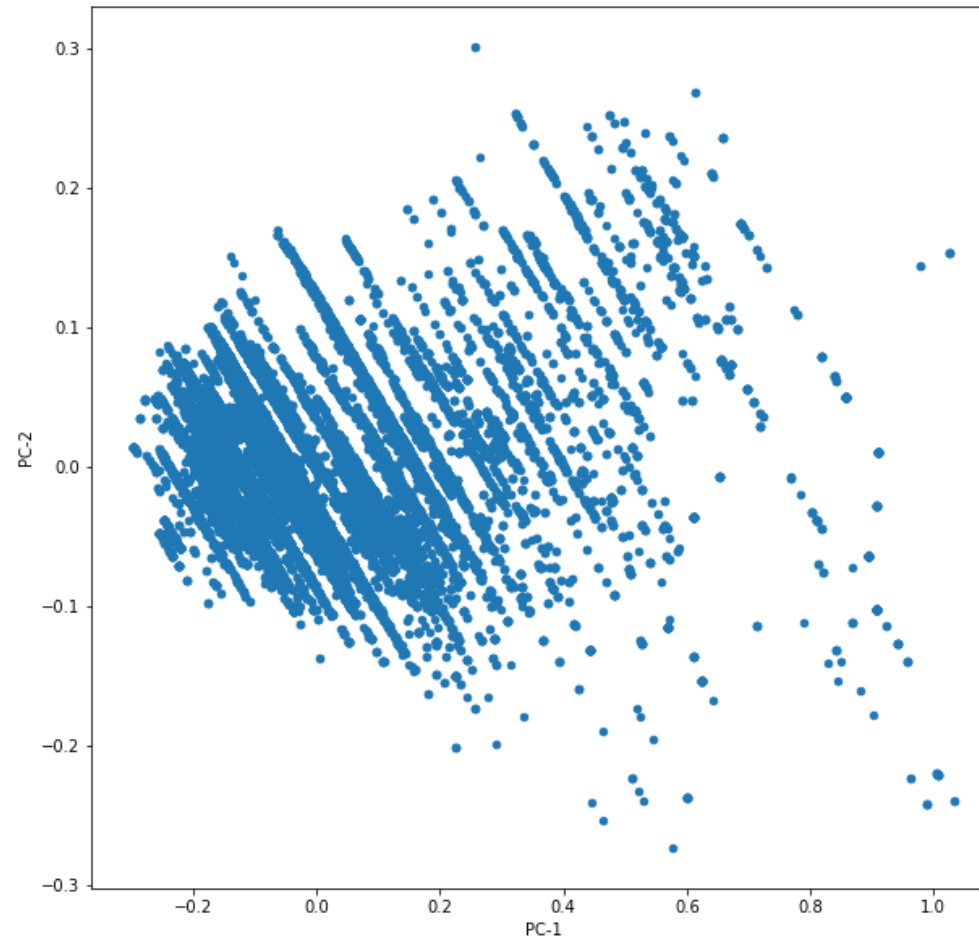
Spalanie diesel a benzyna

W cyklu mieszanym



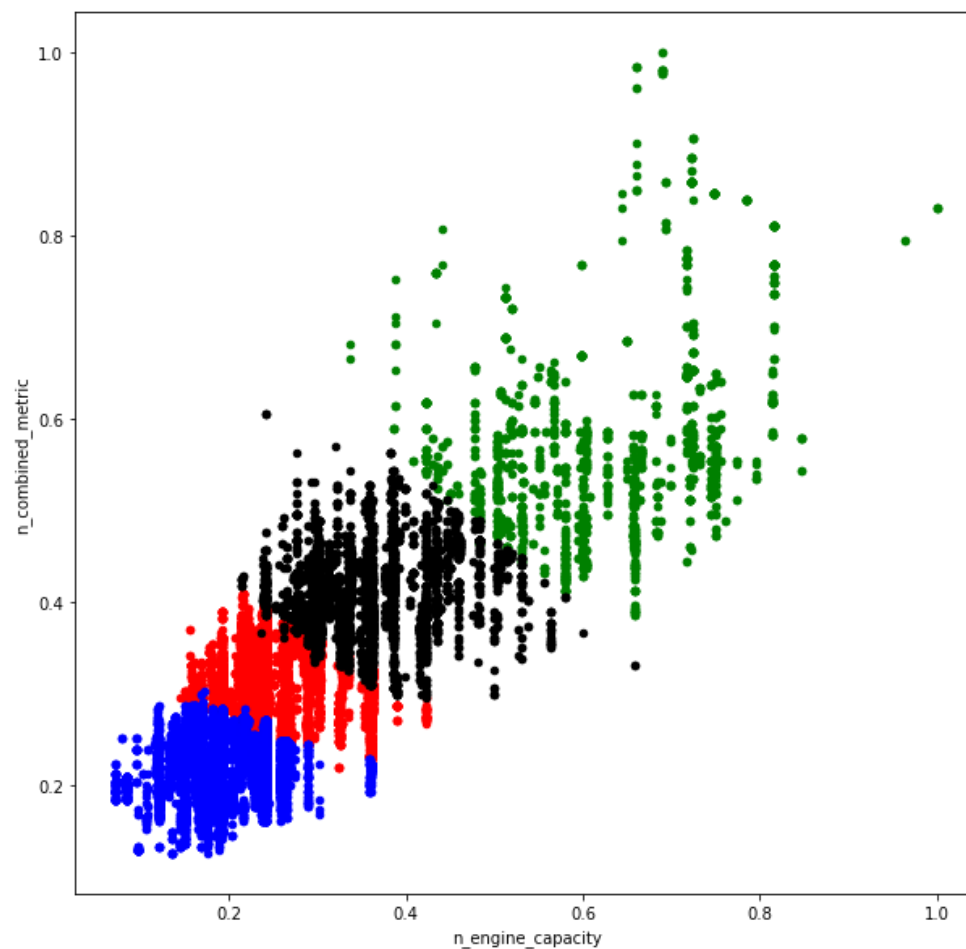
Redukcja wymiarów do 2D

Celem wstępnego oszacowania ilości potrzebnych klastrów



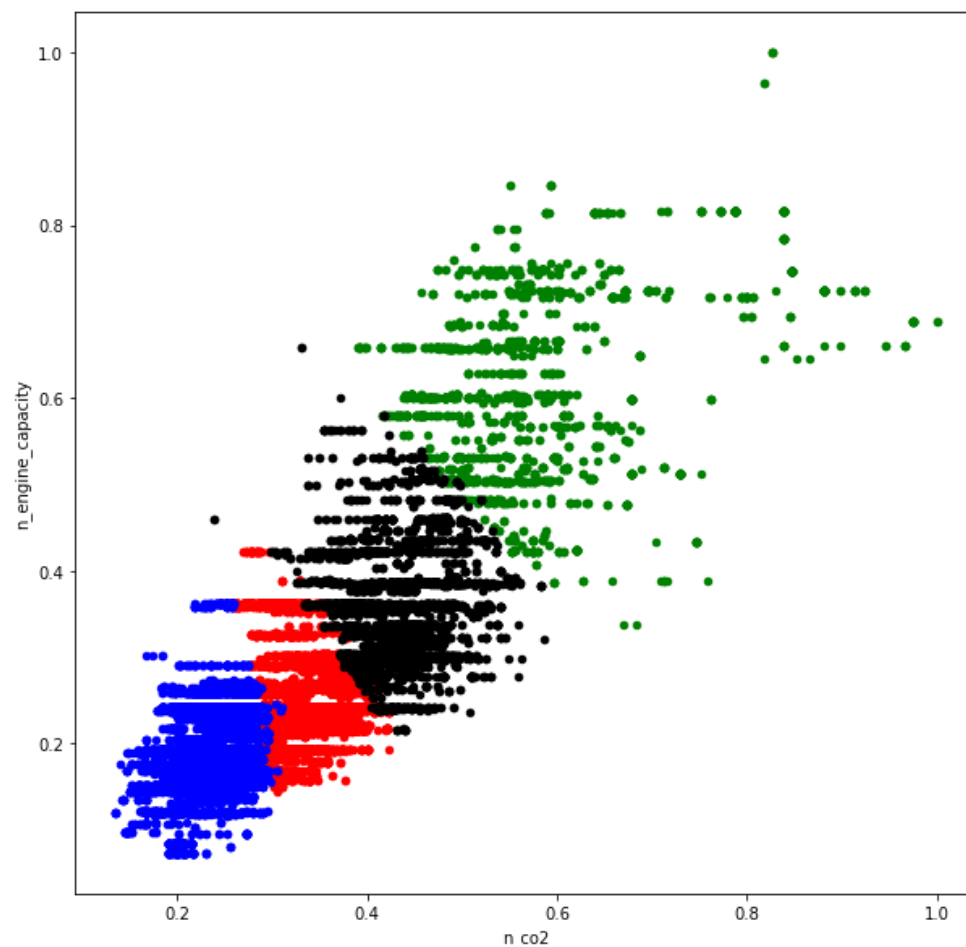
Klasteryzacja

rozmiar silnika a spalanie



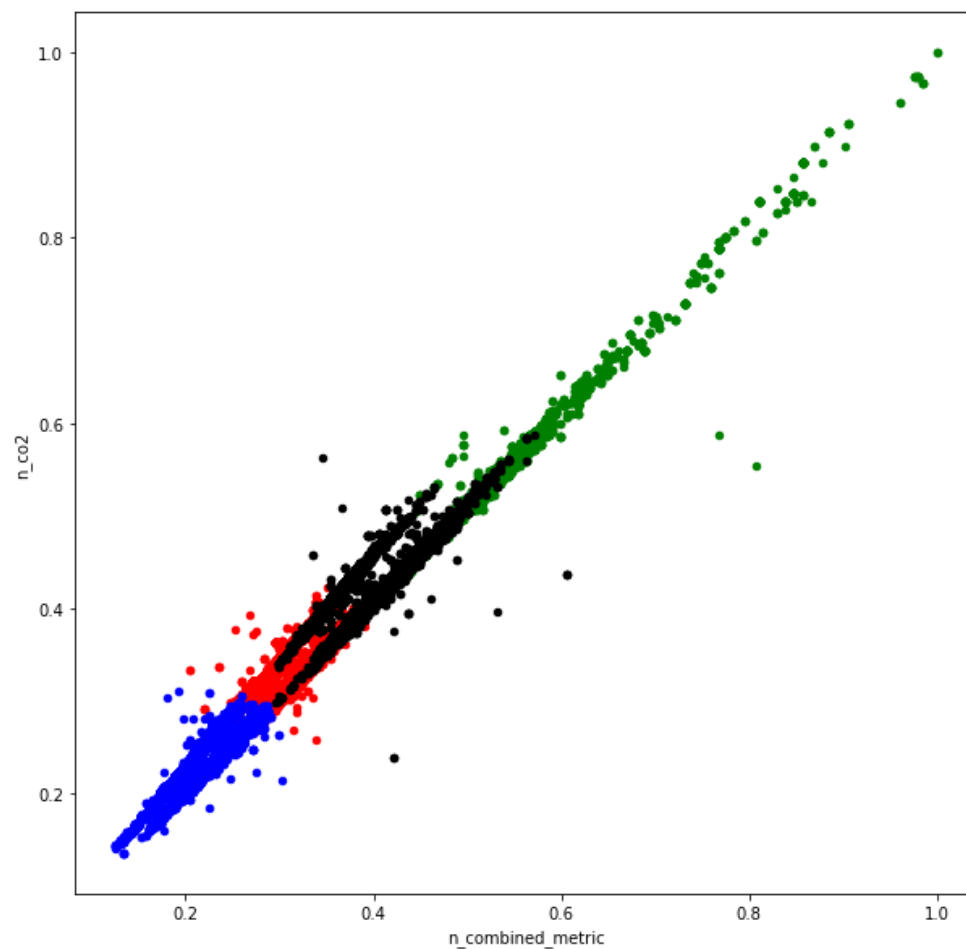
Klasteryzacja

rozmiar silnika a emisje spalin



Klasteryzacja

spalanie a emisje spalin



Klaster 1

Statistics for fuel_type
 Percent of Petrol cars: 70.18827834503925%
 Percent of Diesel cars: 29.81172165496075%

| | max | min | mean | median | std_dev |
