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LAMPIRAN

Lampiran 1. Data rata-rata bulanan curah hujan, periode, kelembapan rata-rata, dan kecepatan angin maksimum sebelum standarisasi

| Periode | Curah Hujan | Kecepatan Angin Maksimum | Arah Angin saat Kecepatan Angin Maksimum |
|----------------|--------------------|---------------------------------|---|
| 1 | 18.047 | 5.61 | 250.10 |
| 2 | 18.604 | 4.86 | 232.45 |
| 3 | 16.033 | 4.71 | 231.72 |
| 4 | 6.544 | 4.17 | 251.43 |
| 5 | 3.004 | 3.90 | 220.00 |
| 6 | 4.323 | 3.73 | 223.57 |
| 7 | 3.893 | 4.06 | 223.10 |
| 8 | 6.421 | 4.39 | 227.93 |
| 9 | 3.903 | 4.37 | 246.43 |
| 10 | 2.752 | 4.48 | 215.93 |
| 11 | 8.141 | 4.53 | 256.79 |
| 12 | 32.286 | 4.84 | 227.41 |
| 13 | 18.679 | 5.97 | 273.55 |
| 14 | 5.932 | 4.32 | 249.64 |
| 15 | 13.043 | 4.84 | 247.19 |
| 16 | 12.975 | 4.17 | 230.30 |
| 17 | 0.964 | 4.52 | 210.74 |
| 18 | 2.541 | 4.33 | 234.33 |
| 19 | 2.627 | 4.42 | 237.97 |
| 20 | 5.323 | 4.39 | 204.35 |
| 21 | 2.992 | 4.47 | 232.00 |
| 22 | 1.532 | 4.90 | 244.19 |
| 23 | 1.617 | 4.70 | 243.67 |
| 24 | 10.067 | 5.29 | 289.68 |
| 25 | 12.944 | 4.39 | 247.56 |
| 26 | 13.808 | 4.48 | 231.11 |
| 27 | 11.526 | 4.71 | 242.28 |
| 28 | 11.712 | 4.92 | 216.82 |
| 29 | 10.792 | 4.36 | 236.92 |
| 30 | 8.380 | 4.00 | 226.43 |
| 31 | 3.542 | 4.23 | 228.93 |
| 32 | 6.844 | 4.68 | 199.10 |
| 33 | 10.550 | 4.94 | 274.00 |

Lampiran 1. Data rata-rata bulanan curah hujan, periode, kelembapan rata-rata, dan kecepatan angin maksimum sebelum standarisasi (lanjutan)

| Periode | Curah Hujan | Kecepatan Angin Maksimum | Arah Angin saat Kecepatan Angin Maksimum |
|----------------|--------------------|---------------------------------|---|
| 34 | 5.833 | 4.67 | 235.71 |
| 35 | 10.281 | 4.83 | 250.71 |
| 36 | 27.936 | 5.30 | 244.07 |
| 37 | 36.200 | 5.19 | 251.23 |
| 38 | 24.518 | 4.93 | 235.36 |
| 39 | 13.221 | 4.26 | 253.87 |
| 40 | 8.371 | 3.93 | 248.67 |
| 41 | 15.324 | 4.26 | 230.65 |
| 42 | 20.829 | 4.07 | 258.67 |
| 43 | 15.788 | 4.23 | 244.84 |
| 44 | 10.261 | 4.65 | 238.39 |
| 45 | 9.575 | 4.23 | 223.67 |
| 46 | 9.985 | 4.03 | 253.87 |
| 47 | 15.158 | 4.93 | 237.33 |
| 48 | 16.946 | 4.83 | 246.00 |
| 49 | 23.811 | 5.29 | 260.97 |
| 50 | 18.431 | 5.19 | 258.15 |
| 51 | 8.928 | 4.77 | 292.67 |
| 52 | 5.719 | 4.43 | 241.33 |
| 53 | 11.564 | 4.27 | 240.33 |
| 54 | 7.570 | 4.28 | 249.66 |
| 55 | 4.769 | 4.48 | 260.00 |
| 56 | 6.793 | 4.58 | 244.19 |
| 57 | 3.957 | 4.53 | 244.00 |
| 58 | 7.252 | 4.58 | 255.81 |
| 59 | 14.257 | 5.23 | 248.00 |
| 60 | 25.133 | 5.84 | 254.84 |
| 61 | 13.833 | 5.68 | 268.06 |
| 62 | 38.088 | 6.11 | 268.14 |
| 63 | 7.988 | 5.03 | 268.39 |
| 64 | 5.273 | 4.28 | 243.10 |
| 65 | 5.882 | 4.32 | 243.87 |
| 66 | 3.026 | 4.63 | 234.00 |
| 67 | 4.203 | 4.48 | 236.13 |

