

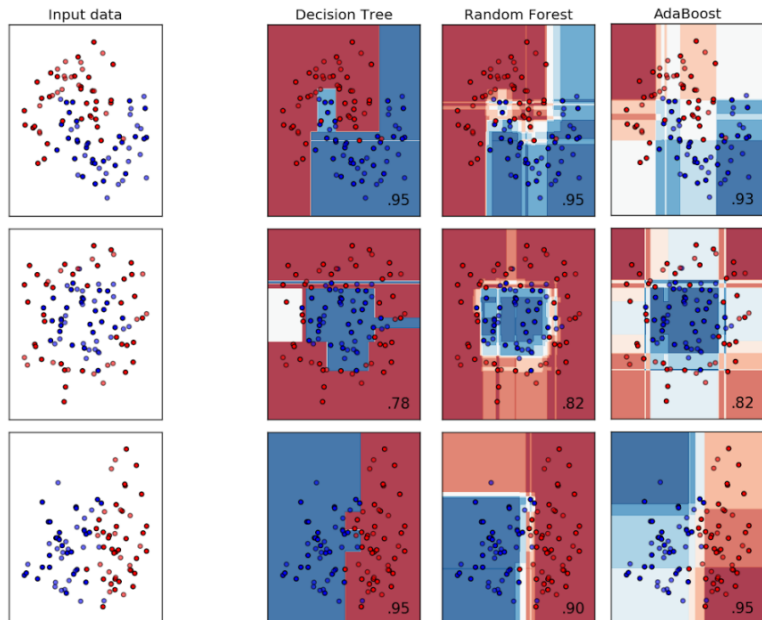
Numeric features

Numeric

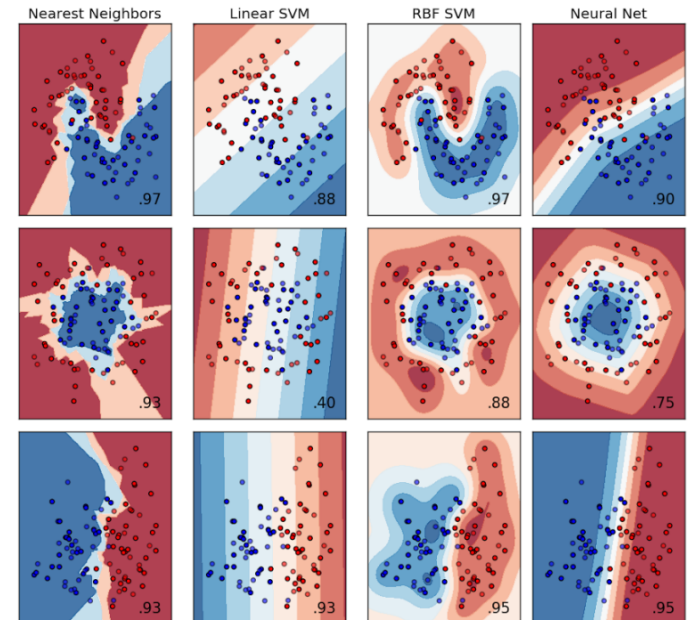
- Preprocessing
 - a) Tree-based models
 - b) Non-tree-based models
- Feature generation

