

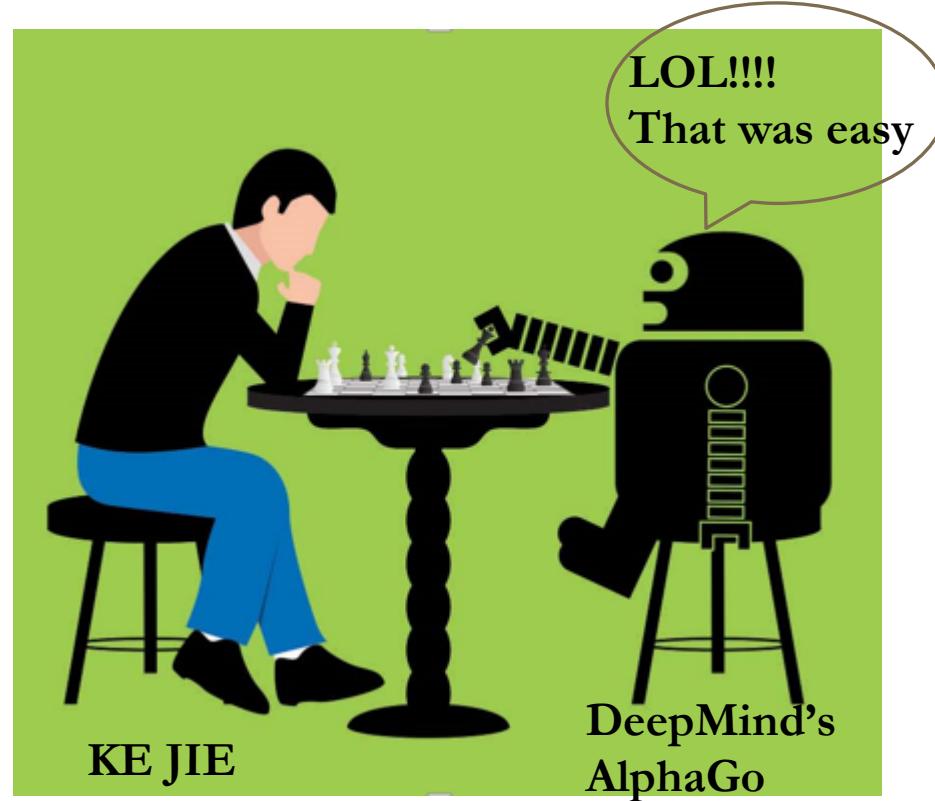
Machine learning

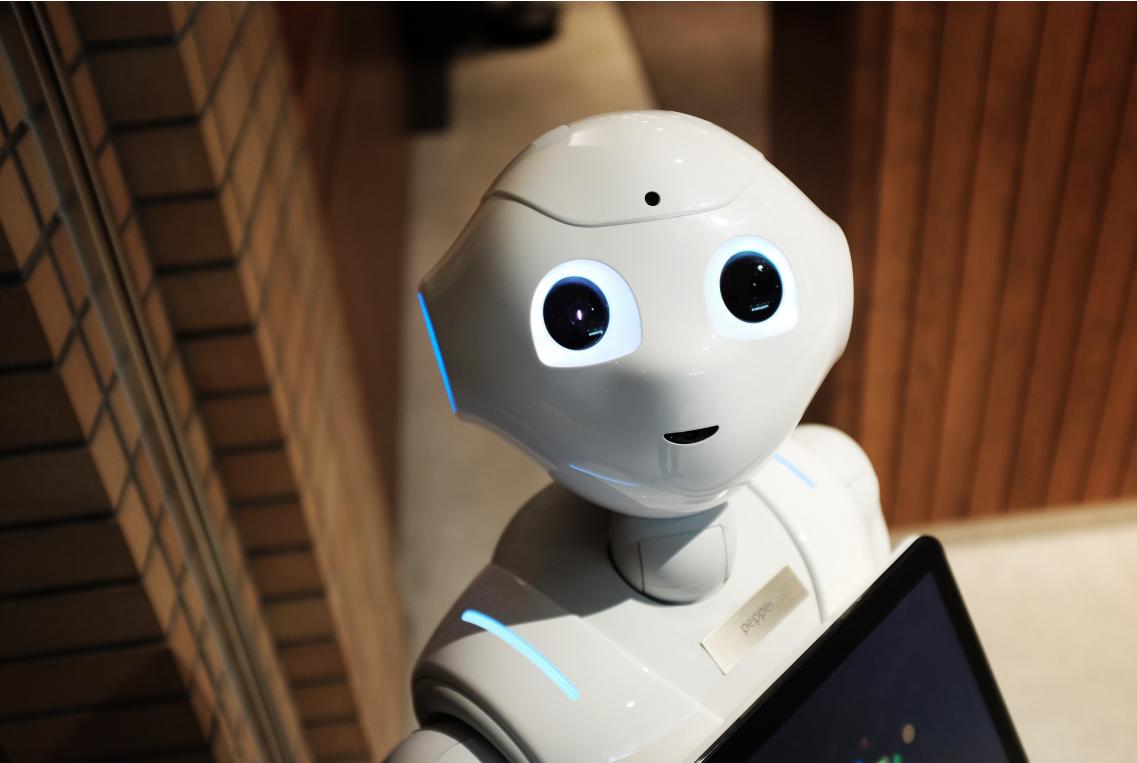
~Abhishek Kumar

What is Machine learning?