Lampiran 1. Data rata-rata bulanan curah hujan, periode, kelembapan rata-rata, dan kecepatan angin maksimum sebelum standarisasi (lanjutan)

| Periode | Curah Hujan | Kecepatan Angin Maksimum | Arah Angin saat Kecepatan Angin Maksimum |
|----------------|--------------------|---------------------------------|---|
| 68 | 2.876 | 5.40 | 229.67 |
| 69 | 3.393 | 4.80 | 236.00 |
| 70 | 2.741 | 4.87 | 238.33 |
| 71 | 7.654 | 4.83 | 258.33 |
| 72 | 3.119 | 5.16 | 266.13 |

Lampiran 2. Data rata-rata bulanan curah hujan, periode, kelembapan rata-rata, dan kecepatan angin maksimum setelah standarisasi

| Curah hujan | Periode | Kecepatan angin maksimum | Arah angin saat kecepatan maksimum |
|--------------------|----------------|---------------------------------|---|
| 0.910 | -1.696 | 1.935 | 0.407 |
| 0.978 | -1.648 | 0.388 | -0.615 |
| 0.661 | -1.601 | 0.086 | -0.656 |
| -0.510 | -1.553 | -1.026 | 0.484 |
| -0.947 | -1.505 | -1.566 | -1.335 |
| -0.785 | -1.457 | -1.913 | -1.128 |
| -0.838 | -1.410 | -1.235 | -1.155 |
| -0.526 | -1.362 | -0.575 | -0.876 |
| -0.836 | -1.314 | -0.617 | 0.195 |
| -0.978 | -1.266 | -0.377 | -1.570 |
| -0.313 | -1.218 | -0.275 | 0.794 |
| 2.667 | -1.171 | 0.350 | -0.906 |
| 0.988 | -1.123 | 2.662 | 1.764 |
| -0.586 | -1.075 | -0.709 | 0.381 |
| 0.292 | -1.027 | 0.350 | 0.239 |
| 0.284 | -0.980 | -1.026 | -0.739 |
| -1.199 | -0.932 | -0.310 | -1.871 |
| -1.004 | -0.884 | -0.685 | -0.505 |
| -0.994 | -0.836 | -0.509 | -0.295 |
| -0.661 | -0.788 | -0.575 | -2.240 |
| -0.949 | -0.741 | -0.412 | -0.640 |
| -1.129 | -0.693 | 0.482 | 0.065 |
| -1.119 | -0.645 | 0.066 | 0.035 |
| -0.075 | -0.597 | 1.275 | 2.698 |
| 0.280 | -0.549 | -0.575 | 0.260 |
| 0.386 | -0.502 | -0.379 | -0.692 |
| 0.105 | -0.454 | 0.086 | -0.046 |
| 0.128 | -0.406 | 0.510 | -1.519 |
| 0.014 | -0.358 | -0.636 | -0.356 |
| -0.284 | -0.311 | -1.367 | -0.963 |
| -0.881 | -0.263 | -0.890 | -0.818 |
| -0.473 | -0.215 | 0.020 | -2.545 |
| -0.016 | -0.167 | 0.560 | 1.790 |

