CS540 Introduction to Artificial Intelligence
Lecture 1

Young Wu
Based on lecture slides by Jerry Zhu, Yingyu Liang, and Charles Dyer

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Socrative

Admin

- Download the Socrative App or go to the Socrative website.
- Use Room CS540 log in with wisc ID.
- Choose "B" for the first question Q1.

Zoom Login Test

Admin

- Change your Zoom name to your favorite animal or plant (add a random number at the end to avoid repetition, for example "Cat88" or "Dog31").
- Send a public message in chat.
- Send a private message to someone who used the same name.

Remind Me to Start Recording

Admin

Grading

Admin

- Quizzes: best 20 of 24, daily, 0 or 0.5 points each.
- Math homework: best 10 of $10 + 2$, weekly, 0 or 1 point each.
- Programming homework: best 5 of $5 + 1$, weekly, 8 points each.
- Exams: one midterm and one final, 30 or 25 or 20 points each.

Quizzes

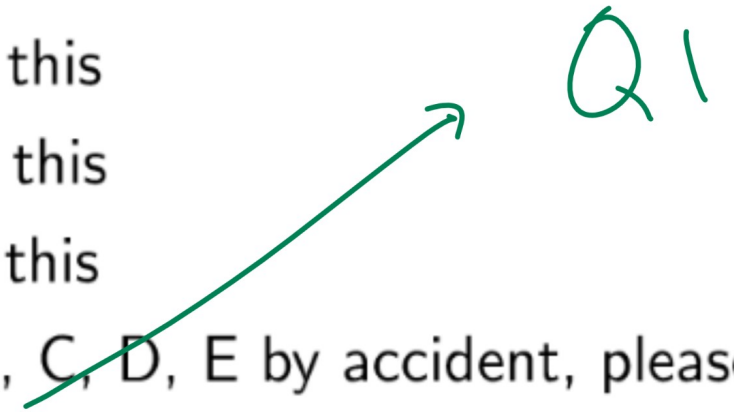
Admin

- Download Socrative, the room number is CS540.
- Default login for Socrative is your wisc email ID.
- If someone else tries to hack your account, please email or private post on Piazza.
- Quiz questions can show up any time during the lecture.
- Missing one or two questions due to technical difficulty is okay.
- If you select obviously false answers, you will lose points.

Socrative Test Multiple Choice

Quiz

- A: Don't choose this
- B: Choose this
- C: Don't choose this
- D: Don't choose this
- E: Don't choose this
- If you selected A, C, D, E by accident, please keep a note of the question name and the correct answer.



Socrative Test Short Answer

Quiz

- Enter a random integer between 0 and 9.

Math Homework

Admin

- Please do not start before I announce it on Canvas and Piazza.
- Officially: due in 1 week Sunday.
- Unofficially: any time before the midterm or the final.
- Solution: please volunteer to share your answers on Piazza.
- Auto-graded: unlimited number of times, I will not see your submission as long as you do not click the "Submit" button.

Programming Homework

Admin

- Please do not start before I announce it on Canvas and Piazza.
- Officially: due in 2 weeks Sunday.
- Unofficially: any time before the final.
- Solution: posted in 1 week Sunday.
- Auto-graded: use the "Submit" button AND submit the output and code on Canvas.
- Code: any language, Java and Python are recommended, MATLAB, R, JavaScript okay too.

Favorite Programming Language

Quiz

- What is your favorite programming language?
- A: Yes
- B: Java
- C: Python
- D: Other
- E: None

Programming Language

Quiz

A2

- Which programming language are you planning to use for the assignments?

Office Hours

Admin

- Daily 2 to 3, weekdays on Zoom, weekends in person, for Math and Java Programming help.
- TA: Tuesday 3 to 5 in person, Thursday 3 to 5 on Zoom, for Math and Python Programming help.

Midterm and Final

Admin

- Synchronous exams: two parts, 12 : 30 PM and 12 : 30 AM versions, choose any two to take.
- 30 Questions: $\sim$ 10 from homework, $\sim$ 10 from homework or quizzes, $\sim$ 10 new.

Questions

Admin

- Questions?
- Use public chat or just interrupt me if you have questions.
- I am not reading private chat, Piazza, and email messages during the lectures.

