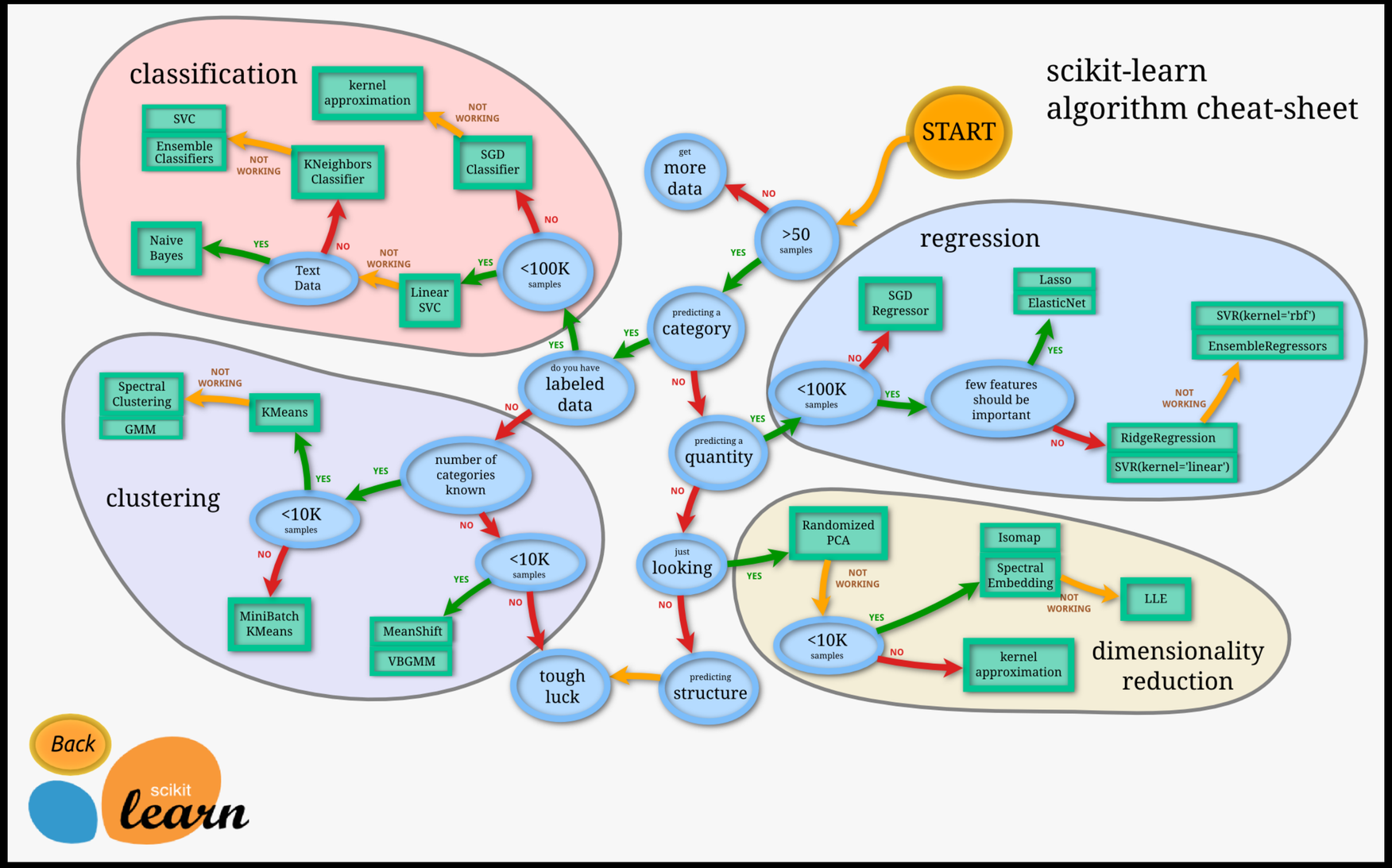
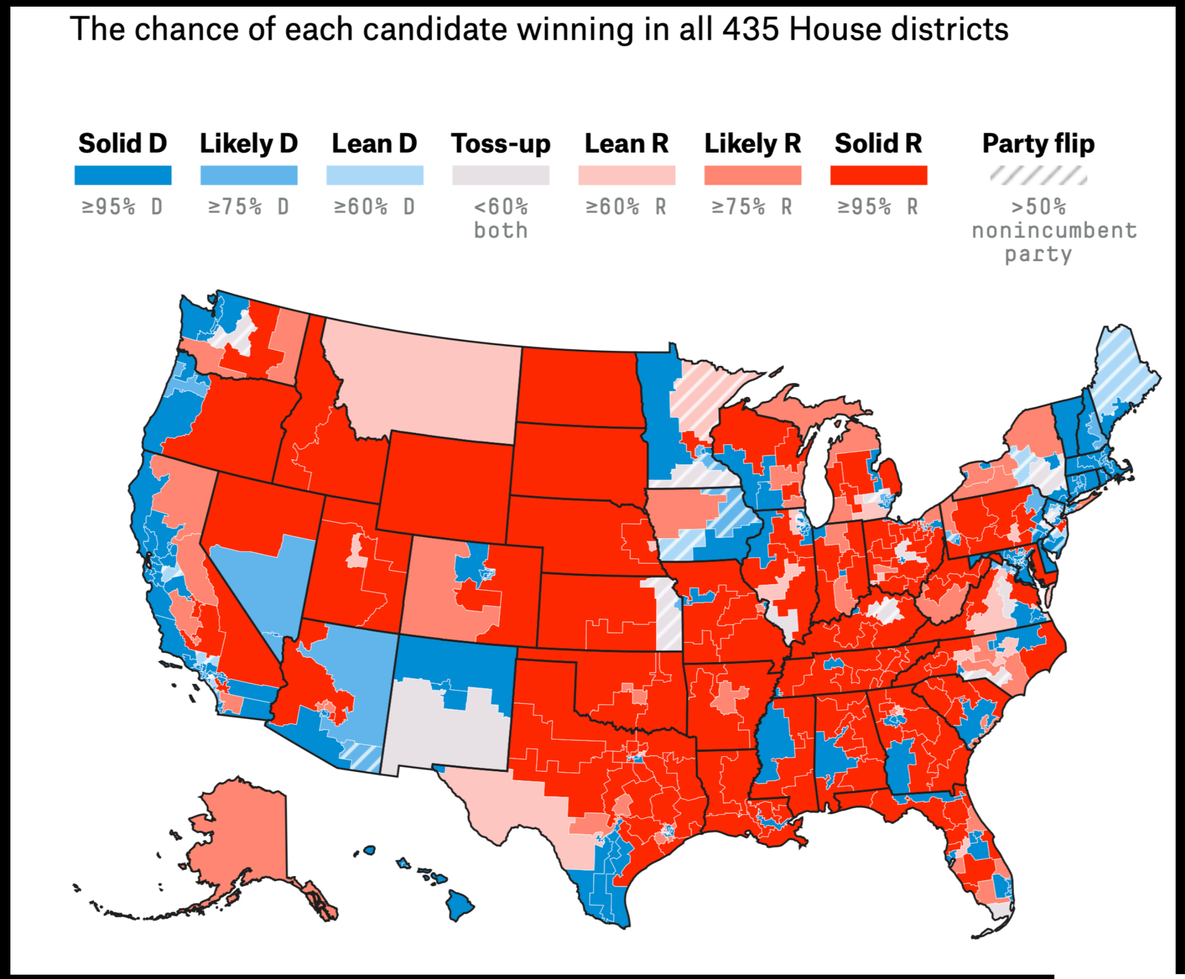
Supervised Learning
Classification

X-Ed
Demian Wassermann
Inria, France

Where are we in the Data Science Landscape?

