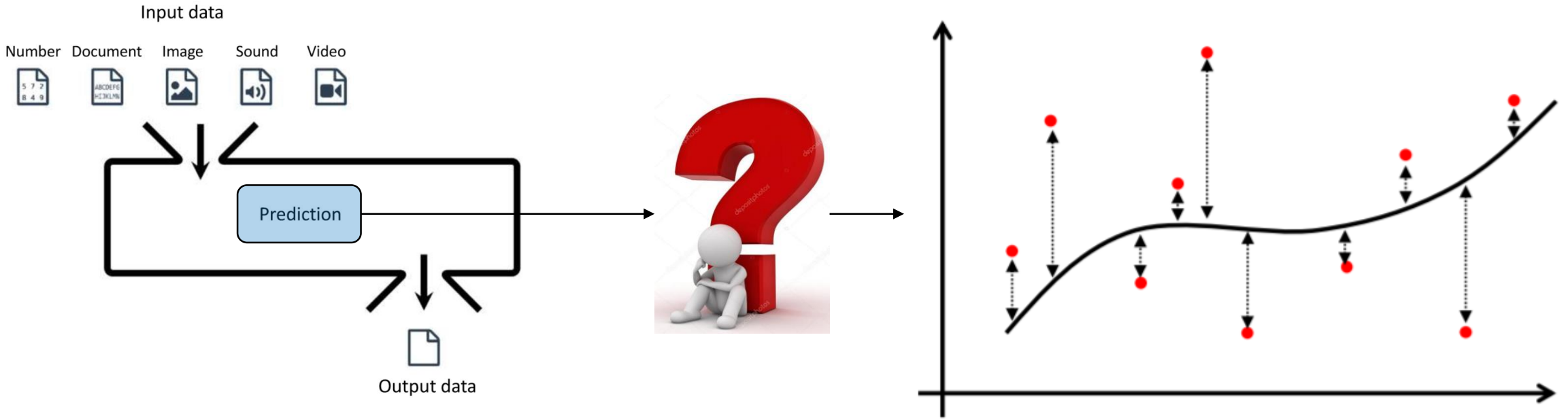
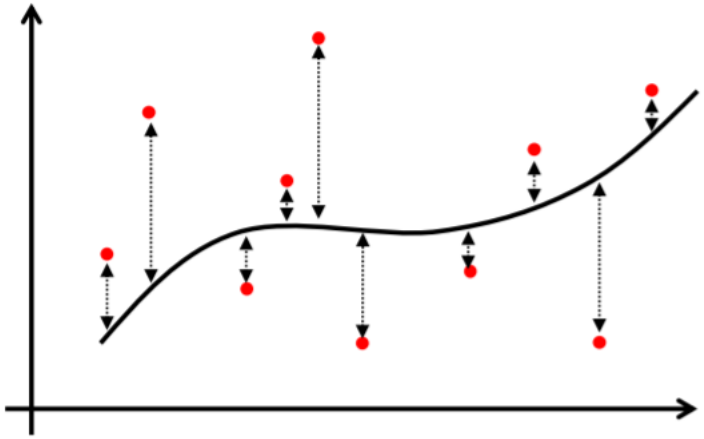

Input data
Number
Document
Image
Sound
Video
Prediction
Output data



- K-Means Clustering
- k-Nearest Neighbors
- Support Vector Machine
- Naive Bayes Classifier
- Hidden Markov Model
- Deep Learning

$f(\mathbf{x}; w_1, w_2, \ldots, w_m)$

LOOP

X	Y
X_1	Y_1
X_2	Y_2
X_3	Y_3
…	…
…	…
X_{n-2}	Y_{n-2}
X_{n-1}	Y_{n-1}
X_n	Y_n

X	f(X)	Y
X_1	$f(X_1)$	Y_1
X_2	$f(X_2)$	Y_2
X_3	$f(X_3)$	Y_3
…	…	…
…	…	…
X_{n-2}	$f(X_{n-2})$	Y_{n-2}
X_{n-1}	$f(X_{n-1})$	Y_{n-1}
X_n	$f(X_n)$	Y_n

X	Y	Loss
X_1	Y_1	$Y_1 - f(X_1)$
X_2	Y_2	$Y_2 - f(X_2)$
X_3	Y_3	$Y_3 - f(X_3)$
…	…	
…	…	
X_{n-2}	Y_{n-2}	$Y_{n-2} - f(X_{n-2})$
X_{n-1}	Y_{n-1}	$Y_{n-1} - f(X_{n-1})$
X_n	Y_n	$Y_n - f(X_n)$

Update Rule

$f(\mathbf{x}; w_1, w_2, \ldots, w_m)$

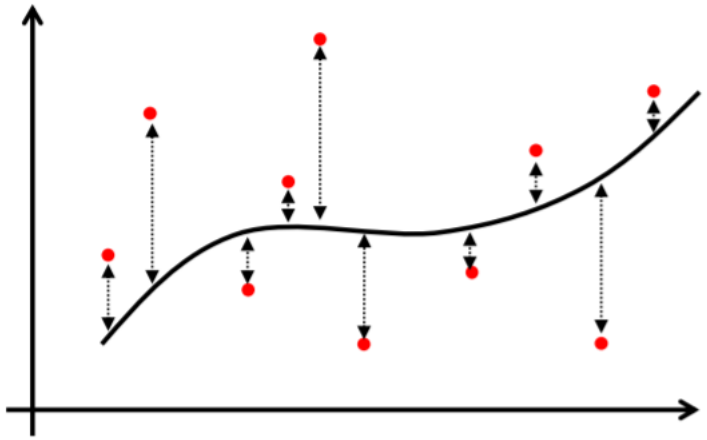
LOOP

X	f(X)	Y
X_1	$f(X_1)$	Y_1
X_2	$f(X_2)$	Y_2
X_3	$f(X_3)$	Y_3
…	…	…
…	…	…
X_{n-2}	$f(X_{n-2})$	Y_{n-2}
X_{n-1}	$f(X_{n-1})$	Y_{n-1}
X_n	$f(X_n)$	Y_n

X	Y	Loss
X_1	Y_1	$Y_1 - f(X_1)$
X_2	Y_2	$Y_2 - f(X_2)$
X_3	Y_3	$Y_3 - f(X_3)$
…	…	
…	…	
X_{n-2}	Y_{n-2}	$Y_{n-2} - f(X_{n-2})$
X_{n-1}	Y_{n-1}	$Y_{n-1} - f(X_{n-1})$
X_n	Y_n	$Y_n - f(X_n)$

```
x_train = torch.FloatTensor([[1],[2],[3]])
y_train = torch.FloatTensor([[2],[4],[6]])

W = torch.zeros(1, requires_grad=True)
b = torch.zeros(1, requires_grad=True)

model = lambda x: W*x + b
criterion = lambda y,t : torch.mean((y - t)**2)
optimizer = optim.SGD([W,b], lr=0.01)

epochs = 2000
for epoch in range(epochs+1):
        hypothesis = model(x_train)
        cost = criterion(hypothesis, y_train)

        optimizer.zero_grad()
        cost.backward()
        optimizer.step()
```

Classification, Regression?



X	Y
X_1	Y_1
X_2	Y_2
X_3	Y_3
…	…
…	…
X_{n-2}	Y_{n-2}
X_{n-1}	Y_{n-1}
X_n	Y_n

- **Binary class classification**
- **Multi class classification**
- **Multi label classification**