Is This Face Real

Quiz

Q3

- Which face is real?
- A: Left
- B: Do not choose this
- C: Do not choose this
- D: Do not choose this
- E: Right

Generative Adversarial Network

Motivation

- Generative Adversarial Network (GAN):

1. Generative part: input random noise and output fake images.
2. Discriminative part: input real and fake images and output labels real or fake.
3. The two parts compete with each other.

Supervised Learning Example 1

Motivation

Data	images of cats and dogs
Features (Input)	height, length, eye color, ...
-	pixel intensity
Output	cat or dog

Supervised Learning

Motivation

- Supervised learning:

Data	Features (Input)	Output	-
Sample	$\{(x_{i1}, \ldots, x_{im})\}_{i=1}^{n}$	$\{y_i\}_{i=1}^{n}$	find "best" $\hat{f}$
-	observable	known	-
New	$(x'_1, \ldots, x'_m)$	y'	guess $\hat{y} = \hat{f}(x')$
-	observable	unknown	-

Linear Classifier

Motivation

- One possible guess is in the form of a linear classifier.

$$\hat{y} = \mathbb{1}_{\{w_1 x_1 + w_2 x_2 + \ldots + w_m x_m + b \geqslant 0\}}$$
$$= \mathbb{1}_{\{w^T x + b \geqslant 0\}}$$