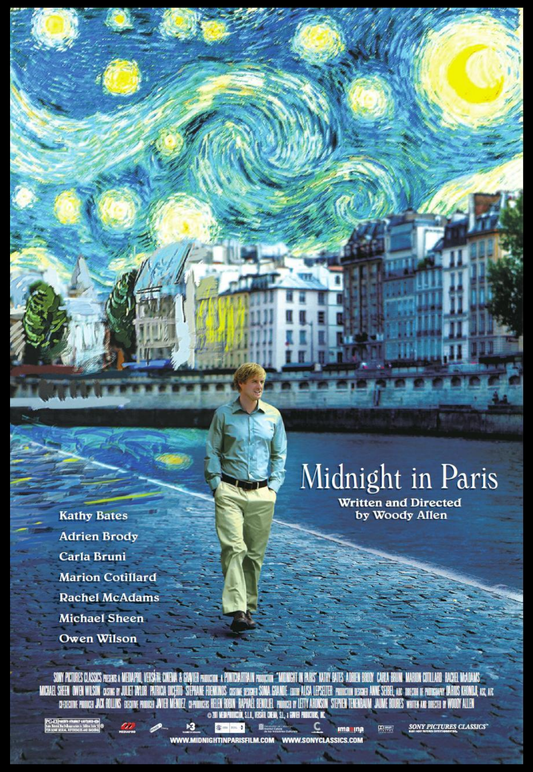


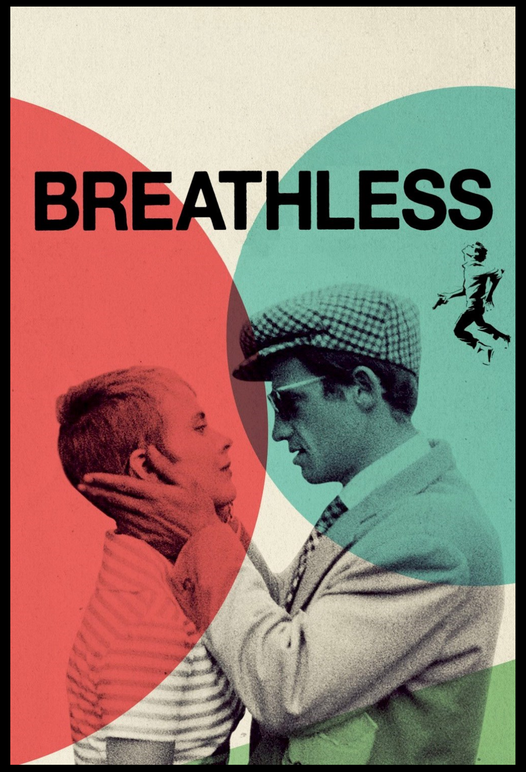
Motivating Example

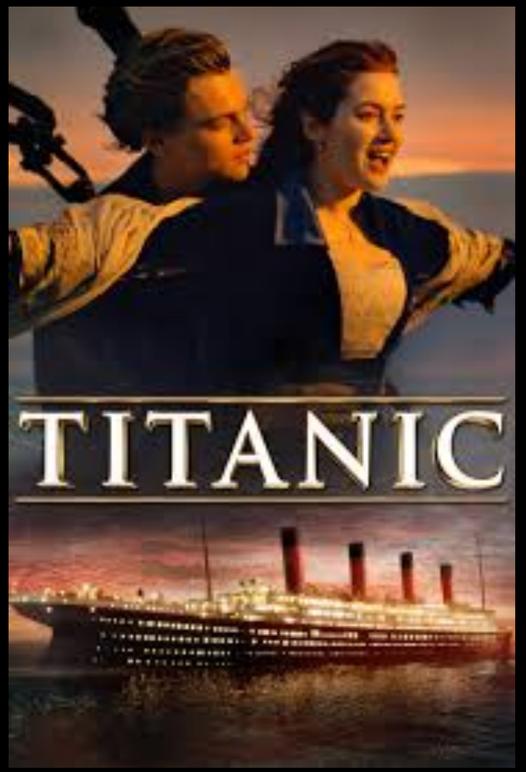


Regression Implies a Model of Reality

“A movie is better when there are more explosions”