Preprocessing

Tree-based models

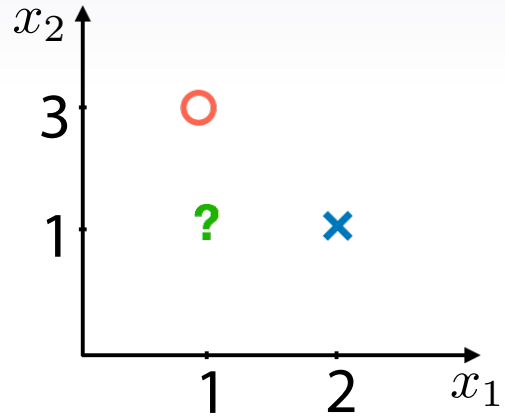


Non-tree-based models

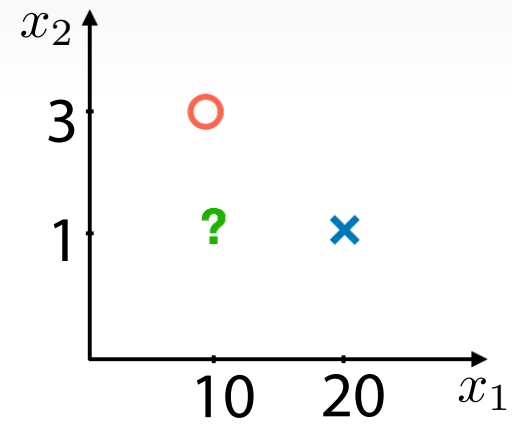
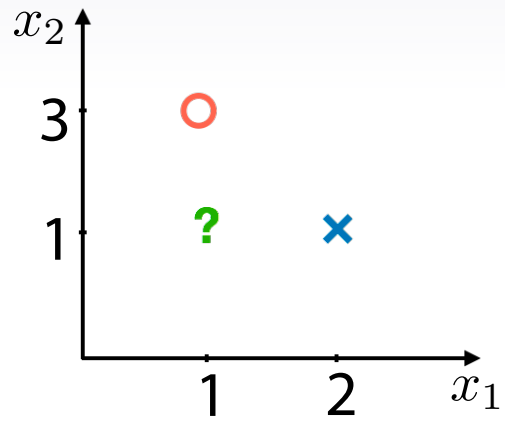


Classifier comparison¶, http://scikit-learn.org/stable/auto_examples/classification/plot_classifier_comparison.html

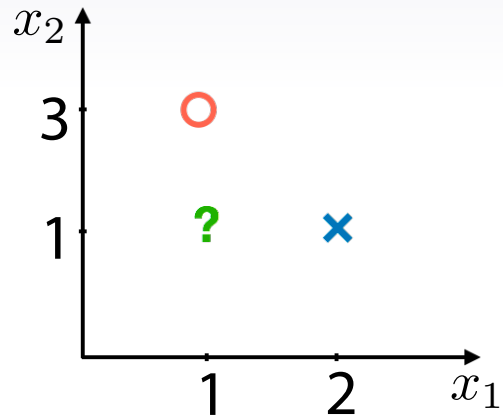
Preprocessing: scaling



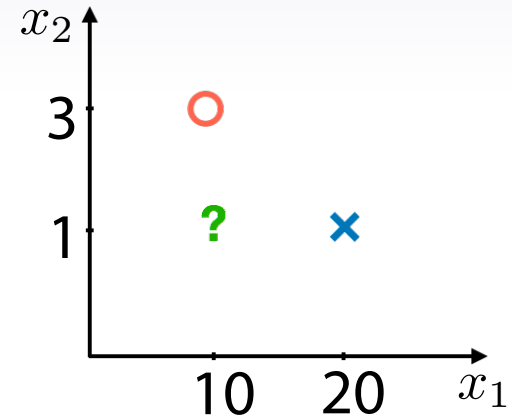
Preprocessing: scaling



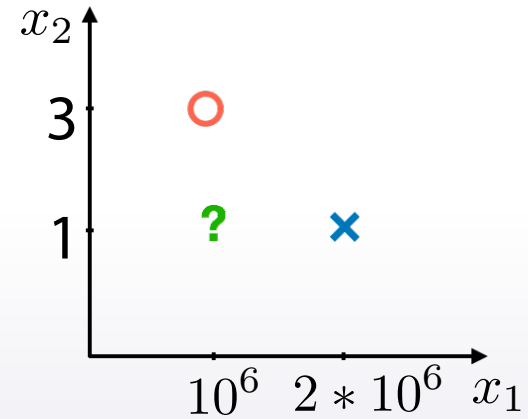
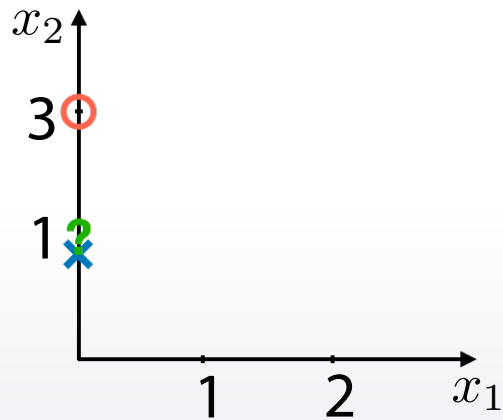
Preprocessing: scaling