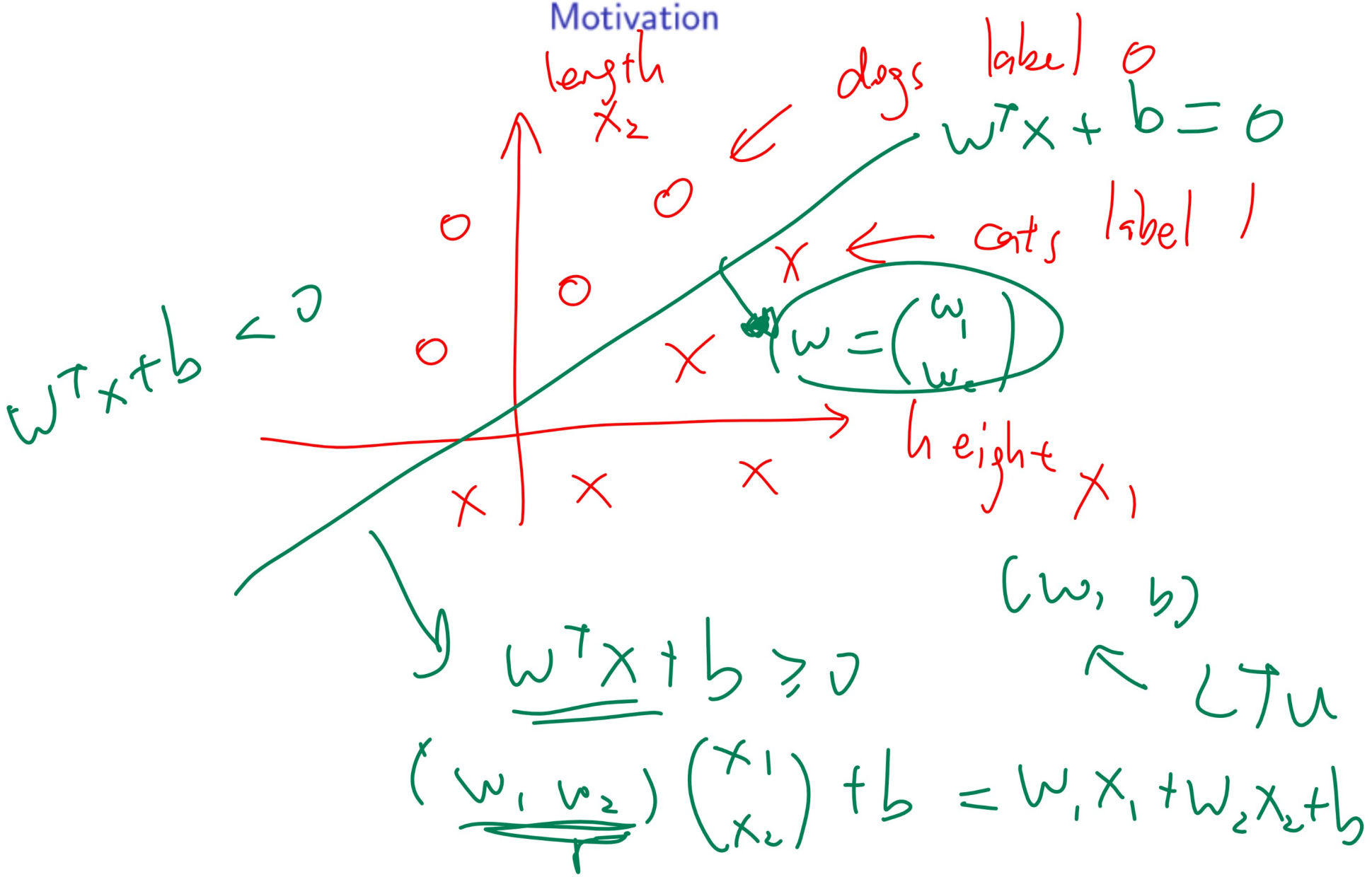
weights, bias, ≥ 0 → cat, < 0 → dog

- The $\mathbb{1}$ (open number 1) is the indicator function.

$$\mathbb{1}_E = \begin{cases} 1 & \text{if } E \text{ is true} \\ 0 & \text{if } E \text{ is false} \end{cases} \quad (1)$$