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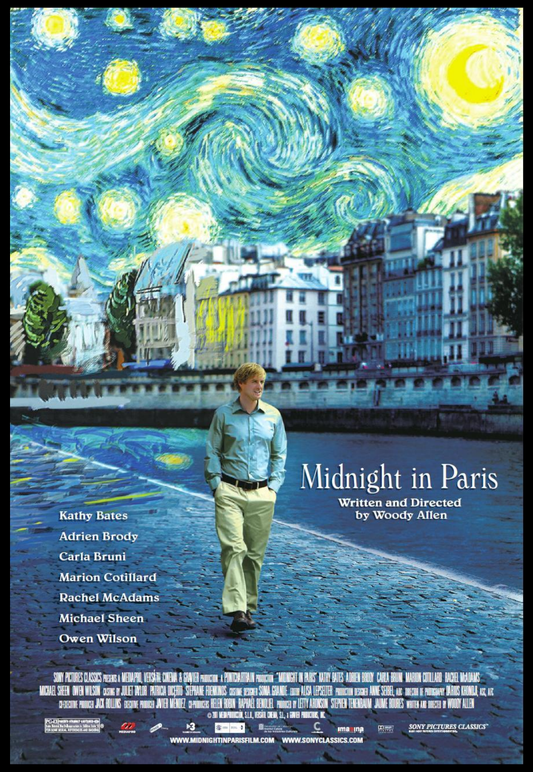
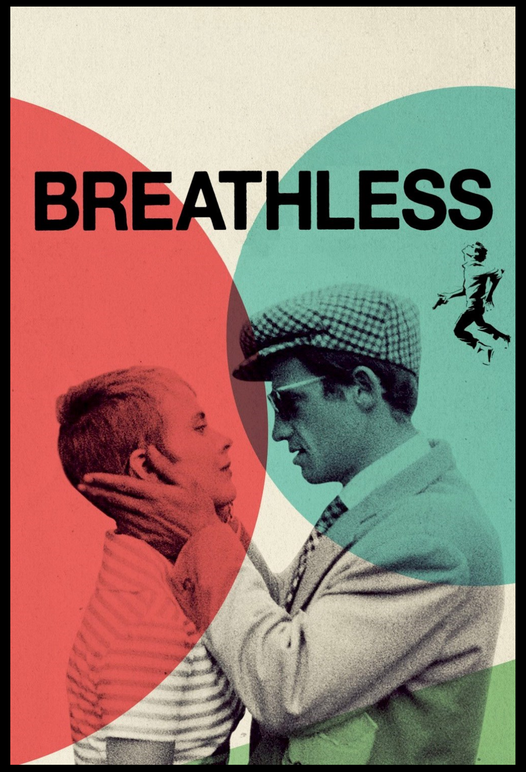
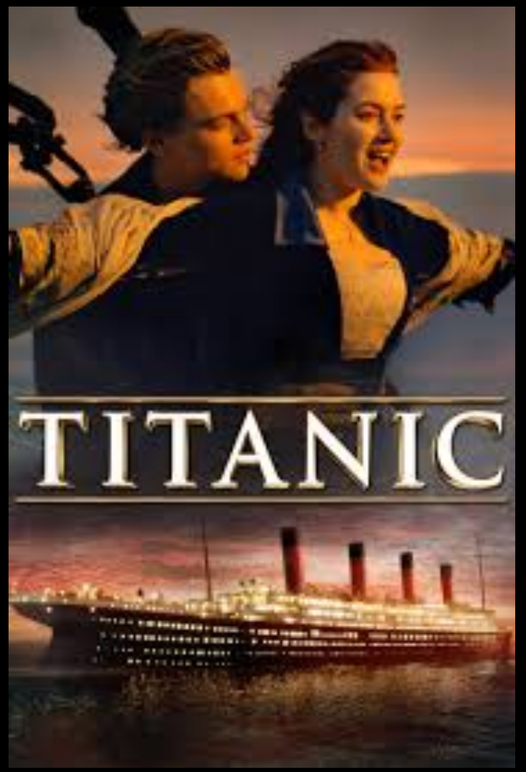
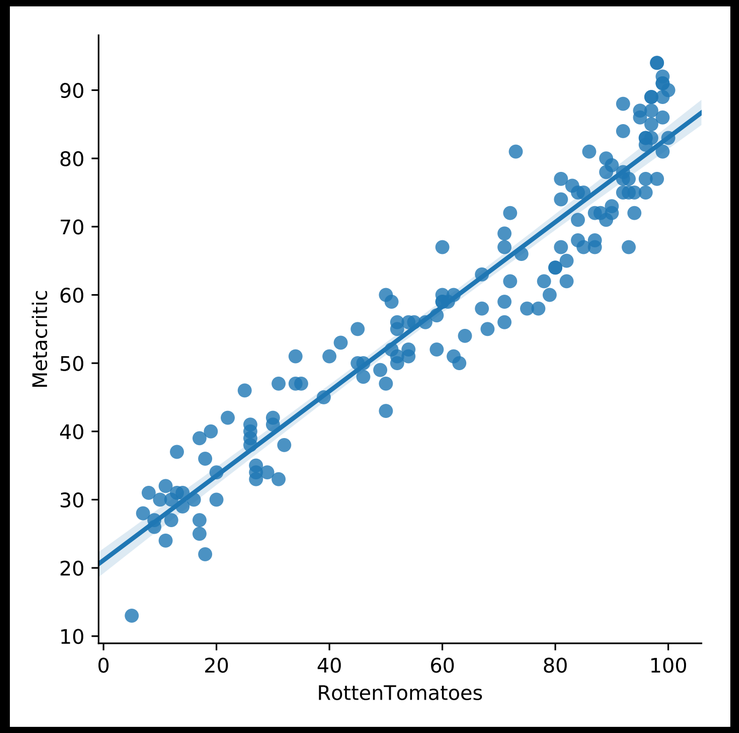


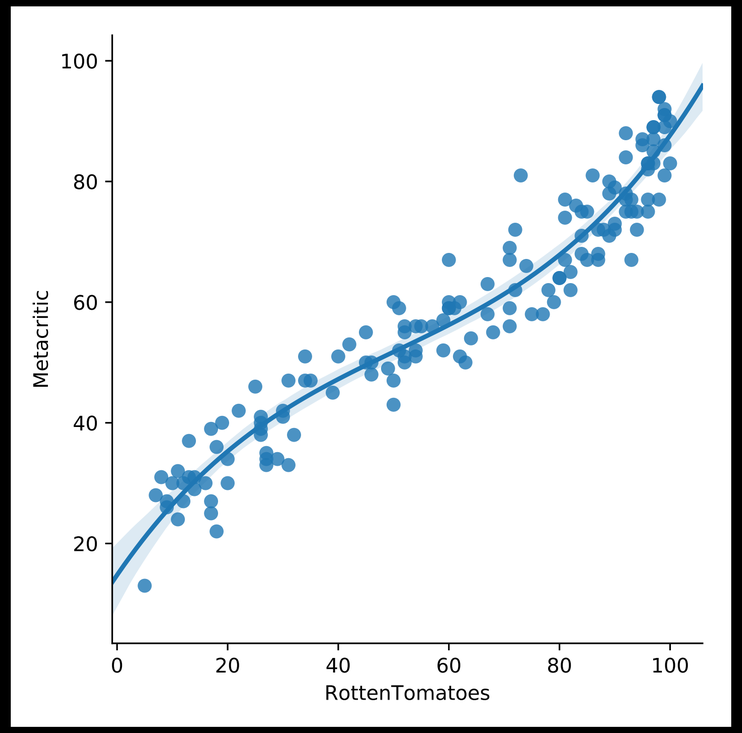


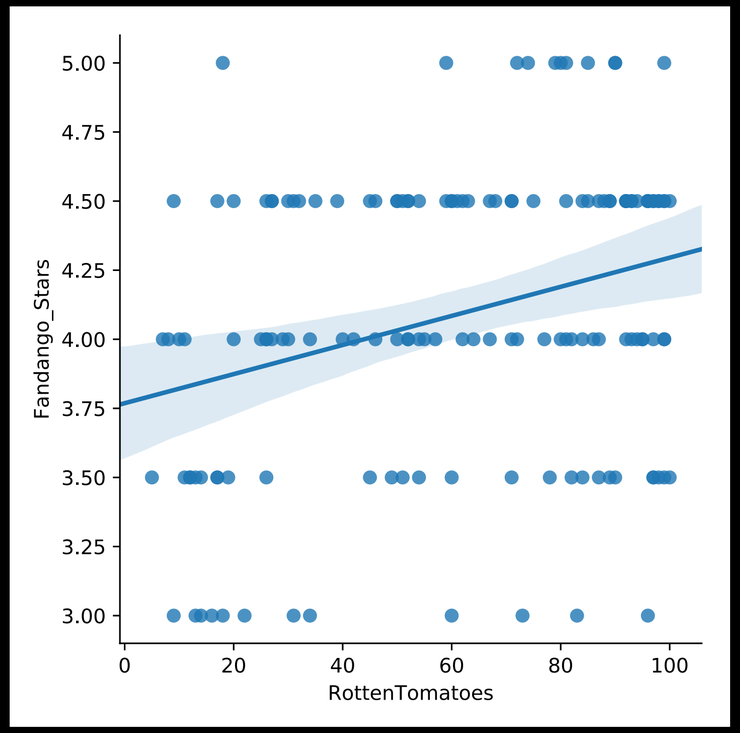


Model Selection - Regression Model

Are movie recommendation systems consistent?