Go

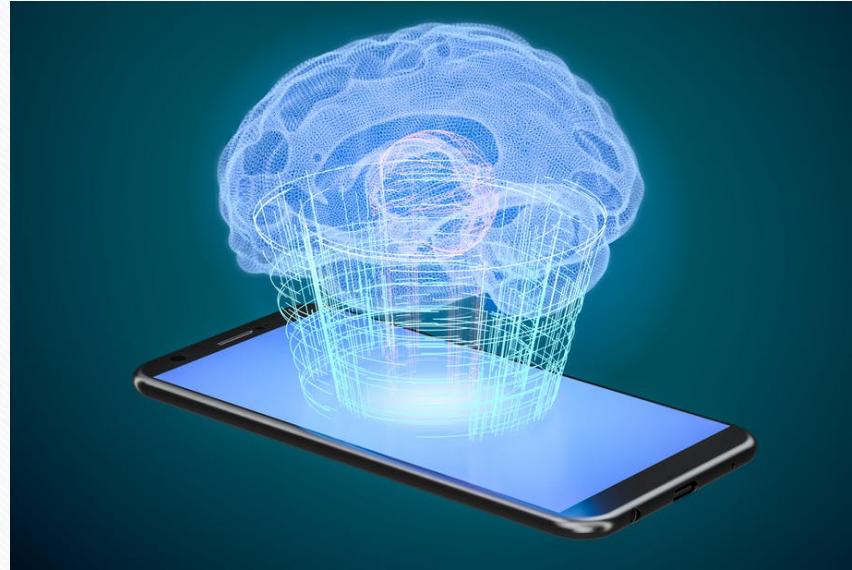




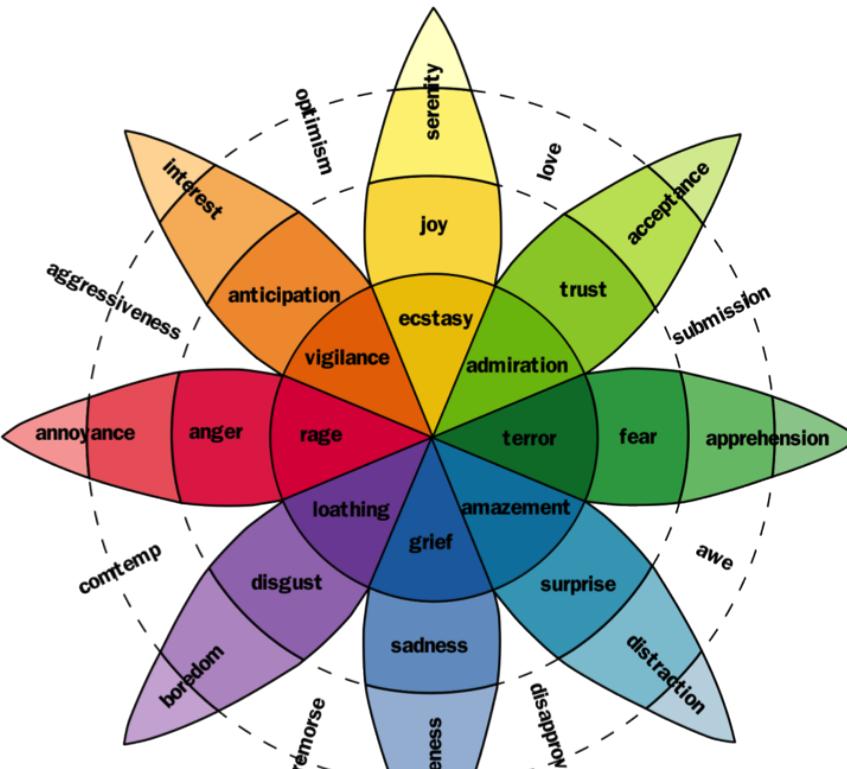
AlphaZero

Question of the century!

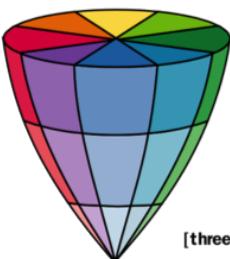
Can a machine become **Conscious**?