Brute Force LTU Learning

Motivation



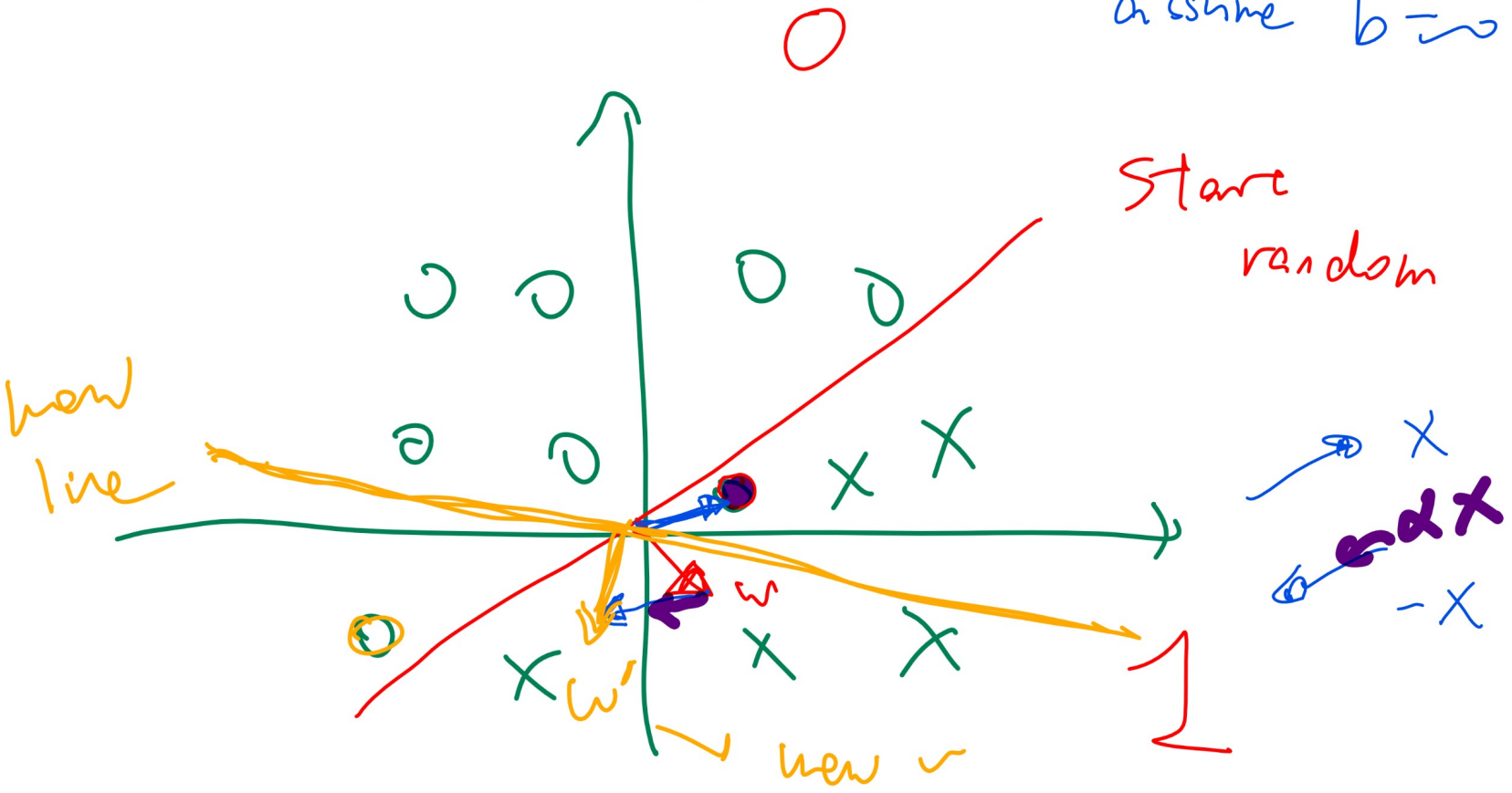
Perceptron Algorithm

Description

- Initialize random weights.
- Evaluate the activation function at one instance x_i to get $\hat{y}_i$.
- If the prediction $\hat{y}_i$ is 0 and actual y_i is 1, increase the weights by x_i.
- If the prediction $\hat{y}_i$ is 1 and actual y_i is 0, decrease the weights by x_i.
- Repeat for all data points and until convergent.

Perceptron Algorithm Diagram, 0 Example

Description



Perceptron Algorithm

Definition

- Update weights using the following rule.

$$w = w - \alpha (a_i - y_i) x_i$$
$$b = b - \alpha (a_i - y_i)$$
$$a_i = \mathbb{1}_{\{w^T x_i + b \geq 0\}}$$

actual 0 1
predict 1 0

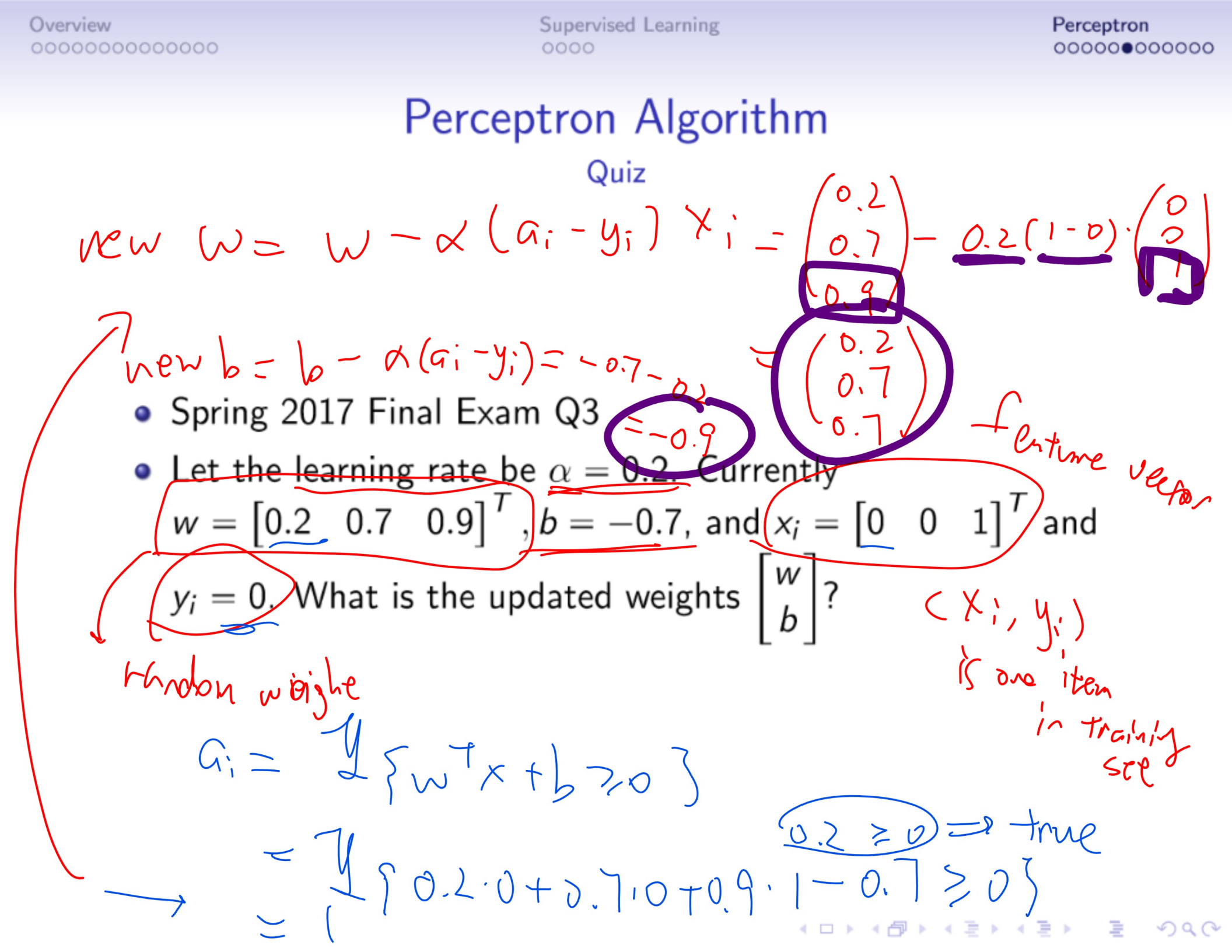
$a_i = y_i = 0$
$a_i = y_i = 1$
no change.

