

# Lecture 16:

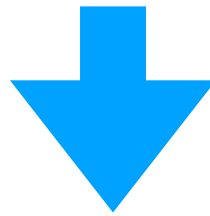
# Classification

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## Multi-class logistic regression

# Recognizing hand-written digits

inputs  $x =$



labels  $y =$

0                      1                      2                      3                      ...

# Multi-class logistic regression model

$K$  different labels,  $1, 2, \dots, K$

$$p(y=k | \underline{x}, \underline{w}) = \frac{\exp \left\{ \sum_{j=1}^M \underline{w}_{jk} \phi_j(\underline{x}) \right\}}{\sum_{k'=1}^K \exp \left\{ \sum_{j=1}^M \underline{w}_{jk'} \phi_j(\underline{x}) \right\}}$$

(softmax transformation)

$$\underline{w} = (\underline{w}_1, \dots, \underline{w}_K)$$

# Results

Prediction: 8



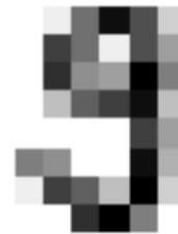
Prediction: 8



Prediction: 4



Prediction: 8



# Results

Confusion Matrix