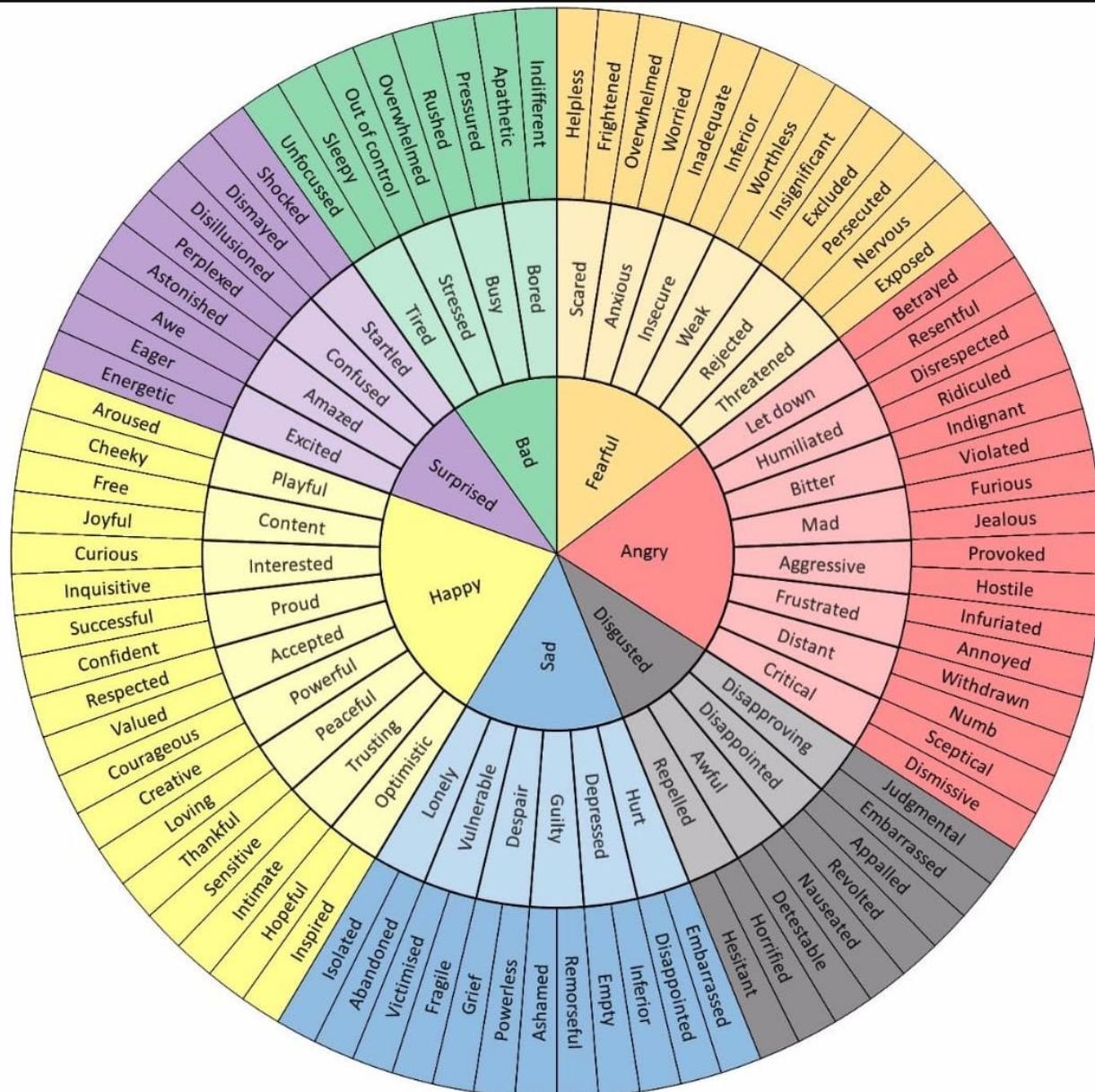
Plutchik's Wheel of Emotions



[two-dimensional circumplex model]



[three-dimensional circumplex model]



Price of a house



\$70,000

Price of a house



\$70,000



\$160,000

Price of a house



\$70,000

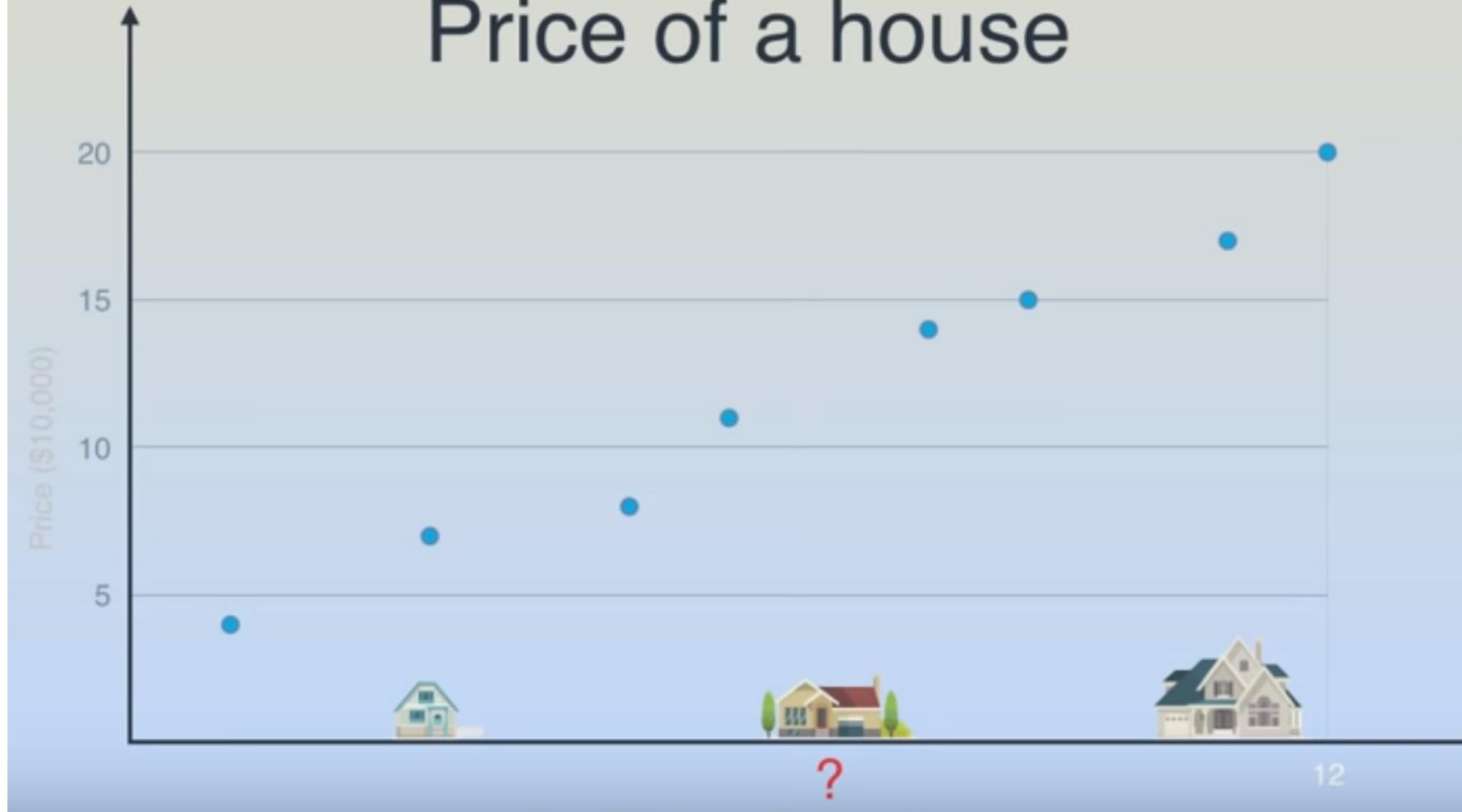


?