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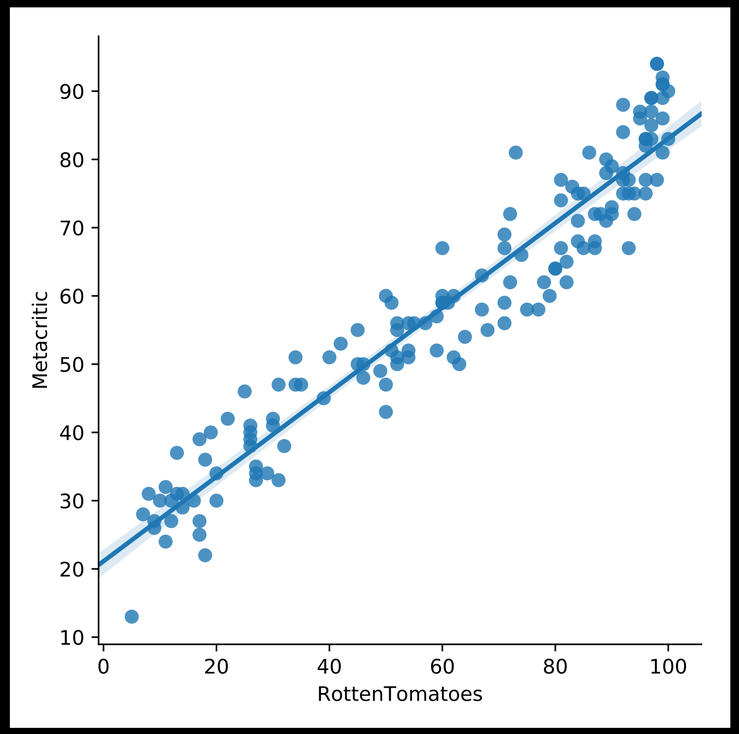
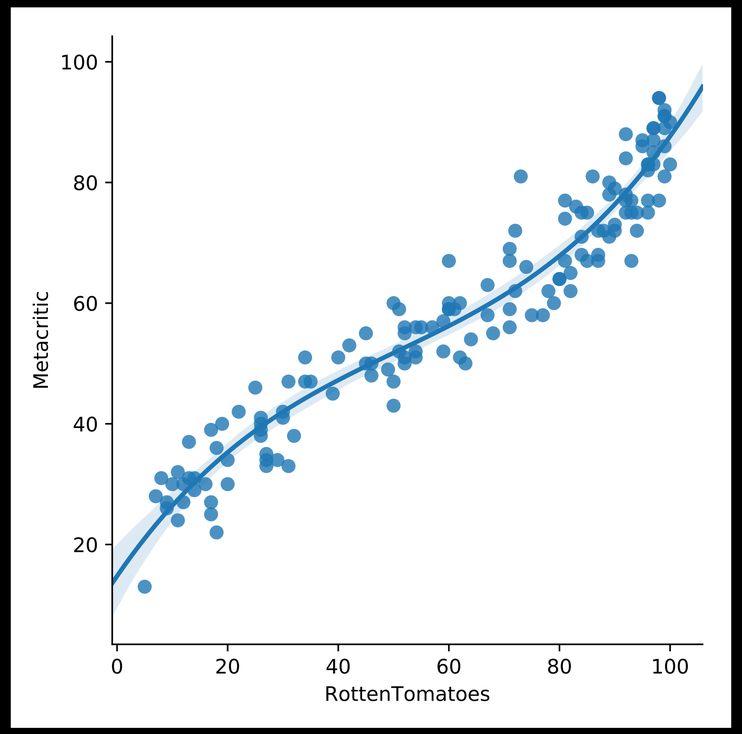
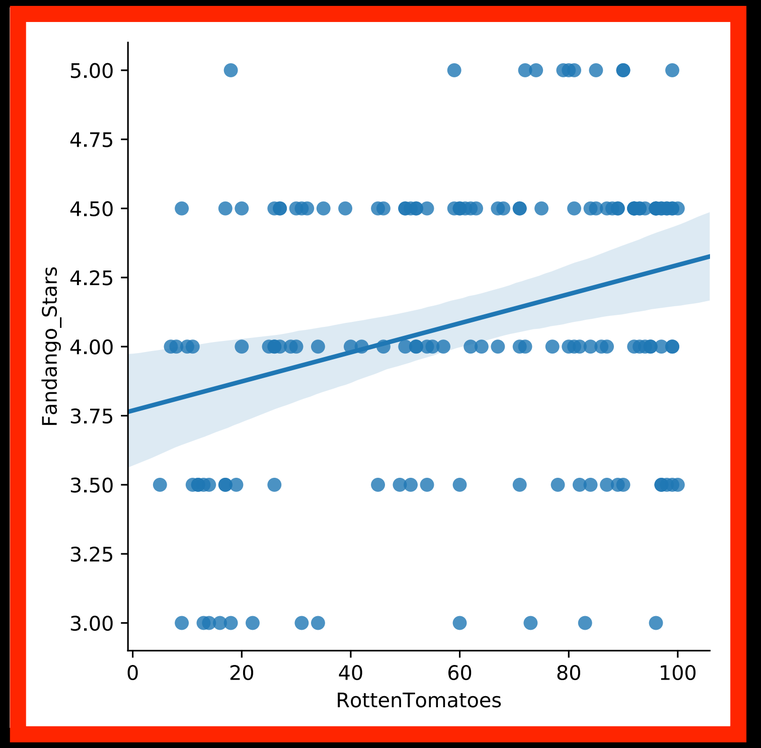