|----------------------|-------------|-------------|-------------|-------------|------------|
| year | 2013.000000 | 2000.000000 | 2006.344626 | 2006.000000 | 3.676095 |
| euro_standard | 6.000000 | 2.000000 | 3.776663 | 4.000000 | 0.804122 |
| engine_capacity | 3498.000000 | 1199.000000 | 2026.467214 | 1991.000000 | 370.670411 |
| combined_metric | 10.400000 | 5.200000 | 7.930189 | 7.900000 | 0.856268 |
| co2 | 250.000000 | 152.000000 | 194.761967 | 192.000000 | 18.065221 |
| co_emissions | 1909.000000 | 3.000000 | 404.813732 | 359.000000 | 275.093633 |
| fuel_cost_6000_miles | 860.000000 | 417.000000 | 588.699763 | 584.000000 | 63.107304 |
| n_engine_capacity | 0.422209 | 0.144719 | 0.244595 | 0.240314 | 0.044740 |
| n_combined_metric | 0.409449 | 0.204724 | 0.312212 | 0.311024 | 0.033711 |
| n_co2 | 0.423729 | 0.257627 | 0.330105 | 0.325424 | 0.030619 |
| class | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |

Klaster 2

Statistics for fuel_type
 Procent of Petrol cars: 98.87842081650965%
 Procent of Diesel cars: 1.1215791834903546%

| | max | min | mean | median | std_dev |
|-----------------------------|--------|-------------|-------------|-------------|------------|
| year | 2013.0 | 2000.000000 | 2006.887393 | 2007.000000 | 3.662901 |
| euro_standard | 6.0 | 2.000000 | 3.808434 | 4.000000 | 0.816460 |
| engine_capacity | 8285.0 | 2790.000000 | 5064.292059 | 4966.000000 | 872.015620 |
| combined_metric | 25.4 | 9.800000 | 14.349529 | 13.900000 | 2.704700 |
| co2 | 590.0 | 230.000000 | 340.557649 | 328.000000 | 62.382161 |
| co_emissions | 2000.0 | 2.000000 | 514.608476 | 417.000000 | 338.928814 |
| fuel_cost_6000_miles | 1934.0 | 706.000000 | 1062.254019 | 988.500000 | 241.288836 |
| n_engine_capacity | 1.0 | 0.336753 | 0.611260 | 0.599396 | 0.105252 |
| n_combined_metric | 1.0 | 0.385827 | 0.564942 | 0.547244 | 0.106484 |
| n_co2 | 1.0 | 0.389831 | 0.577216 | 0.555932 | 0.105732 |
| class | 1.0 | 1.000000 | 1.000000 | 1.000000 | 0.000000 |