\$160,000

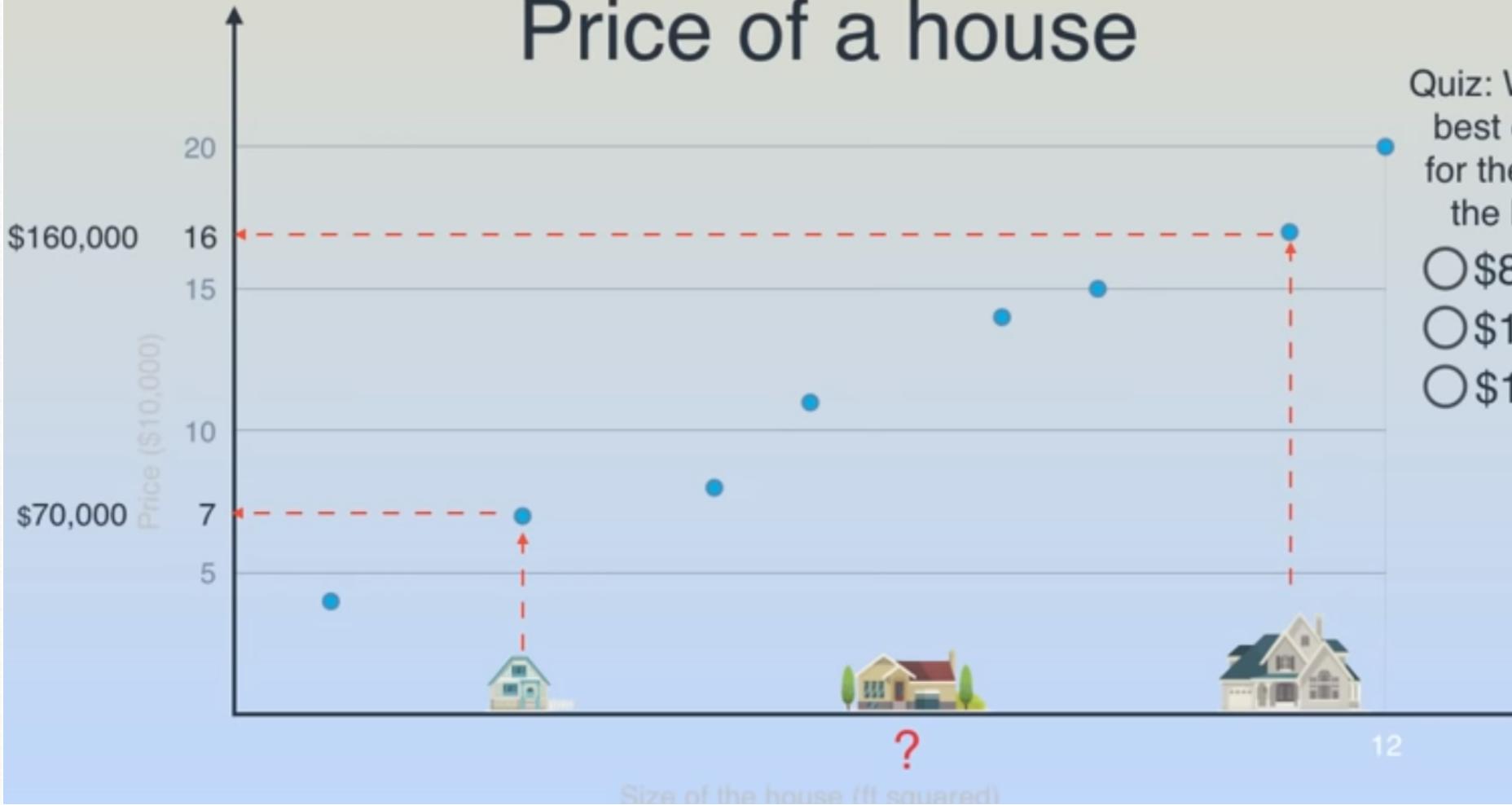
Price of a house



Price of a house

Quiz: What's the best estimate for the price of the house?

