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ML Cheatsheet #1

Your practical 7-step guide from business idea to a deployable regression model

A Foundational Guide for Aspiring Data Scientists

Based on
"Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow"
by

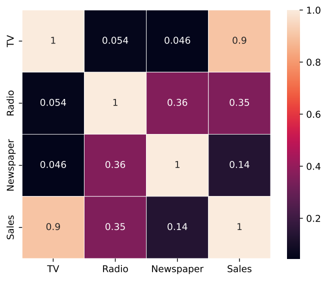
Aurélien Géron

Step 1: Properly Frame the Problem

Steps 2 & 3: Acquire and explore the data

Possible data sources:

- public, open data repository (e.g., Kaggle, UCI)
- first-party data (e.g., company, operational data)
- online sources (e.g., web scraping, APIs)



Correlation matrix[1]

```python
import kagglehub
from kagglehub import KaggleDatasetAdapter

# Loading a DataFrame from Kaggle
adsSales = kagglehub.dataset_load(
    KaggleDatasetAdapter.PANDAS,
    "thorgodofthunder/tvradionewspaperadvertising/versions/1",
    "Advertising.csv",)
```

Exploratory data analysis (EDA)

1. split data into train & test sets
2. investigate correlation (numeric attributes)
3. transform data using pipelines (e.g., imputation, one-hot-encoding)

Source of "Advertising sales data": www.kaggle.com/datasets/thorgodofthunder/tvradionewspaperadvertising

Step 4: Train & evaluate candidate models

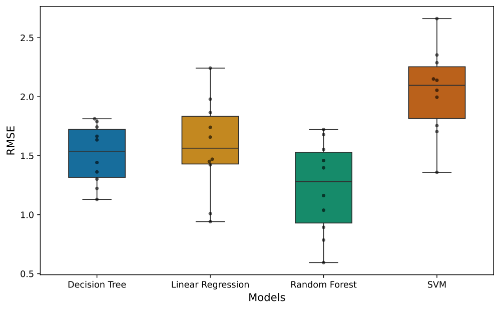
Candidate models (Regression)	Advantages	Disadvantages
Linear regression	simple, interpretable, fast to train	assumes linearity, sensitive to outliers & multicollinearity
Decision tree regressor	models non-linearity, easy to visualize & interpret	prone to overfitting, sensitive to data change & skewness
Support vector regression (SVR)	models non-linearity, effective for high-dimensional & medium-sized data	Computationally expensive, difficult to interpret & sensitive to kernel choice

```python
# Training a linear regression model

from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
import numpy as np

lin_reg = LinearRegression()
lin_reg.fit(adsSales_prepared, adsSales_labels)

adsSales_predictions = lin_reg.predict(
    adsSales_prepared)
lin_mse = mean_squared_error(adsSales_labels,
    adsSales_predictions)
lin_rmse = np.sqrt(lin_mse)
```



Root mean squared scores of candidate models

Step 5 : Fine-tune best model

Model hyper-parameters are fine-tuned to improve its performance:

1. explore large space with Random search
2. fine tune search with Grid search
3. use cross-validation in both cases

```python
# Hyper-parameters tuning using grid search

from sklearn.model_selection import GridSearchCV

param_grid = [
    {'n_estimators': [3, 10, 30, 50], 'max_features': [6, 8, 10]},
    {'bootstrap': [False], 'n_estimators': [3, 10], 'max_features': [2, 3, 4]},
]

forest_reg = RandomForestRegressor()
grid_search = GridSearchCV(forest_reg, param_grid, cv=5,
                           scoring='neg_mean_squared_error',
                           return_train_score=True)

# Fit model for all combinations of parameters
grid_search.fit(adsSales_prepared, adsSales_labels)

# Picking best model from grid search
final_model = grid_search.best_estimator_
```

Step 6: Assess final model performance on unseen test set

Prepare test set with same pipeline as the training set

```python
# Defining test dataset
X_test = strat_test_set.drop("Sales", axis=1)
y_test = strat_test_set["Sales"].copy()

X_test_prepared = full_pipeline.transform(X_test)
```

Evaluate model performance

```python
# Running predictions on test set

final_predictions = final_model.predict(X_test_prepared)

final_mse = mean_squared_error(y_test, final_predictions)
final_rmse = np.sqrt(final_mse)
```

Step 7: Save model for possible deployment

```python
# Saving the model as joblib file

def save_model(model, name="model", model_path="./"):
    """
    Save the model with a given name to a specific location.

    Parameters
    ----------
    model :
        The model trained.
    name:
        The file name with which to save the model
    model_path:
        The path in which the model is saved
        Example:
            "./models/"

    """
    os.makedirs(model_path, exist_ok=True)
    model_name = name + ".pkl"
    pkl_path = os.path.join(model_path, model_name)
    joblib.dump(model, pkl_path)

MODEL_PATH = os.path.join("models", "adsSales")
save_model(final_model, name="Random_forest_V1.1", model_path=MODEL_PATH)
```

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