Klaster 3

Statistics for fuel_type
 Procent of Petrol cars: 41.177760719377126%
 Procent of Diesel cars: 58.82223928062288%

| | max | min | mean | median | std_dev |
|----------------------|-------------|-------------|-------------|-------------|------------|
| year | 2013.000000 | 2000.000000 | 2008.787532 | 2010.000000 | 3.628750 |
| euro_standard | 6.000000 | 2.000000 | 4.274482 | 4.000000 | 0.805338 |
| engine_capacity | 2993.000000 | 599.000000 | 1667.458713 | 1598.000000 | 355.681749 |
| combined_metric | 7.700000 | 3.200000 | 5.636550 | 5.700000 | 0.812298 |
| co2 | 183.000000 | 80.000000 | 141.861662 | 145.000000 | 17.814914 |
| co_emissions | 1733.000000 | 2.000000 | 286.359820 | 252.000000 | 181.177814 |
| fuel_cost_6000_miles | 572.000000 | 236.000000 | 427.025806 | 427.000000 | 52.604078 |
| n_engine_capacity | 0.361255 | 0.072299 | 0.201262 | 0.192879 | 0.042931 |
| n_combined_metric | 0.303150 | 0.125984 | 0.221911 | 0.224409 | 0.031980 |
| n_co2 | 0.310169 | 0.135593 | 0.240443 | 0.245763 | 0.030195 |
| class | 2.000000 | 2.000000 | 2.000000 | 2.000000 | 0.000000 |

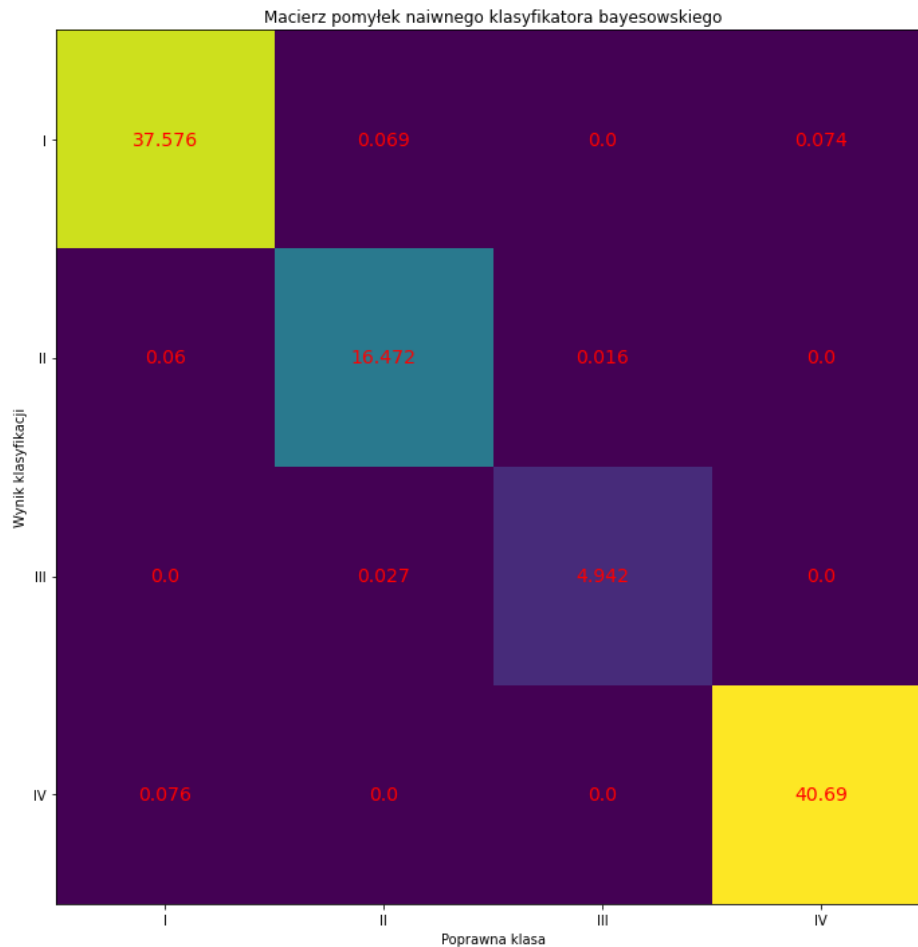
Klaster 4

Statistics for fuel_type
 Procent of Petrol cars: 78.17156665324204%
 Procent of Diesel cars: 21.828433346757954%