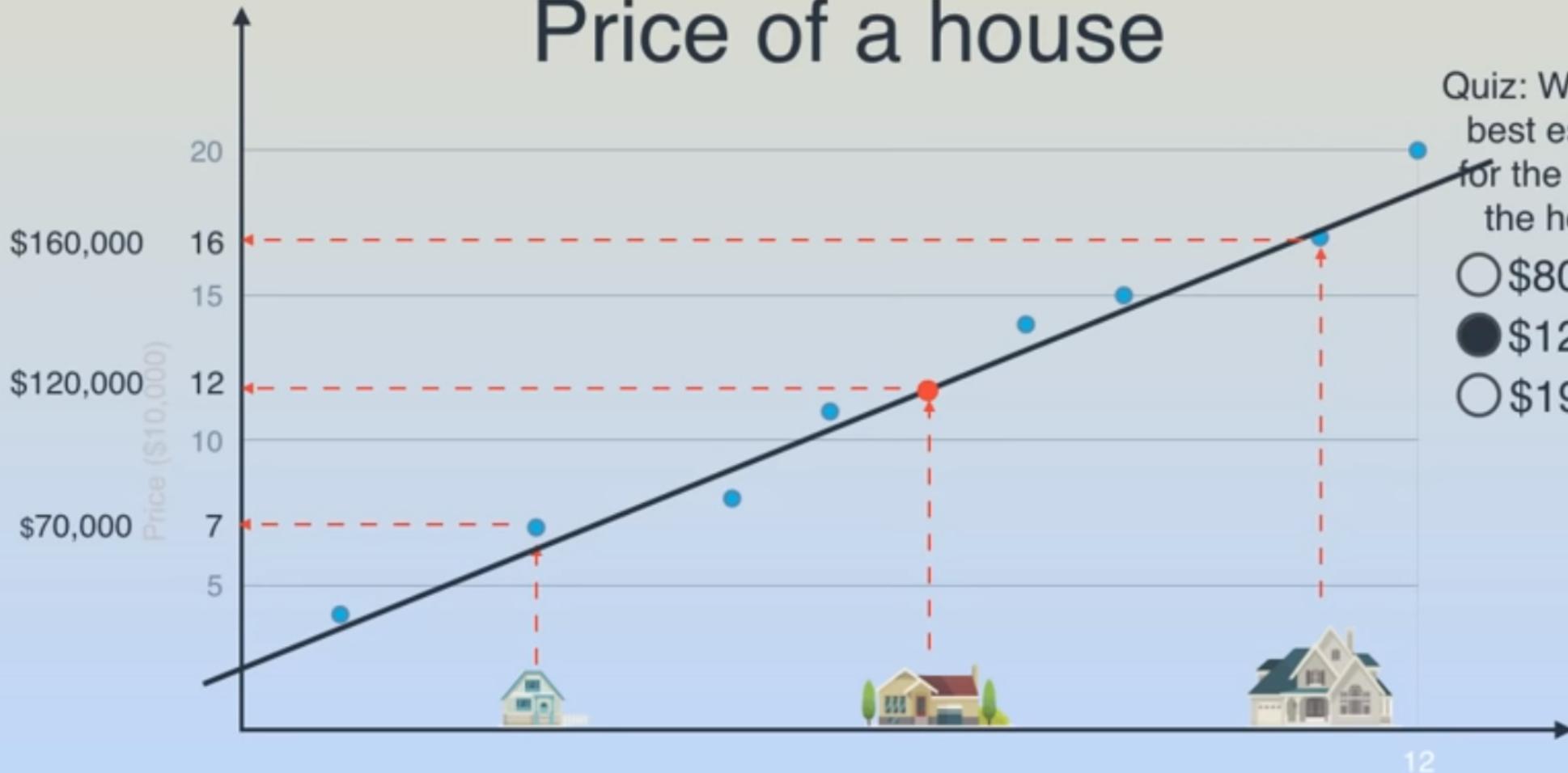
- \$80,000
- \$120,000
- \$190,000



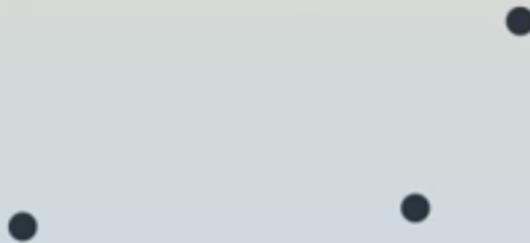
Price of a house

Quiz: What's the best estimate for the price of the house?

