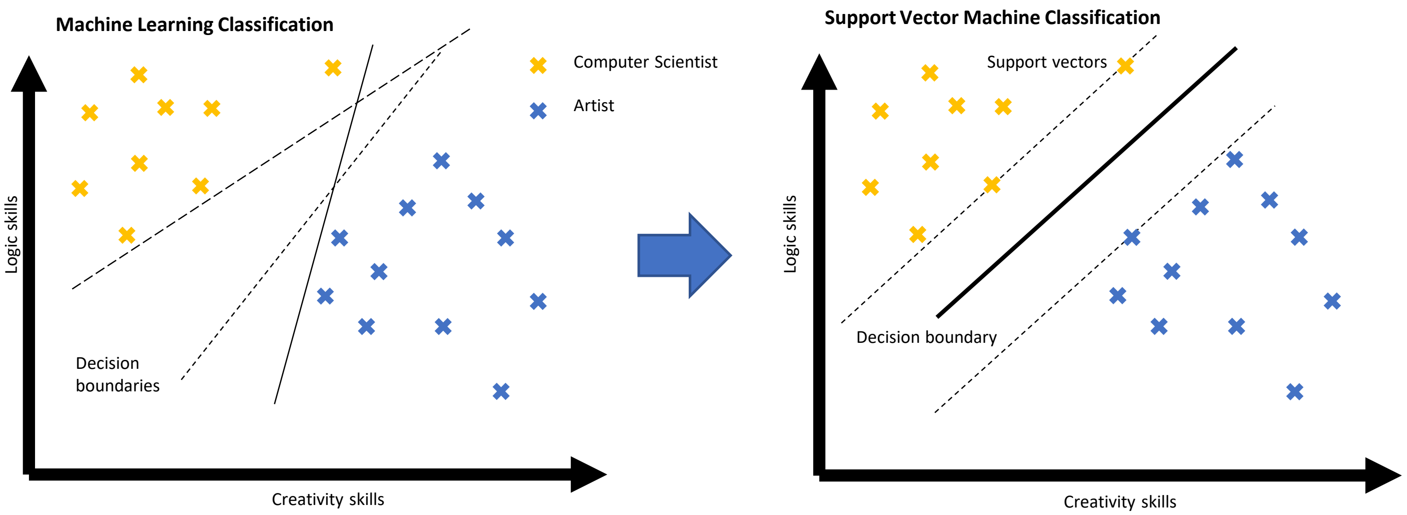
[Machine Learning Cheat Sheet] Support Vector Machines

Based on Article: https://blog.finxter.com/support-vector-machines-python/

Main idea: Maximize width of separator zone → increases „margin of safety“ for classification



What are basic SVM properties?

Support Vector Machines

Alternatives:	SVM, support-vector networks
Learning:	Classification, Regression
Advantages:	Robust for high-dimensional space Memory efficient (only uses support vectors) Flexible and customizable
Disadvantages:	Danger of overfitting in high-dimensional space No classification probabilities like Decision trees
Boundary:	Linear and Non-linear

What‘s the most basic Python code example?

```
## Dependencies
from sklearn import svm
import numpy as np


## Data: student scores in (math, language, creativity)
## --> study field
X = np.array([[9, 5, 6, "computer science"],
              [10, 1, 2, "computer science"],
              [1, 8, 1, "literature"],
              [4, 9, 3, "literature"],
              [0, 1, 10, "art"],
              [5, 7, 9, "art"]])


## One-liner
svm = svm.SVC().fit(X[:,:-1], X[:,-1])


## Result & puzzle
student_0 = svm.predict([[3, 3, 6]])
print(student_0)

student_1 = svm.predict([[8, 1, 1]])
print(student_1)
```

What‘s the explanation of the code example?

Explanation: A Study Recommendation System with SVM

- NumPy array holds labeled training data (one row per user and one column per feature).
- Features: skill level in maths, language, and creativity.
- Labels: last column is recommended study field.
- 3D data → SVM separates data using 2D planes (the linear separator) rather than 1D lines.
- One-liner:
    1. Create model using constructor of scikit-learn’s svm.SVC class (SVC = support vector classification).
    2. Call fit function to perform training based on labeled training data.
- Results: call predict function on new observations
    - student_0 (skills maths=3, language=3, and creativity=6) → SVM predicts “art”
    - student_1 (maths=8, language=1, and creativity=1) → SVM predicts “computer science”
- Final output of one-liner:

```
## Result & puzzle
student_0 = svm.predict([[3, 3, 6]])
print(student_0)
# ['art']

student_1 = svm.predict([[8, 1, 1]])
print(student_1)
## ['computer science']
```

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„A Puzzle A Day to Learn, Code, and Play!“