International Journal of Innovation in
Mechanical Engineering and Advanced Materials
Vol. 6 (No. 3), 2024, pp. 119-128
Journal homepage: publikasi.mercubuana.ac.id/index.php/ijimeam
DOI: 10.22441/ijimeam.v6i3.28137

Supplementary Document

Statistical Analysis Engine Capacity, Weight, and Torque on MPV Fuel Consumption Using Regression and Correlation Algorithms

Hafidz Salafuddin [1], Nanang K. Pradipta [1], Farrah Anis Fazliatul Adnan [2], Jong Soo Rhee [3] and Dianta Ginting [1,*]

[1]Department of Mechanical Engineering, Faculty of Engineering, Universitas Mercu Buana, Meruya Selatan, Jakarta 11650, Indonesia
[2]Small Islands Research Centre, Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Kota Kinabalu, Sabah 88400, Malaysia
[3]Department of Applied Physics and Institute of Natural Sciences, Kyung Hee University, Yongin, Gyeonggi 17104, South Korea
*Corresponding Authors: dianta.ginting@mercubuana.ac.id (DG)

Appendix

Correlation

```
% Data input
data = {
    'ERTIGA GX', 14.5, 1462, 129, 1710;
    'APV Arena SGX', 12, 1493, 173, 1950;
    'XENIA 1.5 R Deluxe', 14.4, 1496, 138, 1110;
    'Luxio 1.5 X MC E4', 10, 1495, 128, 1840;
    'AVANZA 1.5G', 11.8, 1496, 137, 1940;
    'MOBILIO 1.5 S', 15, 1496, 133, 1525;
    'CONFERO 1.5 S', 17, 1485, 139, 1295;
    'XPANDER', 14.6, 1499, 145, 1780;};

% Create a table
varNames = {'Brand', 'Fuel_Consumption', 'Engine_Capacity', 'Torque', 'Weight'};
T = cell2table(data, 'VariableNames', varNames);

% Calculate correlations
corr_FuelCapacity_EngineCapacity = corr(T.Fuel_Consumption, T.Engine_Capacity);
corr_FuelCapacity_Torque = corr(T.Fuel_Consumption, T.Torque);
corr_FuelCapacity_Weight = corr(T.Fuel_Consumption, T.Weight);

% Display correlation results
fprintf('Correlation between Fuel Consumption and Engine Capacity: %.2f\n', corr_FuelCapacity_EngineCapacity);
fprintf('Correlation between Fuel Consumption and Torque: %.2f\n', corr_FuelCapacity_Torque);
fprintf('Correlation between Fuel Consumption and Weight: %.2f\n', corr_FuelCapacity_Weight);
```

Boxplot

```
% Data input
data = {
'ERTIGA GX', 14.5, 1462, 129, 1710;
'APV Arena SGX', 12, 1493, 173, 1950;
'XENIA 1.5 R Deluxe', 14.4, 1496, 138, 1110;
'Luxio 1.5 X MC E4', 10, 1495, 128, 1840;
'AVANZA 1.5G', 11.8, 1496, 137, 1940;
'MOBILIO 1.5 S', 15, 1496, 133, 1525;
'CONFERO 1.5 S', 17, 1485, 139, 1295;
```

```
'XPANDER', 14.6, 1499, 145, 1780;
};
% Create table
varNames = {'Brand', 'Fuel_Consumption', 'Engine_Capacity', 'Torque', 'Weight'};
T = cell2table(data, 'VariableNames', varNames);
% Display table
disp(T);
% Scatter Plot
figure;
subplot(2,2,1);
scatter([T.Engine_Capacity], [T.Fuel_Consumption], 'filled');
xlabel('Engine Capacity (cc)');
ylabel('Fuel Consumption (km/l)');
title('Fuel Consumption vs Engine Capacity');
subplot(2,2,2);
scatter([T.Torque], [T.Fuel_Consumption], 'filled');
xlabel('Torque (Nm)');
ylabel('Fuel Consumption (km/l)');
title('Fuel Consumption vs Torque');
subplot(2,2,3);
scatter([T.Weight], [T.Fuel_Consumption], 'filled');
xlabel('Weight (kg)');
ylabel('Fuel Consumption (km/l)');
title('Fuel Consumption vs Weight');
% Histogram
figure;
subplot(2,2,1);
histogram([T.Fuel_Consumption]);
xlabel('Fuel Consumption (km/l)');
ylabel('Frequency');
title('Histogram of Fuel Consumption');
subplot(2,2,2);
histogram([T.Engine_Capacity]);
xlabel('Engine Capacity (cc)');
ylabel('Frequency');
title('Histogram of Engine Capacity');
subplot(2,2,3);
histogram([T.Torque]);
xlabel('Torque (Nm)');
ylabel('Frequency');
title('Histogram of Torque');
subplot(2,2,4);
histogram([T.Weight]);
xlabel('Weight (kg)');
ylabel('Frequency');
title('Histogram of Weight');
% Box Plot
figure;
subplot(2,2,1);
boxplot([T.Fuel_Consumption], 'Labels', {'Fuel Consumption'});
ylabel('Fuel Consumption (km/l)');
title('Box Plot of Fuel Consumption');
subplot(2,2,2);
boxplot([T.Engine_Capacity], 'Labels', {'Engine Capacity'});
ylabel('Engine Capacity (cc)');
title('Box Plot of Engine Capacity');
subplot(2,2,3);
boxplot([T.Torque], 'Labels', {'Torque'});
ylabel('Torque (Nm)');
title('Box Plot of Torque');
subplot(2,2,4);
boxplot([T.Weight], 'Labels', {'Weight'});
ylabel('Weight (kg)');
title('Box Plot of Weight');
% Display plot
sgtitle('Vehicle Fuel Consumption Data Visualization');
```