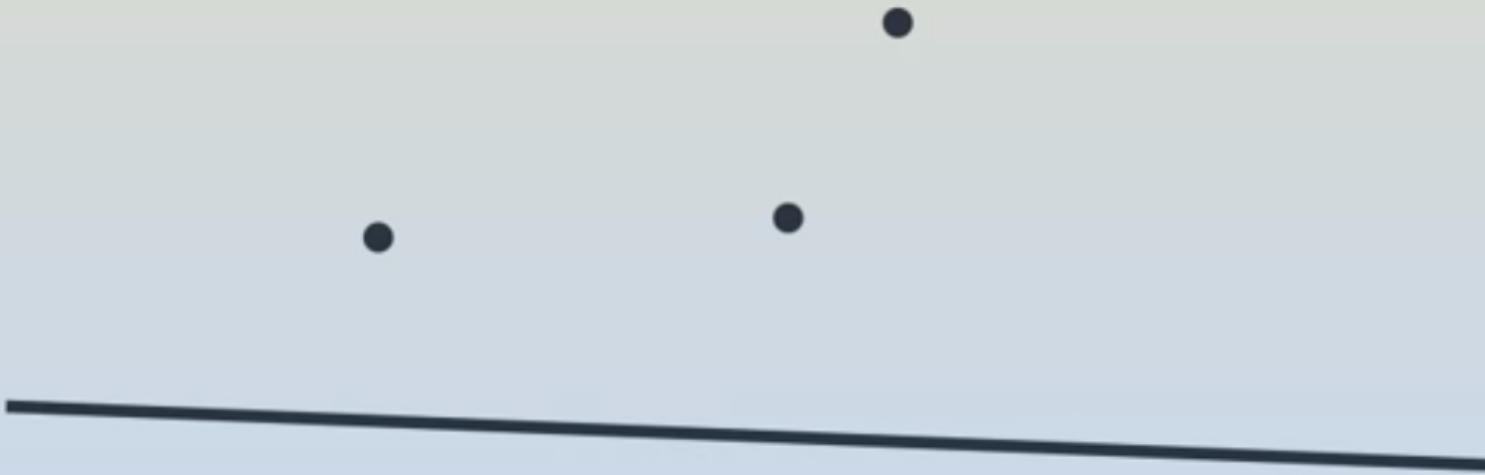
- \$80,000
- \$120,000
- \$190,000



Linear Regression



Linear Regression

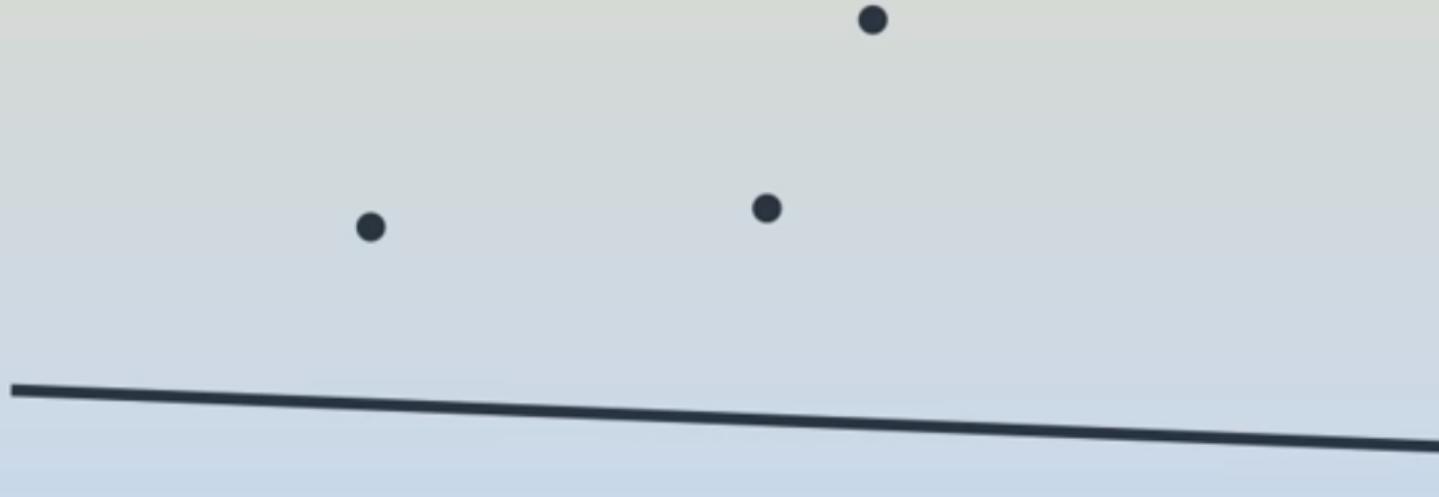


Linear Regression



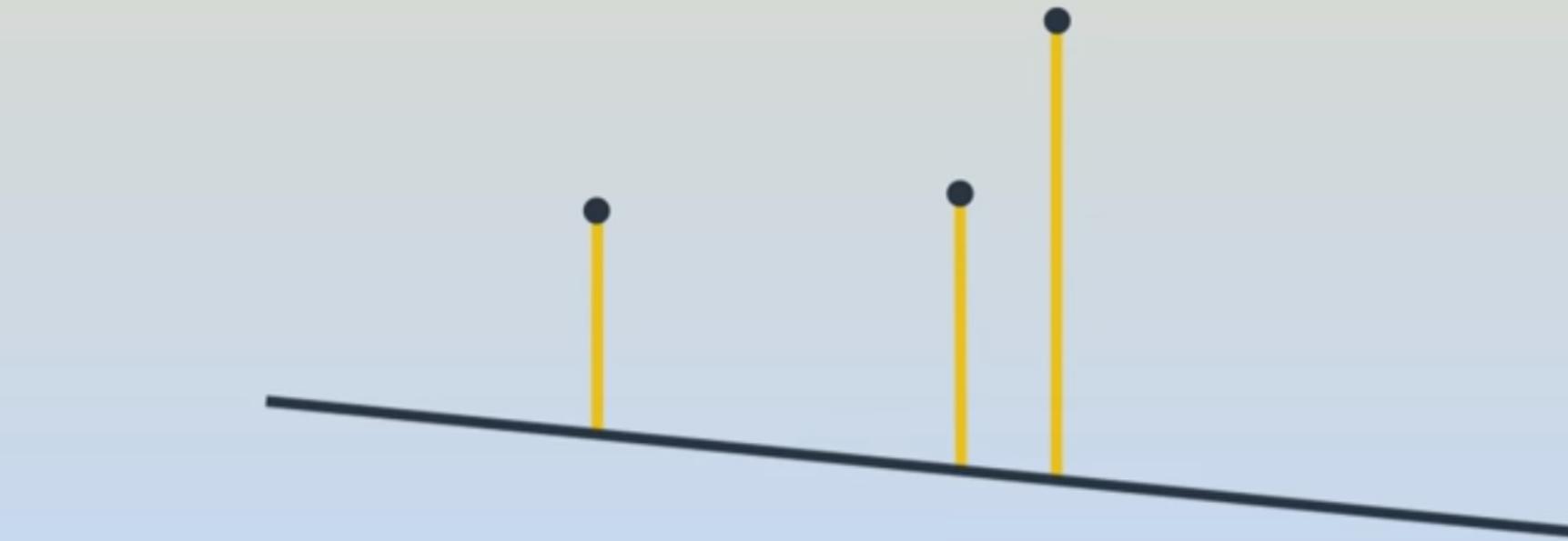
Error:

Linear Regression



Error:

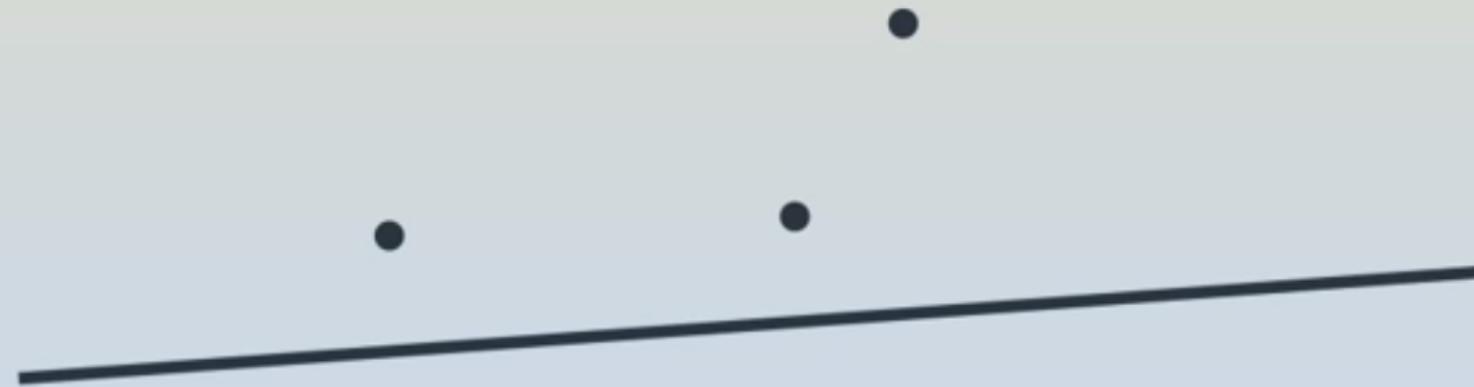
Linear Regression



Error:



Linear Regression



Error:



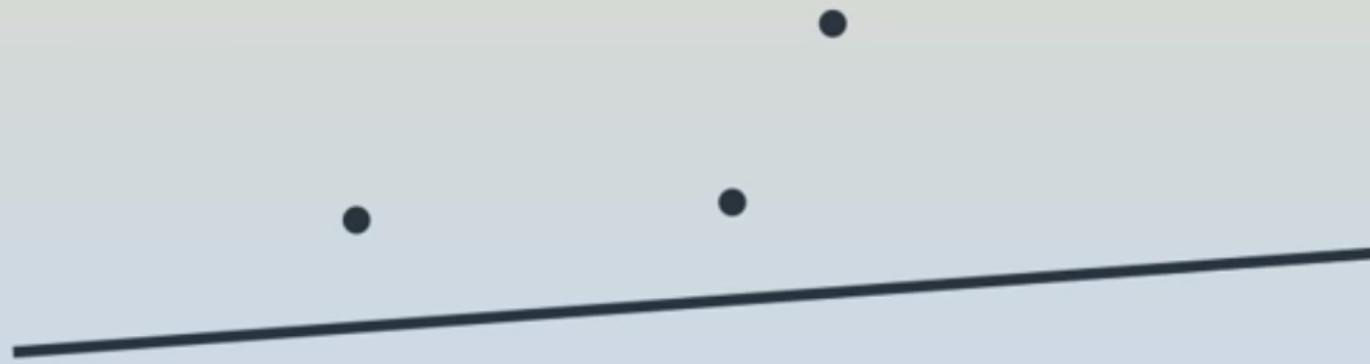
Linear Regression



Error:



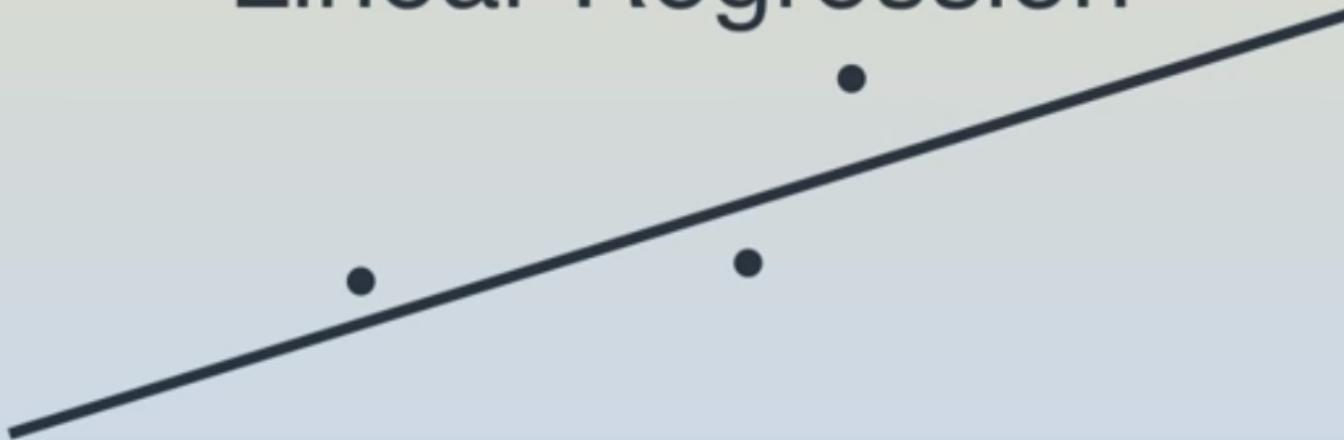
Linear Regression



Error:



Linear Regression



Error:



Linear and Polynomial Regression



Spam Detector

100 e-mails



Spam Detector

25 Spam



75 No spam





“Buy”

25 Spam



75 No spam





“Buy”

25 Spam



75 No spam



Spam Detector



“Buy”

Spam



No spam



Quiz: If an e-mail contains the word “buy”, what is the probability that it is spam?

- 40%
- 60%
- 80%
- 100%

Spam Detector



No spam



20%

Quiz: If an e-mail contains the word “buy”, what is the probability that it is spam?