$$x_1 = x_1 * 0$$



$$x_1 = x_1 * 10^6$$



Preprocessing: scaling

1. To [0,1]

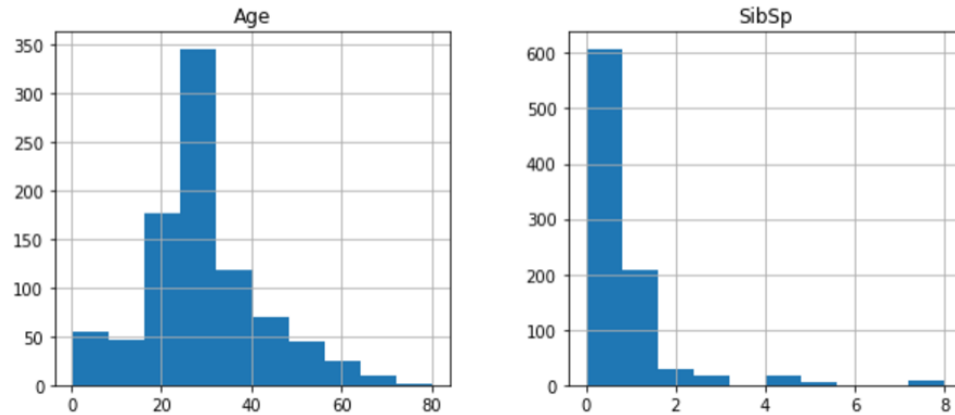
`sklearn.preprocessing.MinMaxScaler`

$$X = (X - X.min()) / (X.max() - X.min())$$

Preprocessing: scaling

$$X = (X - X.min()) / (X.max() - X.min())$$

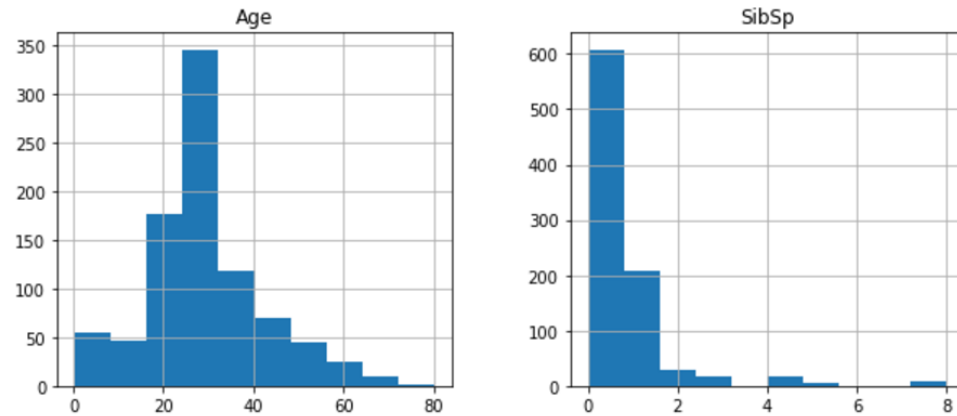
```
train[['Age', 'SibSp']].hist(figsize=(10,4));
```



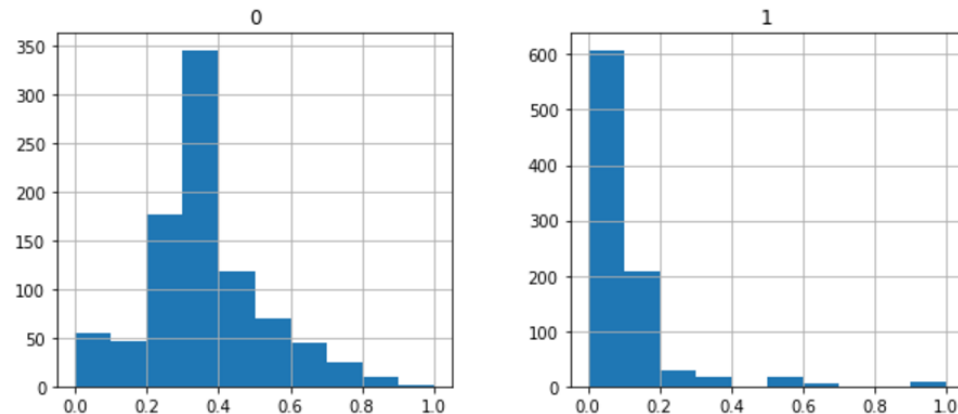
Preprocessing: scaling

$$X = (X - X.min()) / (X.max() - X.min())$$

```
train[['Age', 'SibSp']].hist(figsize=(10,4));
```



```
scaler = MinMaxScaler()  
xtrain = scaler.fit_transform(train[['Age', 'SibSp']])  
pd.DataFrame(xtrain).hist(figsize=(10,4));
```