Lampiran 2. Data rata-rata bulanan curah hujan, periode, kelembapan rata-rata, dan kecepatan angin maksimum setelah standarisasi (lanjutan)

| Curah hujan | Periode | Kecepatan angin maksimum | Arah angin saat kecepatan maksimum |
|--------------------|----------------|---------------------------------|---|
| -0.598 | -0.119 | -0.002 | -0.425 |
| -0.049 | -0.072 | 0.339 | 0.443 |
| 2.130 | -0.024 | 1.295 | 0.058 |
| 3.151 | 0.024 | 1.077 | 0.472 |
| 1.709 | 0.072 | 0.534 | -0.446 |
| 0.314 | 0.119 | -0.839 | 0.625 |
| -0.285 | 0.167 | -1.504 | 0.324 |
| 0.573 | 0.215 | -0.839 | -0.719 |
| 1.253 | 0.263 | -1.231 | 0.903 |
| 0.631 | 0.311 | -0.905 | 0.103 |
| -0.052 | 0.358 | -0.046 | -0.271 |
| -0.136 | 0.406 | -0.890 | -1.123 |
| -0.086 | 0.454 | -1.301 | 0.625 |
| 0.553 | 0.502 | 0.544 | -0.332 |
| 0.774 | 0.549 | 0.339 | 0.170 |
| 1.621 | 0.597 | 1.275 | 1.036 |
| 0.957 | 0.645 | 1.060 | 0.873 |
| -0.216 | 0.693 | 0.203 | 2.871 |
| -0.612 | 0.741 | -0.480 | -0.100 |
| 0.109 | 0.788 | -0.821 | -0.158 |
| -0.384 | 0.836 | -0.802 | 0.381 |
| -0.729 | 0.884 | -0.377 | 0.980 |
| -0.480 | 0.932 | -0.178 | 0.065 |
| -0.830 | 0.980 | -0.275 | 0.054 |
| -0.423 | 1.027 | -0.178 | 0.737 |
| 0.442 | 1.075 | 1.158 | 0.286 |
| 1.784 | 1.123 | 2.398 | 0.681 |
| 0.390 | 1.171 | 2.068 | 1.447 |
| 3.384 | 1.218 | 2.948 | 1.451 |
| -0.332 | 1.266 | 0.746 | 1.465 |
| -0.667 | 1.314 | -0.802 | 0.002 |
| -0.592 | 1.362 | -0.707 | 0.047 |
| -0.945 | 1.410 | -0.070 | -0.525 |
| -0.799 | 1.457 | -0.377 | -0.401 |
| -0.963 | 1.505 | 1.500 | -0.775 |

Lampiran 2. Data rata-rata bulanan curah hujan, periode, kelembapan rata-rata, dan kecepatan angin maksimum setelah standarisasi (lanjutan)

| Curah hujan | Periode | Kecepatan angin maksimum | Arah angin saat kecepatan maksimum |
|--------------------|----------------|---------------------------------|---|
| -0.899 | 1.553 | 0.271 | -0.409 |
| -0.980 | 1.601 | 0.407 | -0.274 |
| -0.373 | 1.648 | 0.339 | 0.884 |
| -0.933 | 1.696 | 1.011 | 1.335 |

Lampiran 3. *Source code* perhitungan koefisien determinasi (R^2) pada data curah

Input:

```
def rsquared(x, y):  
    slope, intercept, r_value, p_value, std_err = scipy.stats.linregress(x, y)  
    return r_value**2
```

```
result = rsquared(data_x_Periode, data_y_Periode)  
print(f'Nilai R2 variabel curah hujan dan periode: {result:.5f}')
```

Output:

Nilai R² variabel curah hujan dan periode: 0.00015

Lampiran 4. *Source code* perhitungan koefisien determinasi (R^2) pada data curah hujan dan kecepatan angin maksimum