Classification



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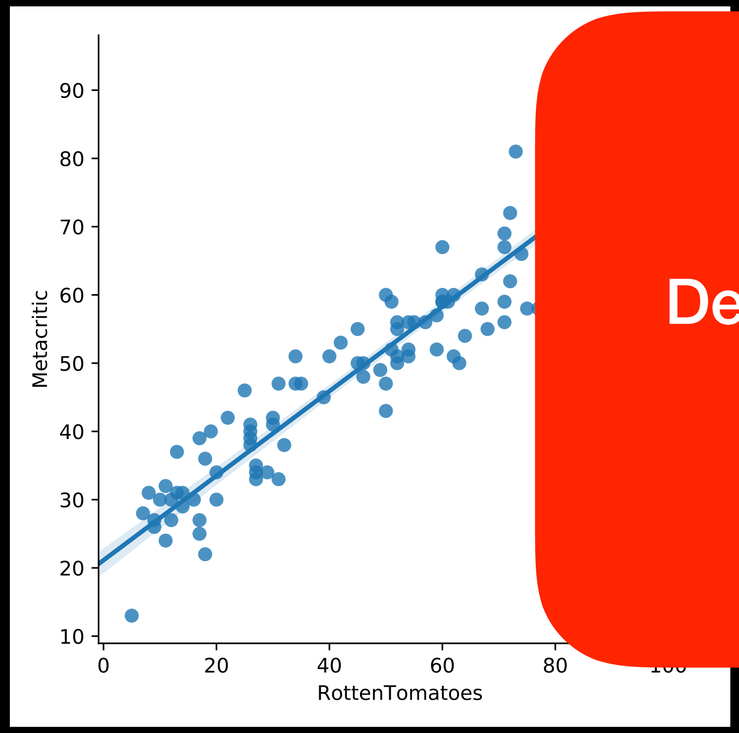
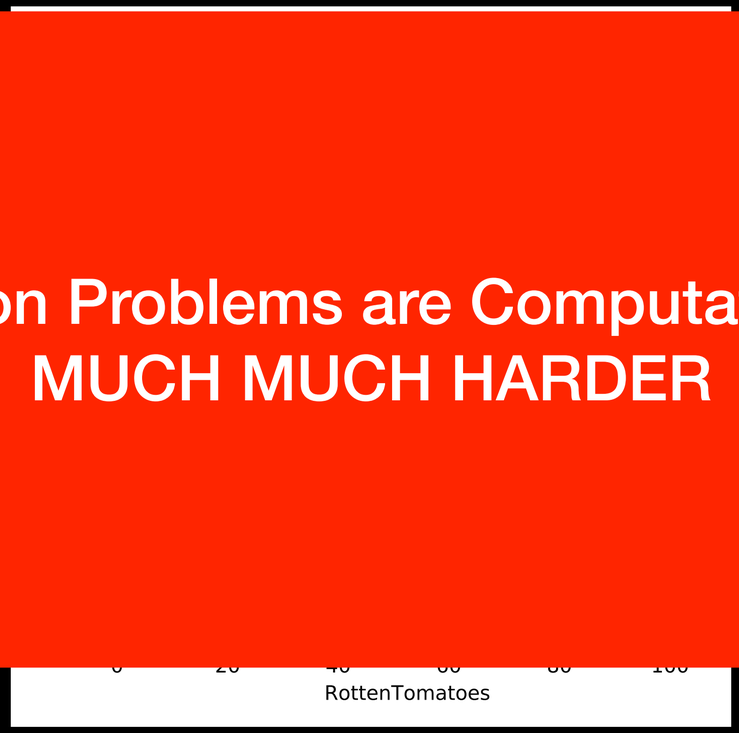
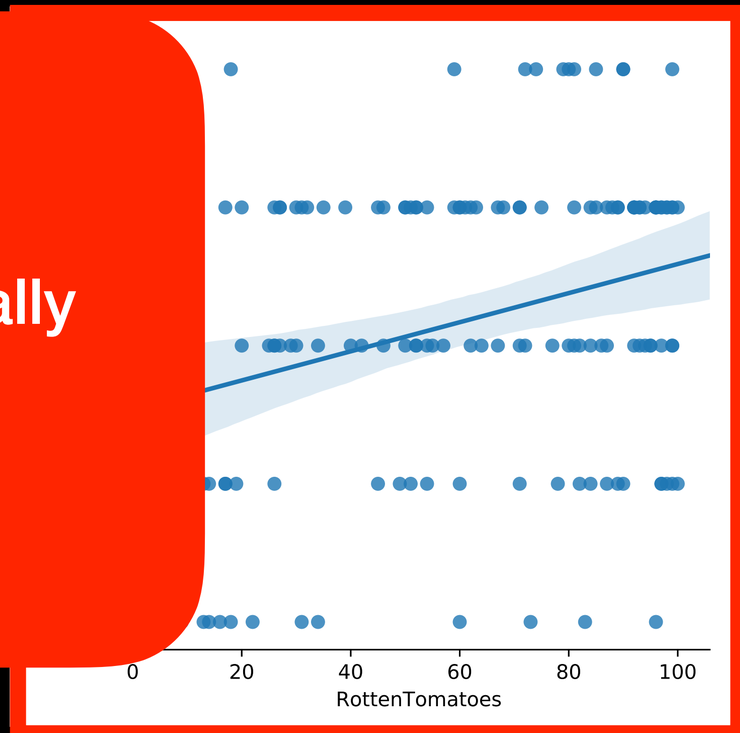