Preprocessing: scaling

1. To [0,1]

`sklearn.preprocessing.MinMaxScaler`

$$X = (X - X.min()) / (X.max() - X.min())$$

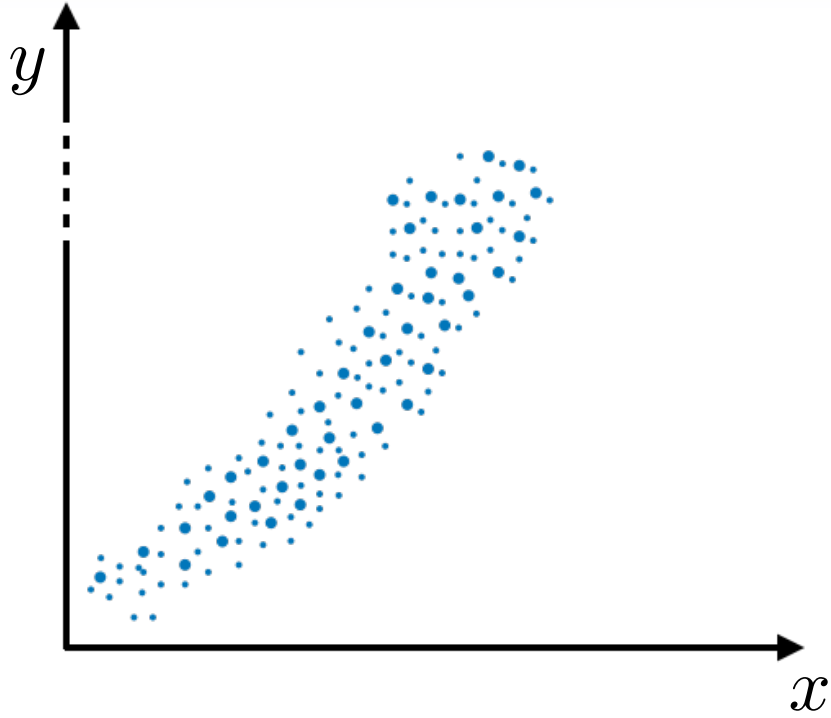
2. To mean=0, std=1

`sklearn.preprocessing.StandardScaler`

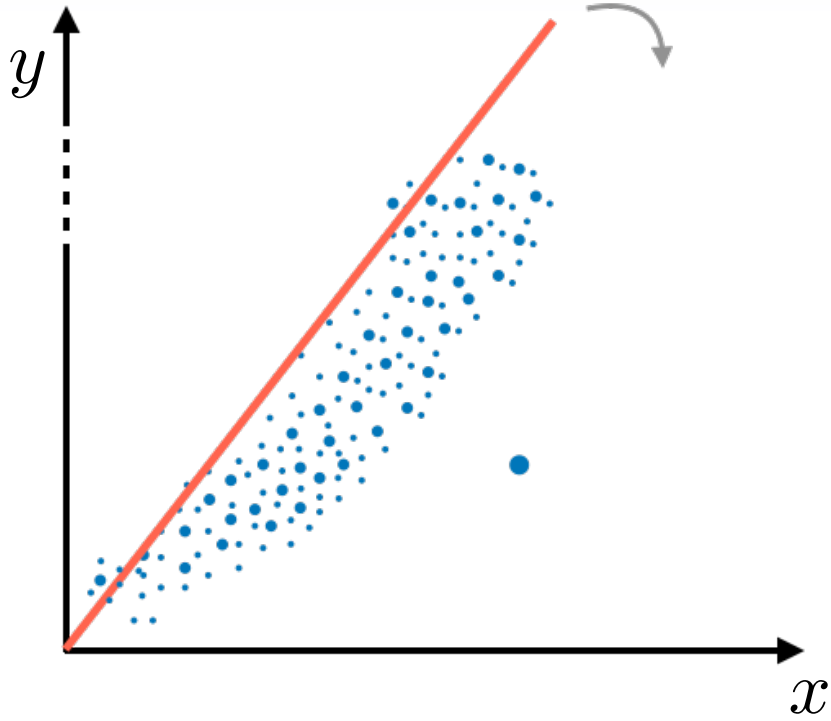