Input:

```
def rsquared(x, y):  
    slope, intercept, r_value, p_value, std_err = scipy.stats.linregress(x, y)  
    return r_value**2  
  
result = rsquared(data_x_Curah_Hujan, data_y_Curah_Hujan)  
print(f'Nilai R2 variabel curah hujan dan kelembapan rata-rata: {result:.5f}')
```

Output:

Nilai R^2 variabel curah hujan dan kelembapan rata-rata: 0.27056

Lampiran 5. *Source code* perhitungan koefisien determinasi (R^2) pada data curah hujan dan arah angin saat kecepatan maksimum

Input:

```
def rsquared(x, y):  
    slope, intercept, r_value, p_value, std_err = scipy.stats.linregress(x, y)  
    return r_value**2  
  
result=rsquared(data_x_Kecepatan_Angin_Maksimum,data_y_Kecepatan_Angin_Ma  
ksimum)  
  
print(f'Nilai  $R^2$  variabel curah hujan dan kelembapan rata-rata: {result:.5f}')
```

Output:

Nilai R^2 variabel curah hujan dan kelembapan rata-rata: 0.09957

Lampiran 6. *Source code* model estimator Gasser-Müller Gaussian

```
def gaussian(u):
    return (1/np.sqrt(2*np.pi)) * np.exp(-0.5 * u**2)

def gasser_muller(x, data_x, data_y, bandwidth):
    n = len(data_x)
    estimator_value = 0
    for i in range(1, n):
        s_i_minus_1 = (data_x[i-1] + data_x[i]) / 2
        s_i = (data_x[i] + (data_x[i+1] if i < n-1 else data_x[i])) / 2
        integral, _ = integrate.quad(lambda u: gaussian((x-u)/bandwidth), s_i_minus_1,
s_i)
        estimator_value += integral * data_y[i]
    return (1/bandwidth) * estimator_value
```

Lampiran 7. Source code metode Generalized Cross Validation (GCV)

```
def gcv(X, Y, a, b, c):
```

```
    h = np.arange(a, b, c)
```

```
    s = len(h)
```

```
    GCV = np.zeros(s)
```

```
    MSE = np.zeros(s)
```

```
    n = len(X)
```

```
    :
```

```
top_10 = gcv(data_x_Curah_Hujan, data_y_Curah_Hujan, a, b, c)
```

Output:

h opt=1.01 dengan GCV minimal=0.013434179916271022 dan
MSE=0.9132275743261703

```
=====
```

| No | h | GCV | MSE |
|----|---|-----|-----|
|----|---|-----|-----|

```
=====
```

| | | | |
|----|------|--------|--------|
| 1 | 1.01 | 0.0134 | 0.9132 |
| 2 | 1.00 | 0.0134 | 0.9127 |
| 3 | 1.02 | 0.0134 | 0.9138 |
| 4 | 0.99 | 0.0134 | 0.9121 |
| 5 | 1.03 | 0.0134 | 0.9144 |
| 6 | 0.98 | 0.0134 | 0.9116 |
| 7 | 1.04 | 0.0134 | 0.9149 |
| 8 | 0.97 | 0.0134 | 0.9110 |
| 9 | 1.05 | 0.0134 | 0.9155 |
| 10 | 0.96 | 0.0134 | 0.9105 |

Lampiran 8. *Source code metode Silverman's Rule of Thumb (SROT)*

```
def silvermans_rule(data):  
    if not len(data.shape) == 2:  
        raise ValueError("Data must be of shape (obs, dims).")  
:  
_bw_methods = {  
    "scott": scotts_rule,  
    "Silverman": silvermans_rule  
}
```

Output:

Optimal Bandwidth: 0.3322908148734982

Lampiran 9. *Source code metode Scott's Rule*

```
def scotts_rule(data, weights=None):
    if not len(data.shape) == 2:
        raise ValueError("Data must be of shape (obs, dims).")
    :
    _bw_methods = {
        "scott": scotts_rule,
        "Silverman": silvermans_rule
    }
```

Output:

Optimal Bandwidth: 0.38839285846762456