| | max | min | mean | median | std_dev |
|----------------------|-------------|-------------|-------------|-------------|------------|
| year | 2013.000000 | 2000.000000 | 2005.993825 | 2006.000000 | 3.505284 |
| euro_standard | 6.000000 | 2.000000 | 3.688415 | 4.000000 | 0.768944 |
| engine_capacity | 5461.000000 | 1781.000000 | 2932.328769 | 2967.000000 | 518.338990 |
| combined_metric | 15.400000 | 7.500000 | 10.281487 | 10.200000 | 1.128751 |
| co2 | 346.000000 | 141.000000 | 250.675258 | 248.000000 | 25.222856 |
| co_emissions | 1985.000000 | 2.000000 | 394.270788 | 314.000000 | 281.356247 |
| fuel_cost_6000_miles | 3329.000000 | 517.000000 | 759.086370 | 750.000000 | 104.742701 |
| n_engine_capacity | 0.659143 | 0.214967 | 0.353932 | 0.358117 | 0.062564 |
| n_combined_metric | 0.606299 | 0.295276 | 0.404783 | 0.401575 | 0.044439 |
| n_co2 | 0.586441 | 0.238983 | 0.424873 | 0.420339 | 0.042751 |
| class | 3.000000 | 3.000000 | 3.000000 | 3.000000 | 0.000000 |

Klasyfikacja (Klasyfikator Bayesowski)