$$X = (X - X.mean()) / X.std()$$

Preprocessing: outliers

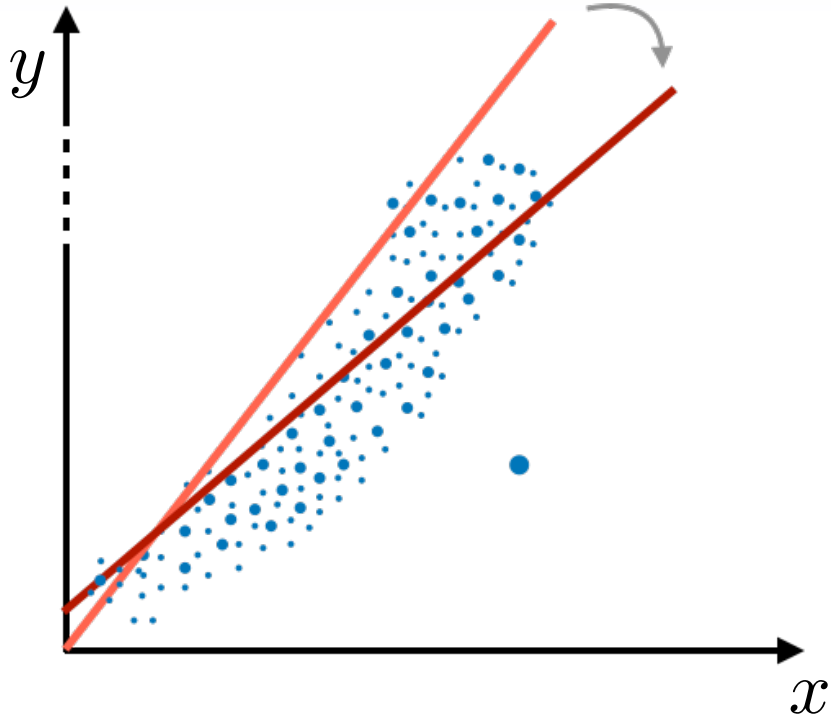
Preprocessing: outliers



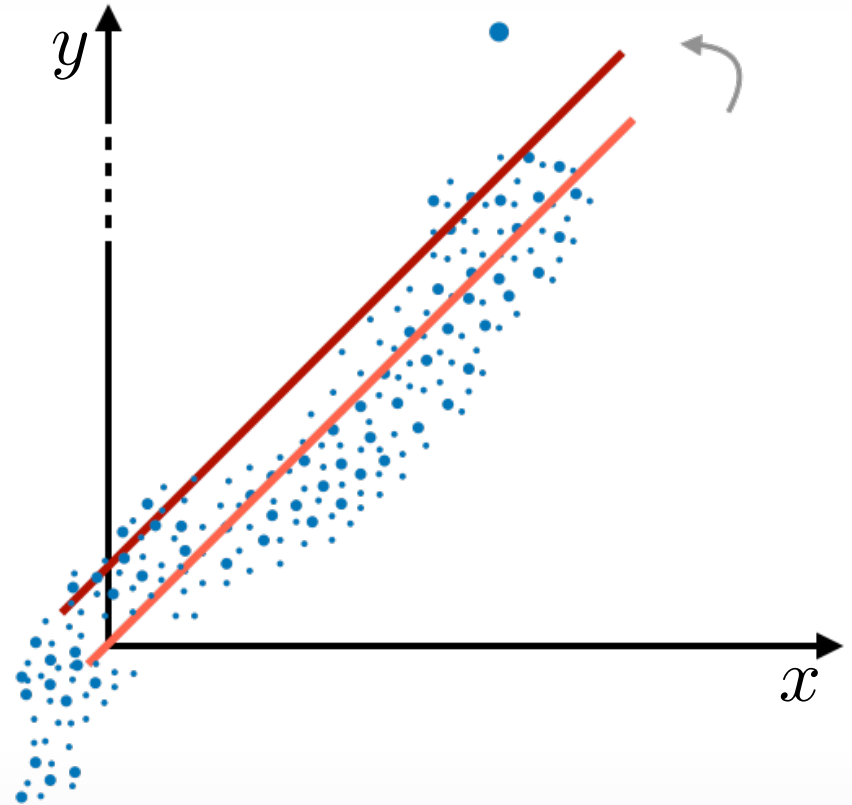
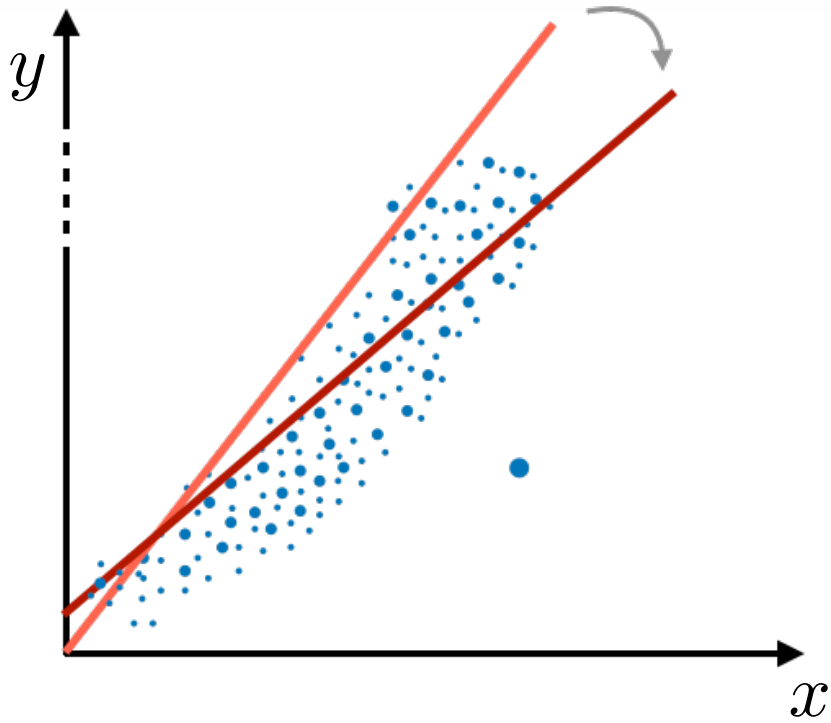
Preprocessing: outliers