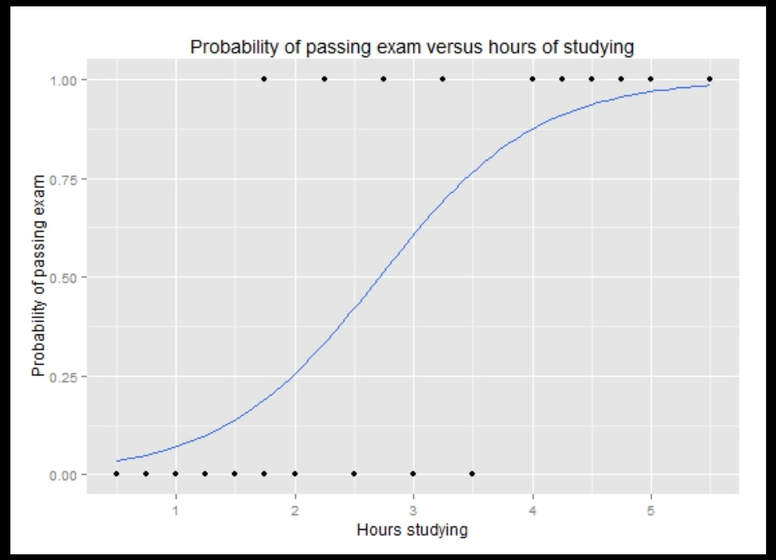


Decision Problems are Computationally
MUCH MUCH HARDER

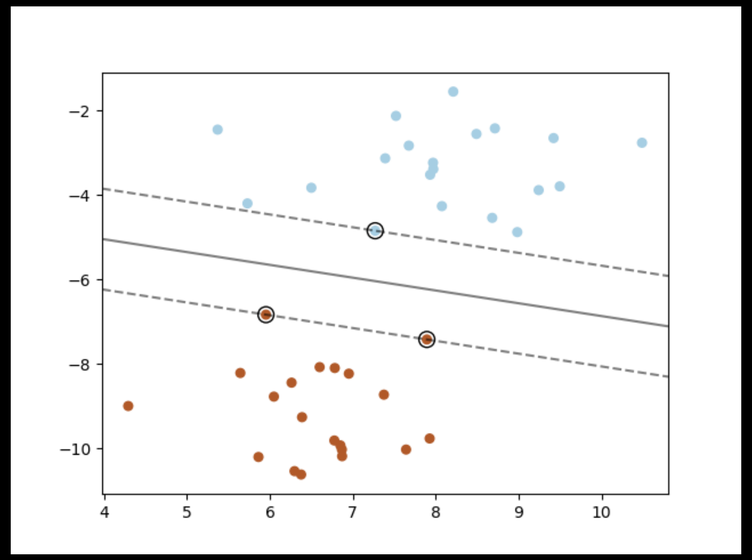
Classification



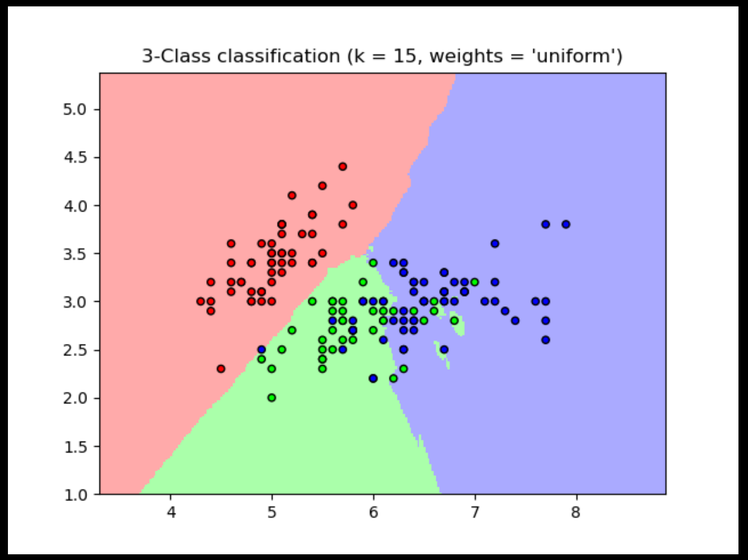
(Some) Classification Models



Logistic Regression

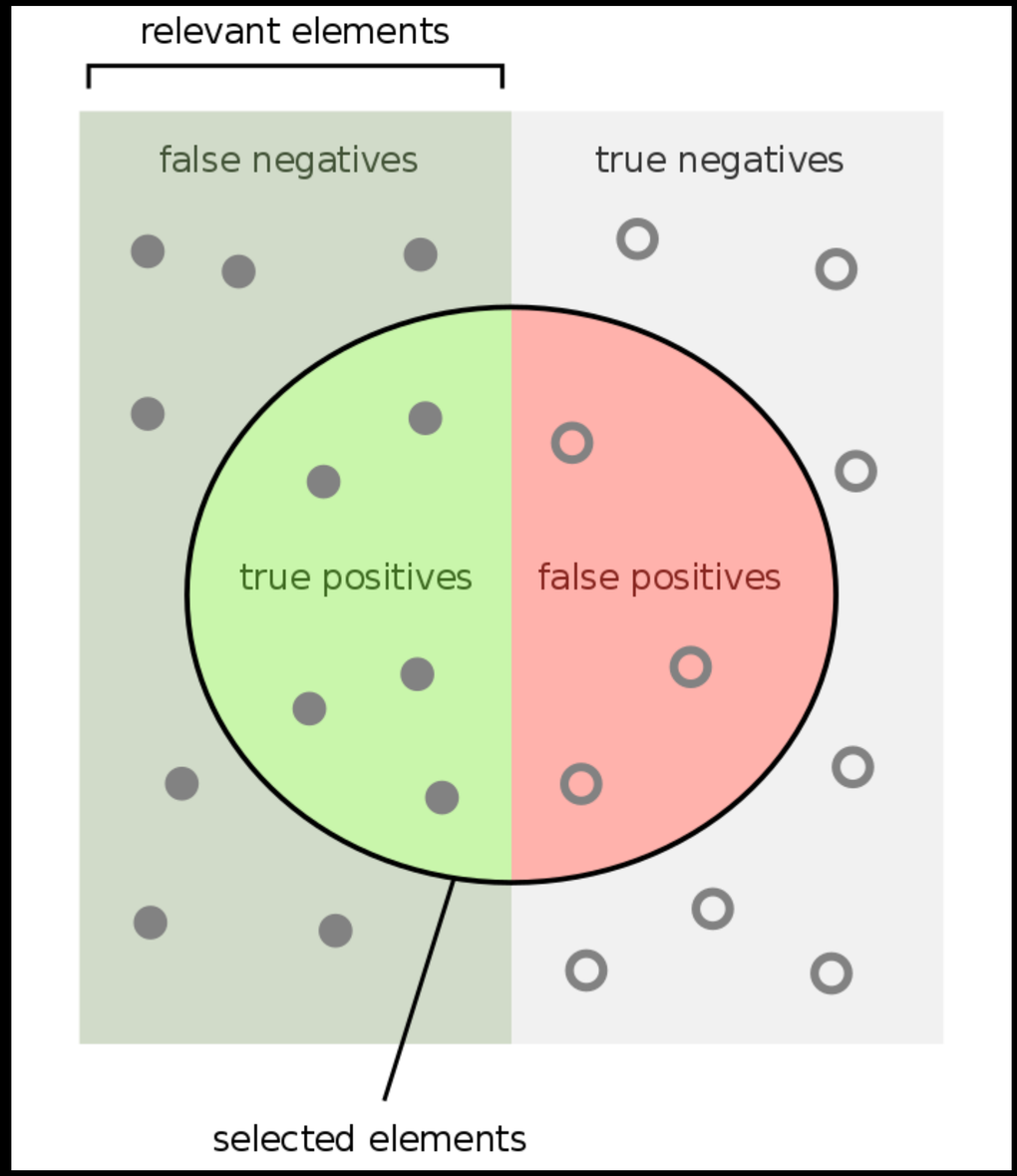


Support Vector Machines



K-Nearest Neighbor Classification

Model Selection and Validation in Classification



Source: Wikipedia

Model Validation in Classification

Precision and Recall

Precision

$$P = \frac{T_p}{T_p + F_p}$$

Recall

$$R = \frac{T_p}{T_p + F_n}$$

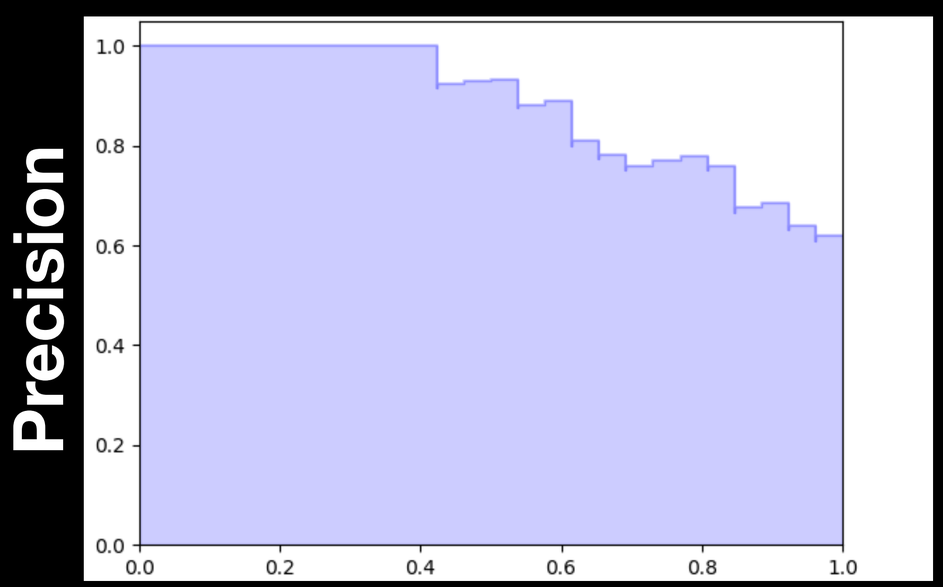
Score

$$F_1 = 2\frac{P \times R}{P + R}$$

T_p **True Positive: “I predicted survival and s/he survived”**