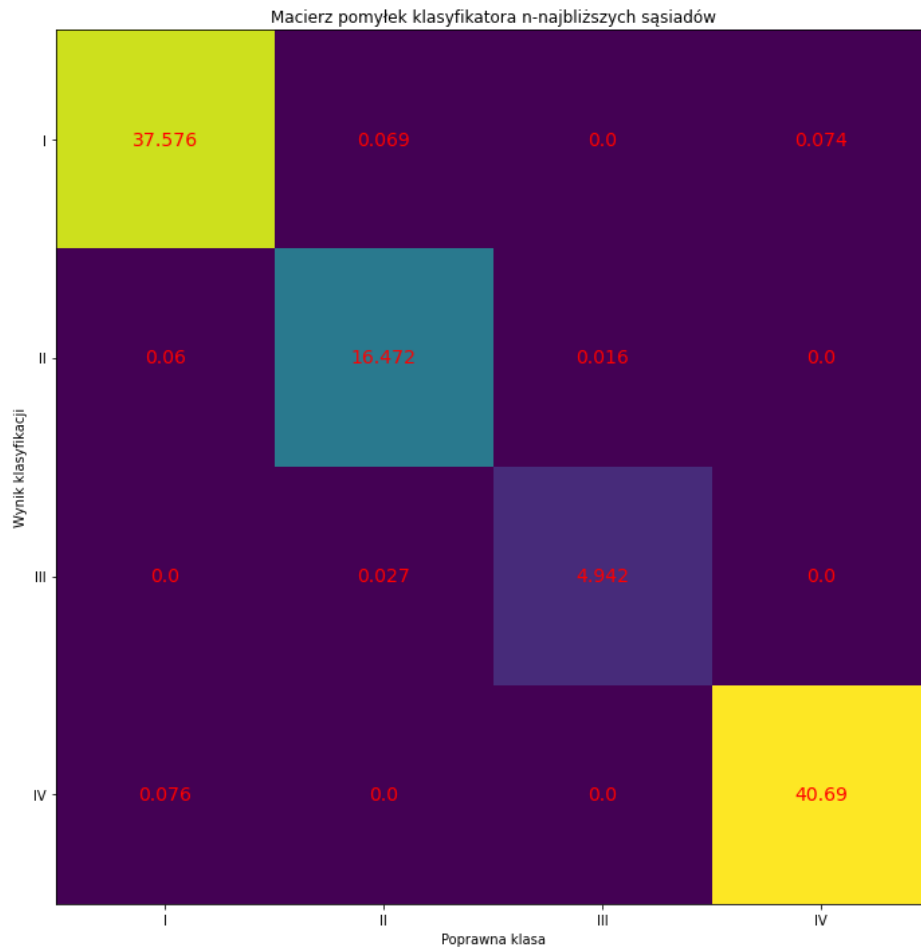
Confusion Matrix



**Prawidłowo
zklasyfikowane =
96.5937715954435%**

Klasyfikacja (Klasyfikator KNN)

Confusion Matrix



**Prawidłowo
zklasyfikowane =
99.67899418176955%**

Przykład nieprawidłowego doboru
klasyfikatora do klasteryzacji.
Klasyfikator działa na tej samej
zasadzie co mechanizm klasteryzacji

Dziękujemy za uwagę!

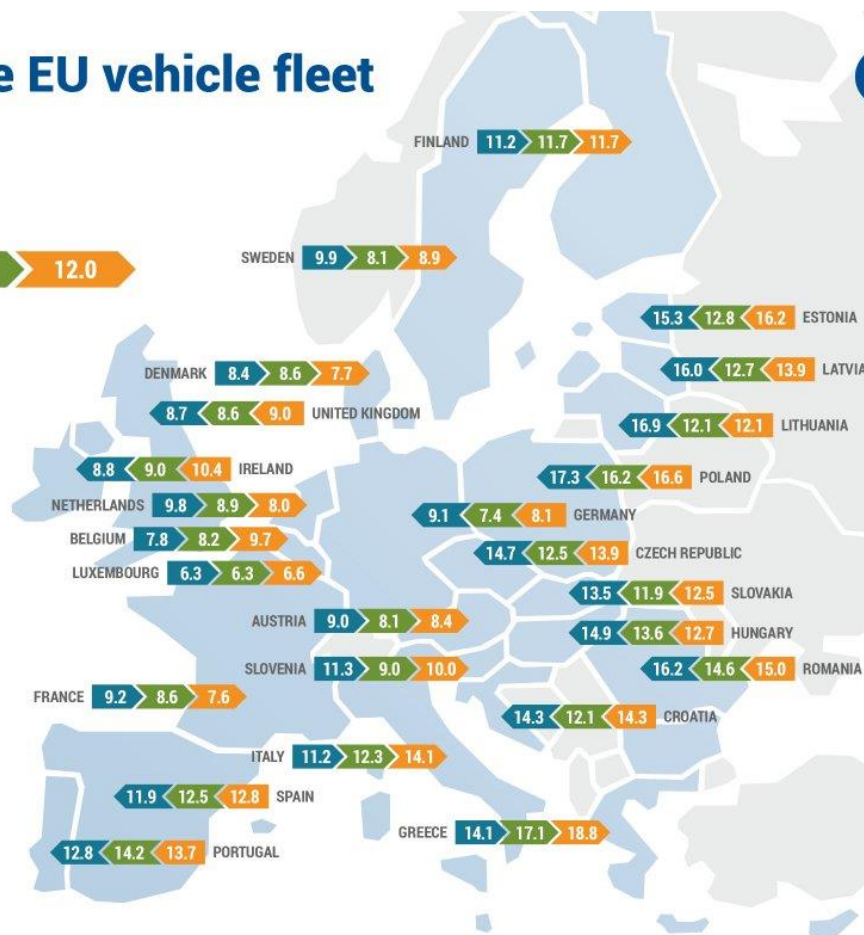
(i życzymy wielu ekonomicznie przejechanych kilometrów)

Average age of the EU vehicle fleet

BY COUNTRY, IN YEARS
2016

EUROPEAN UNION 11.0 10.9 12.0

- Passenger cars
- Light commercial vehicles
- Heavy commercial vehicles



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SOURCE: IHS MARKIT

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