activation $\{1, 0$

Perceptron Algorithm

Quiz

- Spring 2017 Final Exam Q3
- Let the learning rate be $\alpha = 0.2$. Currently $w = [0.2 \quad 0.7 \quad 0.9]^T$, $b = -0.7$, and $x_i = [0 \quad 0 \quad 1]^T$ and $y_i = 0$. What is the updated weights $\begin{bmatrix} w \\ b \end{bmatrix}$?



Perceptron Algorithm, Answer

Quiz

Perceptron Algorithm, Another One

Quiz

- Let the learning rate be $\alpha = 0.1$. Currently $w = \begin{bmatrix} 0.2 \\ -0.3 \end{bmatrix}$, $b = 0.4$, and $x_i = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ and $y_i = 1$. What is the updated weights $\begin{bmatrix} w \\ b \end{bmatrix}$?
- A: $\begin{bmatrix} 0.2 \\ -0.3 \\ 0.4 \end{bmatrix}$, $B: \begin{bmatrix} 0.2 \\ -0.2 \\ 0.5 \end{bmatrix}$, $C: \begin{bmatrix} 0.2 \\ -0.4 \\ 0.3 \end{bmatrix}$
- D: $\begin{bmatrix} 0.2 \\ -0.2 \\ 0.3 \end{bmatrix}$, $E: \begin{bmatrix} 0.2 \\ -0.4 \\ 0.5 \end{bmatrix}$

no change

Q6

$y_i = 1$ if $[w^T x + b \geq 0]$

$(0.2 \quad -0.3)\begin{pmatrix} 0 \\ 1 \end{pmatrix} + 0.4$

$-0.3 + 0.4 \geq 0$

true

do not choose

Perceptron Algorithm, Another One, Answer

Quiz

Perceptron Algorithm, Another One 2

Quiz

- Let the learning rate be $\alpha = 0.1$. Currently $w = \begin{bmatrix} 0.2 \\ -0.3 \end{bmatrix}$, $b = 0.4$, and $x_i = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ and $y_i = 0$. What is the updated weights $\begin{bmatrix} w \\ b \end{bmatrix}$?
- A: $\begin{bmatrix} 0.2 \\ -0.3 \\ 0.4 \end{bmatrix}$, $B: \begin{bmatrix} 0.2 \\ -0.2 \\ 0.5 \end{bmatrix}$, $C: \begin{bmatrix} 0.2 \\ -0.4 \\ 0.3 \end{bmatrix}$
- D: $\begin{bmatrix} 0.2 \\ -0.2 \\ 0.3 \end{bmatrix}$, $E: \begin{bmatrix} 0.2 \\ -0.4 \\ 0.5 \end{bmatrix}$

Perceptron Algorithm, Another One 2, Answer

Quiz

Remind Me to Stop Recording

Admin

A6

- If you accidentally selected an obviously incorrect answer earlier, you can enter the question name and the correct answer here.