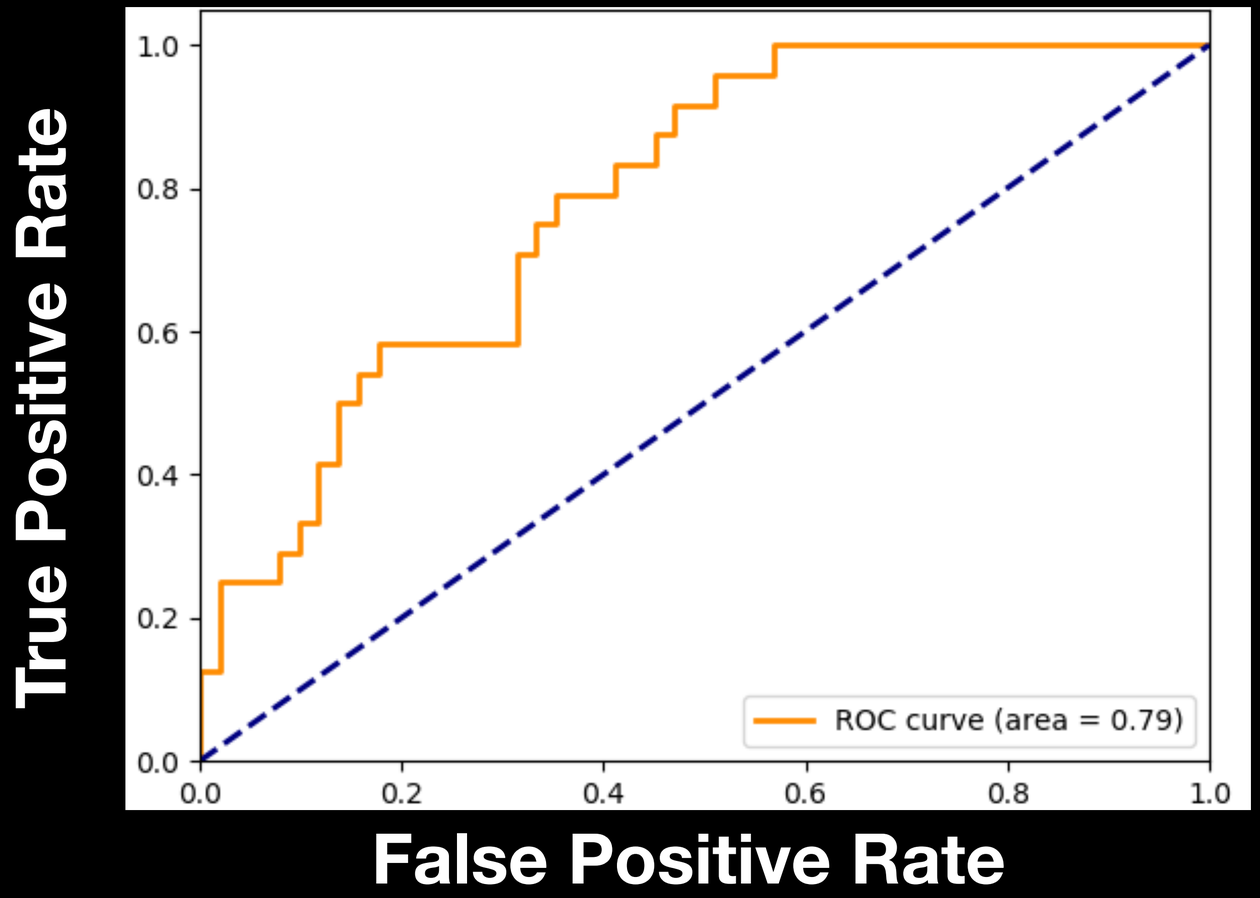
F_p **False Positive: “I predicted survival and s/he did not survived”**

F_n **False Negative: “I predicted death and s/he did survived”**



Model Validation in Classification

Receiver Operator Characteristic



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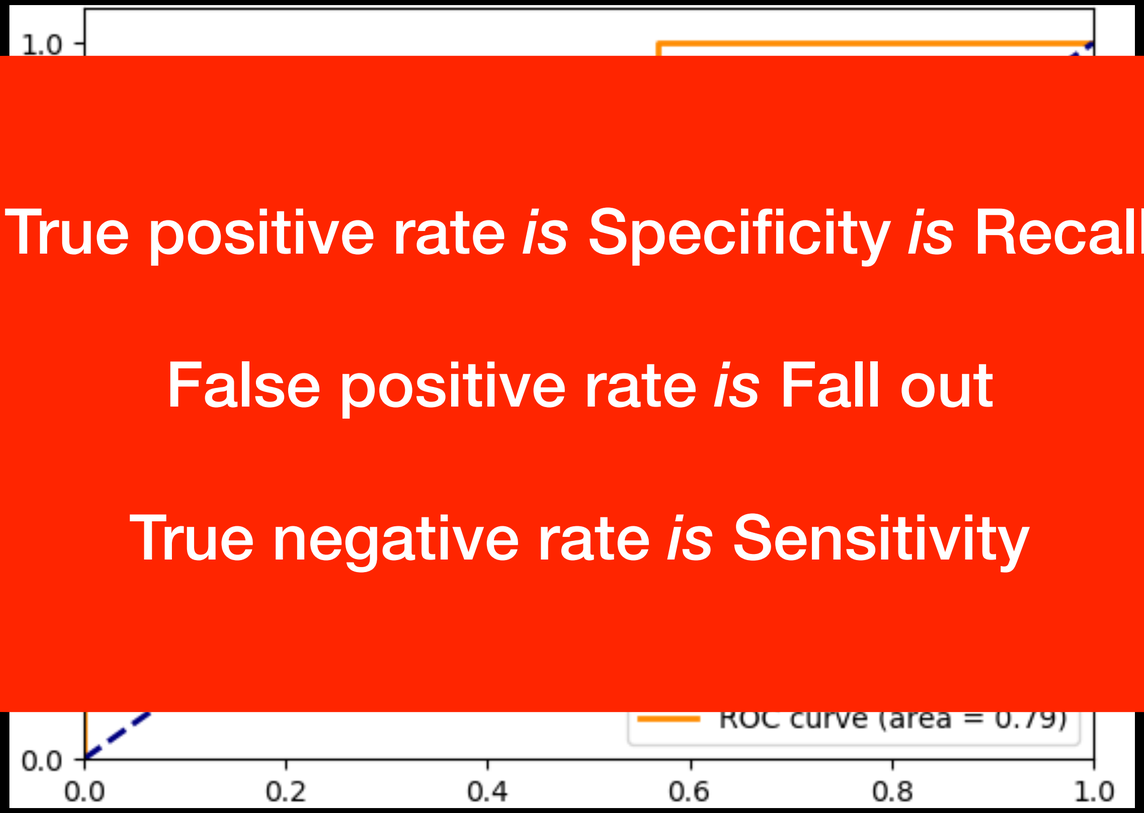

True positive rate *is* Specificity *is* Recall

False positive rate *is* Fall out

True negative rate *is* Sensitivity

False Positive Rate

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Model Validation in Classification

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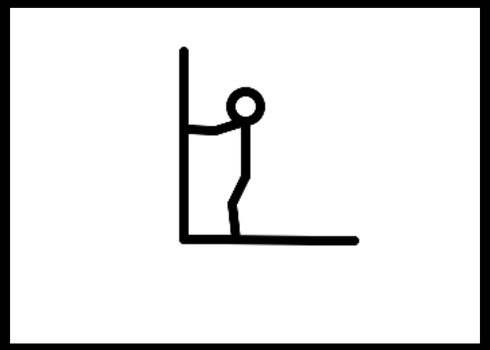