Preprocessing: outliers

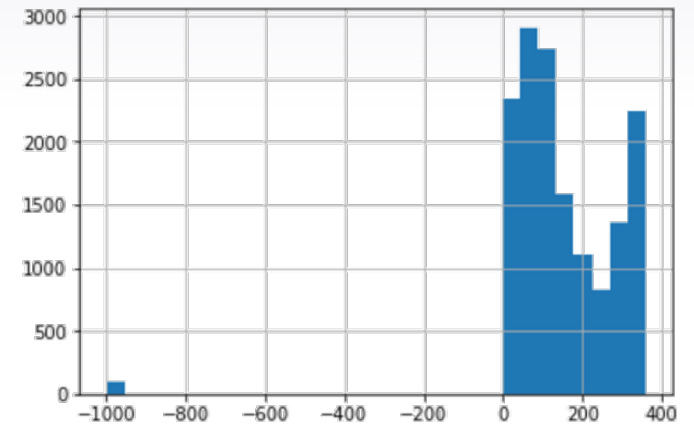
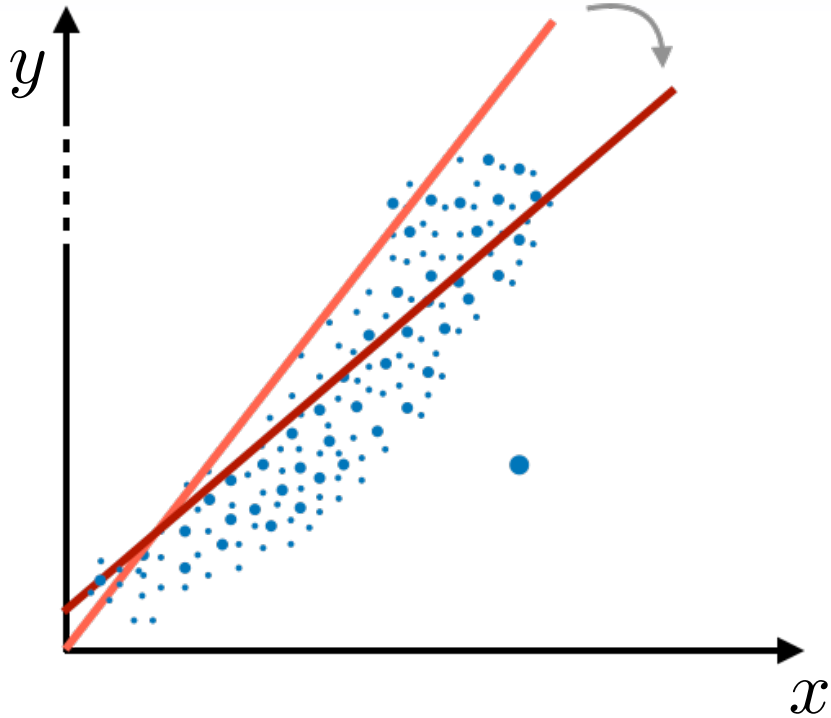