Regression

```
% Data input
data = {
'ERTIGA GX', 14.5, 1462, 129, 1710;
'APV Arena SGX', 12, 1493, 173, 1950;
'XENIA 1.5 R Deluxe', 14.4, 1496, 138, 1110;
'Luxio 1.5 X MC E4', 10, 1495, 128, 1840;
'AVANZA 1.5G', 11.8, 1496, 137, 1940;
'MOBILIO 1.5 S', 15, 1496, 133, 1525;
'CONFERO 1.5 S', 17, 1485, 139, 1295;
'XPANDER', 14.6, 1499, 145, 1780;
};
% Create table
varNames = {'Brand', 'Fuel_Consumption', 'Engine_Capacity', 'Torque', 'Weight'};
T = cell2table(data, 'VariableNames', varNames);
% Linear regression for each independent variable against fuel consumption
mdl_EngineCapacity = fitlm(T.Engine_Capacity, T.Fuel_Consumption);
mdl_Torque = fitlm(T.Torque, T.Fuel_Consumption);
mdl_Weight = fitlm(T.Weight, T.Fuel_Consumption);
% Display linear regression results and regression formulas
disp('Linear Regression Results (Fuel Consumption vs Engine Capacity):');
disp(mdl_EngineCapacity);
fprintf('Regression Formula: Y = %.4f + %.4f*X\n', mdl_EngineCapacity.Coefficients.Estimate);
disp('Linear Regression Results (Fuel Consumption vs Torque):');
disp(mdl_Torque);
fprintf('Regression Formula: Y = %.4f + %.4f*X\n', mdl_Torque.Coefficients.Estimate);
disp('Linear Regression Results (Fuel Consumption vs Weight):');
disp(mdl_Weight);
fprintf('Regression Formula: Y = %.4f + %.4f*X\n', mdl_Weight.Coefficients.Estimate);
% Plot regression results
figure;
% Plot Engine Capacity
subplot(3,1,1);
scatter(T.Engine_Capacity, T.Fuel_Consumption, 'filled');
hold on;
plot(T.Engine_Capacity, mdl_EngineCapacity.Fitted, '-r');
title('Fuel Consumption vs Engine Capacity');
xlabel('Engine Capacity (cc)');
ylabel('Fuel Consumption (km/l)');
legend('Data', 'Linear Regression', 'Location', 'best');
% Add regression formula to the plot
text(min(T.Engine_Capacity), max(T.Fuel_Consumption), sprintf('Y = %.4f + %.4f*X', mdl_EngineCapac-
ity.Coefficients.Estimate), 'FontSize', 12, 'Color', 'r', 'BackgroundColor', 'w');
hold off;
% Plot Torque
subplot(3,1,2);
scatter(T.Torque, T.Fuel_Consumption, 'filled');
hold on;
plot(T.Torque, mdl_Torque.Fitted, '-r');
title('Fuel Consumption vs Torque');
xlabel('Torque (Nm)');
ylabel('Fuel Consumption (km/l)');
legend('Data', 'Linear Regression', 'Location', 'best');
% Add regression formula to the plot
text(min(T.Torque), max(T.Fuel_Consumption), sprintf('Y = %.4f + %.4f*X', mdl_Torque.Coefficients.Esti-
mate), 'FontSize', 12, 'Color', 'r', 'BackgroundColor', 'w');
hold off;
% Plot Weight
subplot(3,1,3);
scatter(T.Weight, T.Fuel_Consumption, 'filled');
hold on;
plot(T.Weight, mdl_Weight.Fitted, '-r');
title('Fuel Consumption vs Weight');
```

```
        xlabel('Weight (kg)');
        ylabel('Fuel Consumption (km/l)');
        legend('Data', 'Linear Regression', 'Location', 'best');
        % Add regression formula to the plot
        text(min(T.Weight), max(T.Fuel_Consumption), sprintf('Y = %.4f + %.4f*X', mdl_Weight.Coefficients.Esti-
mate), 'FontSize', 12, 'Color', 'r', 'BackgroundColor', 'w');
        hold off;
```