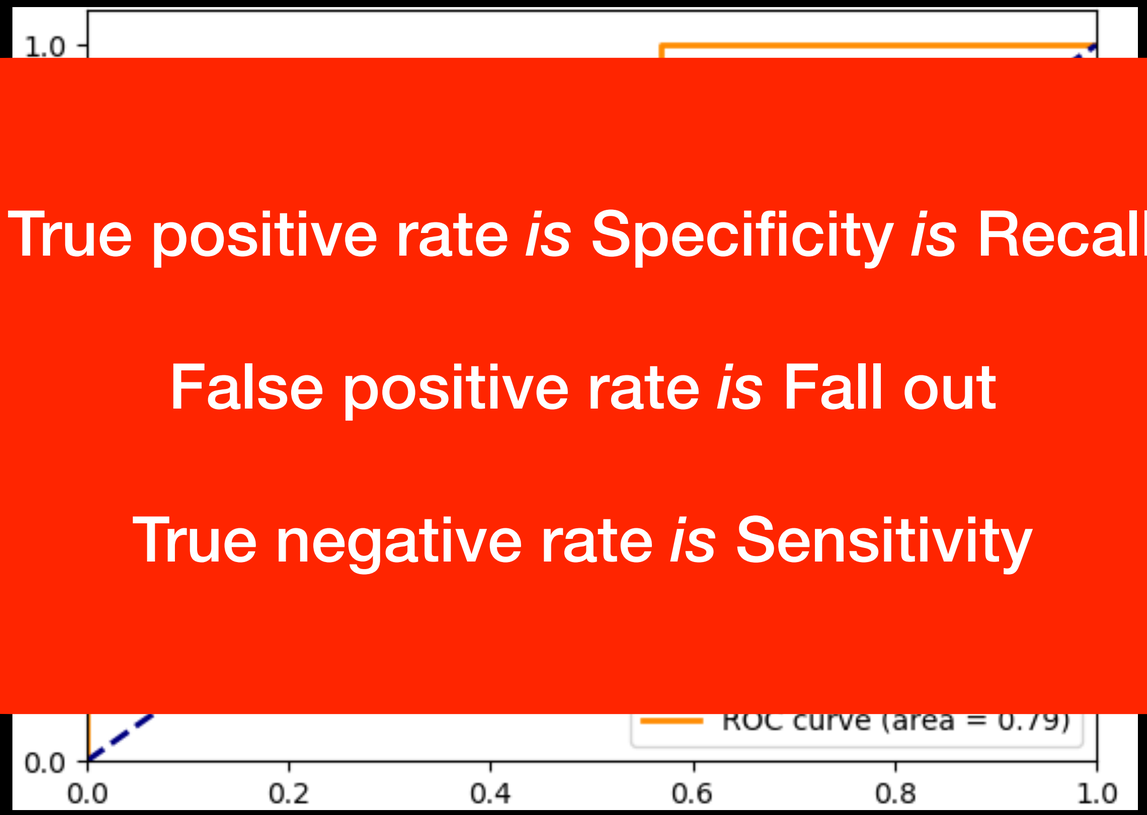

False Positive Rate

True positive rate *is* Specificity *is* Recall

False positive rate *is* Fall out

True negative rate *is* Sensitivity

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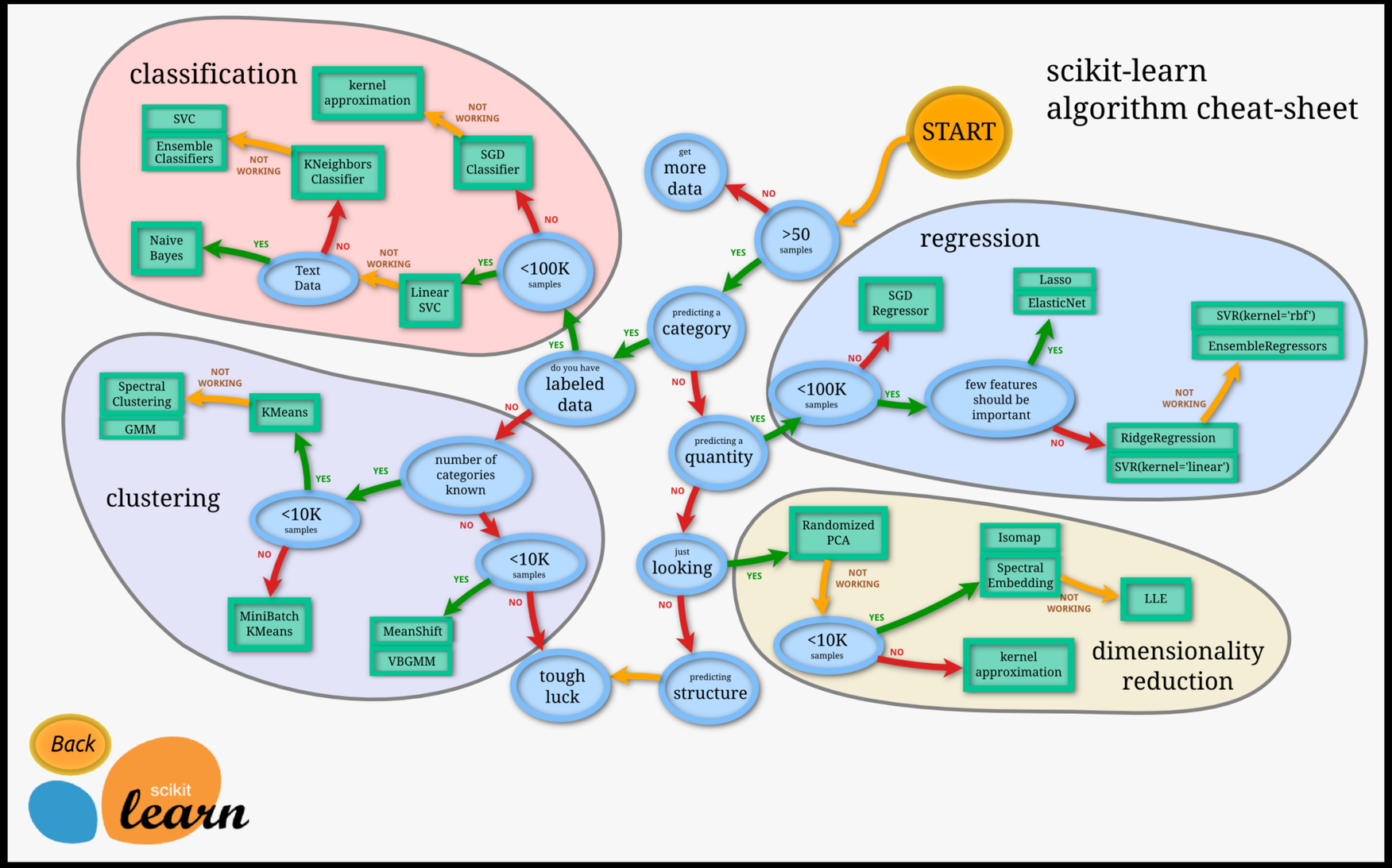

Thanks!