Preprocessing: outliers

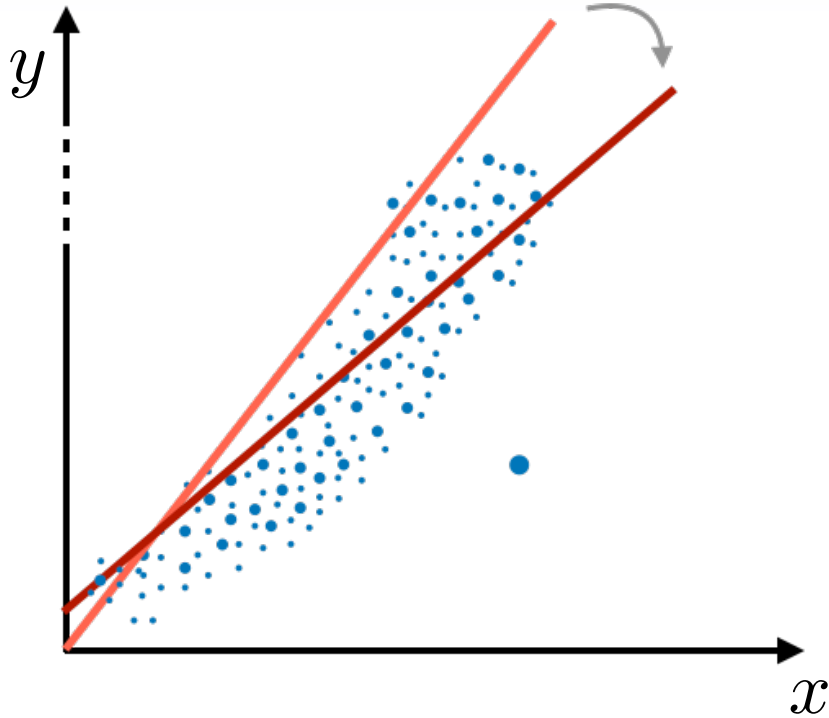


Preprocessing: outliers

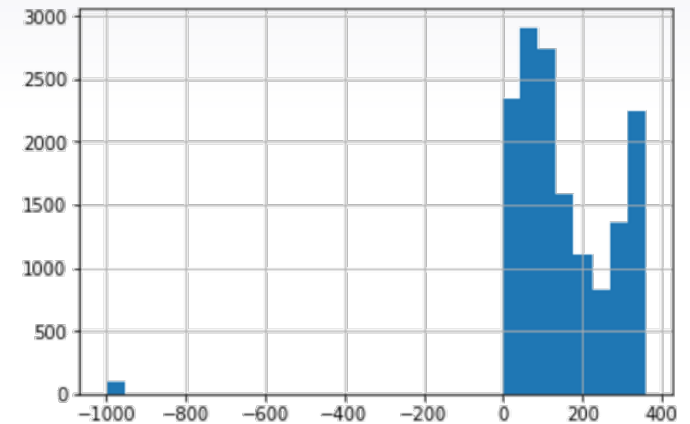
```
In [17]: pd.Series(x).hist(bins=30) ;
```



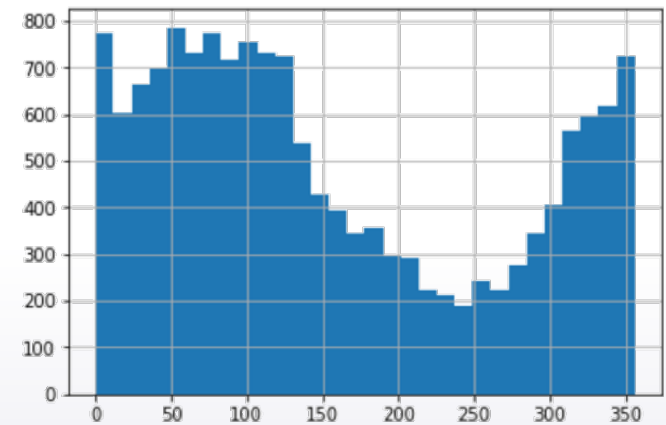
Preprocessing: outliers



```
In [17]: pd.Series(x).hist(bins=30) ;
```



```
In [18]: UPPERBOUND, LOWERBOUND = np.percentile(x, [1, 99])  
y = np.clip(x, UPPERBOUND, LOWERBOUND)  
pd.Series(y).hist(bins=30) ;
```



Preprocessing: rank

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- `rank([-100, 0, 1e5]) == [0, 1, 2]`
- `rank([1000, 1, 10]) = [2, 0, 1]`

Preprocessing: rank

- `rank([-100, 0, 1e5]) == [0, 1, 2]`
- `rank([1000, 1, 10]) = [2, 0, 1]`

`scipy.stats.rankdata`

Preprocessing

1. Log transform:

`np.log(1 + x)`

2. Raising to the power < 1 :

`np.sqrt(x + 2/3)`

Feature generation

Ways to proceed:

- prior knowledge
- EDA

Feature generation

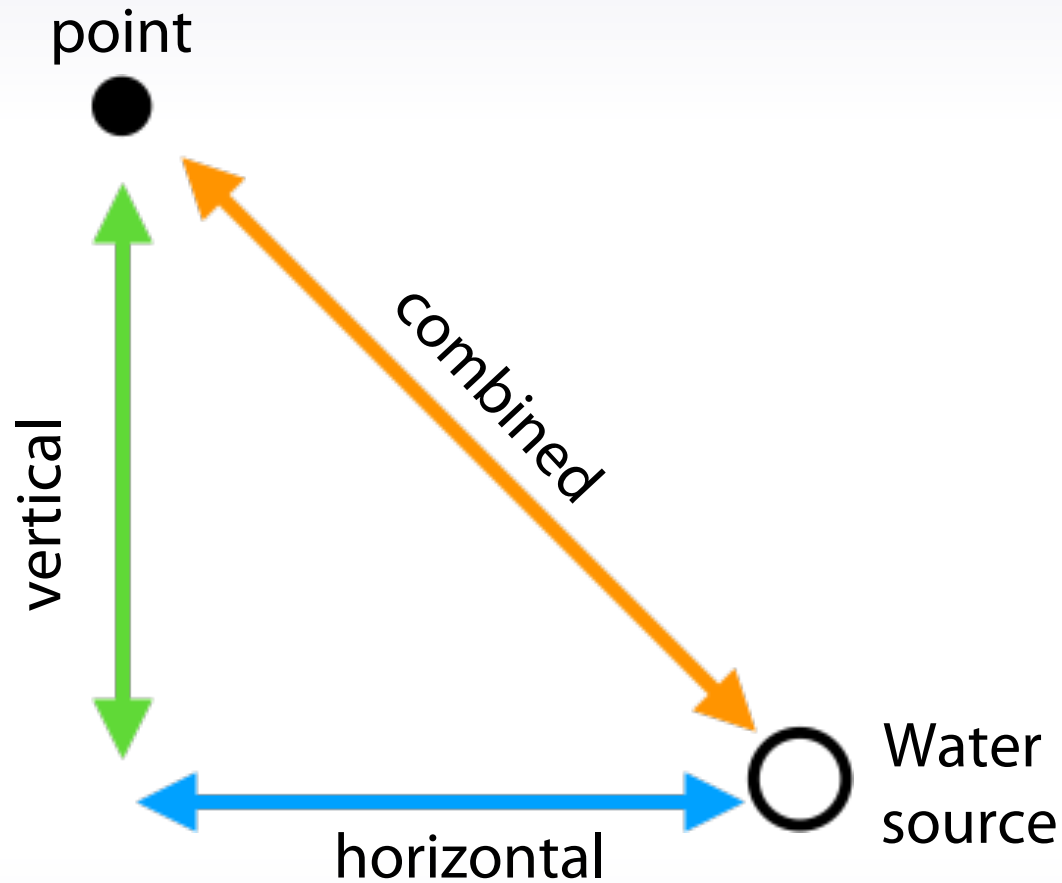


Squared area: 55 m²

Price: 107000 \$

Price for 1m²: 107000 \$ / 55 m²

Feature generation



$$\text{Combined} = (\text{horizontal}^2 + \text{vertical}^2)^{0.5}$$

Feature generation

price	fractional_part
0.99	0.99
2.49	0.49
1.0	0.0
9.99	0.99

Conclusion

1. Numeric feature preprocessing is different for tree and non-tree models:
 - a. Tree-based models doesn't depend on scaling
 - b. Non-tree-based models hugely depend on scaling

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2. Most often used preprocessings are:
 - a. MinMaxScaler - to $[0,1]$
 - b. StandardScaler - to $\text{mean}=0, \text{std}=1$
 - c. Rank - sets spaces between sorted values to be equal
 - d. $\text{np.log}(1+x)$ and $\text{np.sqrt}(1+x)$

Conclusion

1. Scaling and Rank for numeric features:
 - a. Tree-based models doesn't depend on them
 - b. Non-tree-based models hugely depend on them
2. Most often used preprocessings are:
 - a. MinMaxScaler - to $[0,1]$
 - b. StandardScaler - to $\text{mean}=0$, $\text{std}=1$
 - c. Rank - sets spaces between sorted values to be equal
 - d. $\text{np.log}(1+x)$ and $\text{np.sqrt}(1+x)$
3. Feature generation is powered by:
 - a. Prior knowledge
 - b. Exploratory data analysis