- 40%
 - 60%
 - 80%
 - 100%

Solution:
80%

Recommending Apps

Gender	Age	App
F	15	
F	25	
M	32	
F	40	
M	12	
M	14	

Recommending Apps

Gender	Age	App
F	15	
F	25	
M	32	
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M	14	

Quiz: Between Gender and Age, which one seems more decisive for predicting what app will the users download?

- Gender
- Age

Recommending Apps

Gender	Age	App
F	15	
F	25	
M	32	
F	40	
M	12	
M	14	

Quiz: Between Gender and Age, which one seems more decisive for predicting what app will the users download?

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- Age

Recommending Apps

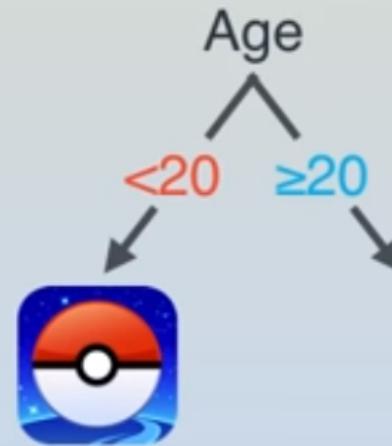
Gender	Age	App
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Quiz: Between Gender and Age, which one seems more decisive for predicting what app will the users download?

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Recommending Apps

Gender	Age	App
F	15	
F	25	
M	32	
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M	14	



Recommending Apps

Gender	Age	App
F	25	
M	32	
F	40	



Decision Tree

Gender	Age	App
F	15	
F	25	
M	32	
F	40	
M	12	
M	14	



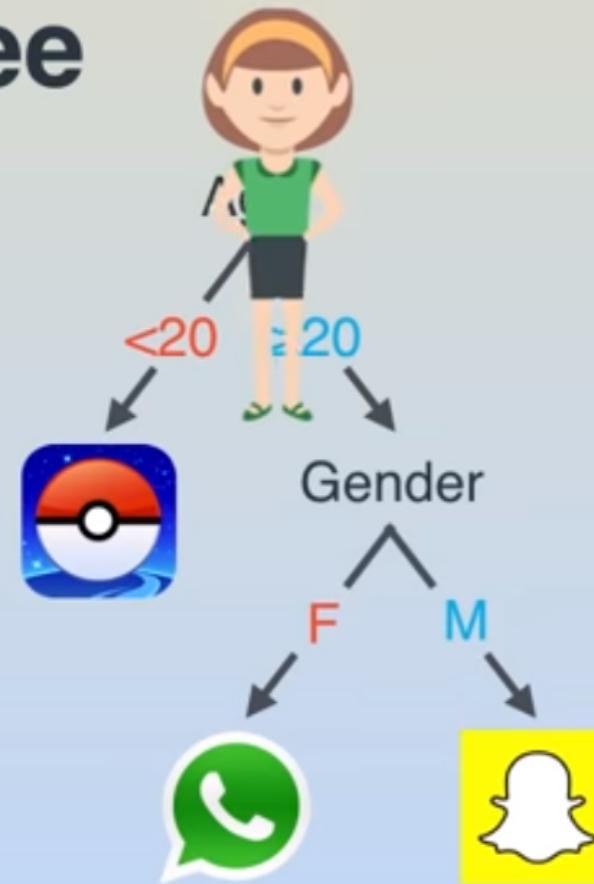
Decision Tree

Gender	Age	App
F	15	
F	25	
M	32	
F	40	
M	12	
M	14	



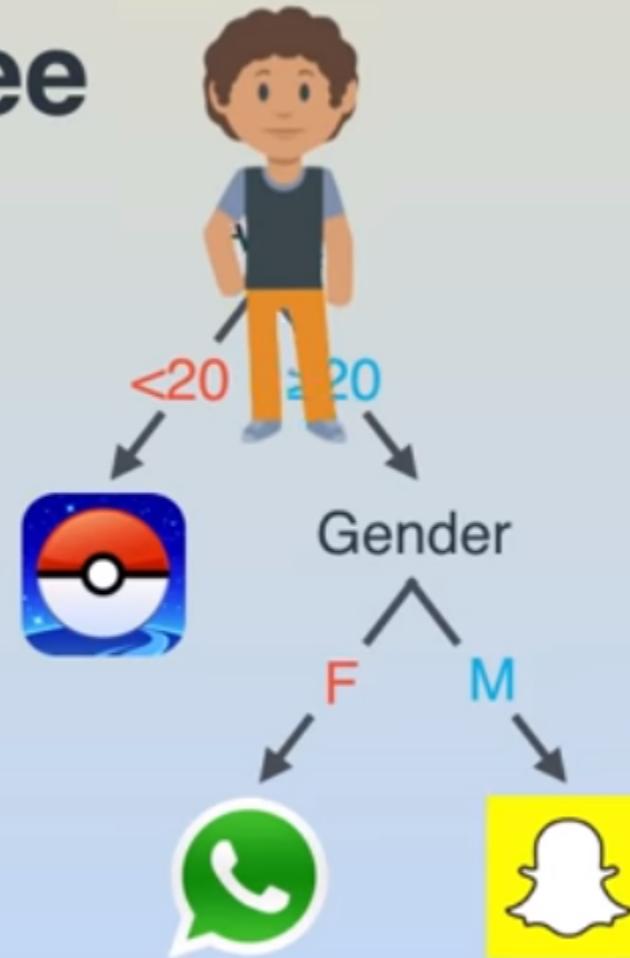
Decision Tree

Gender	Age	App
F	15	
F	25	
M	32	
F	40	
M	12	
M	14	

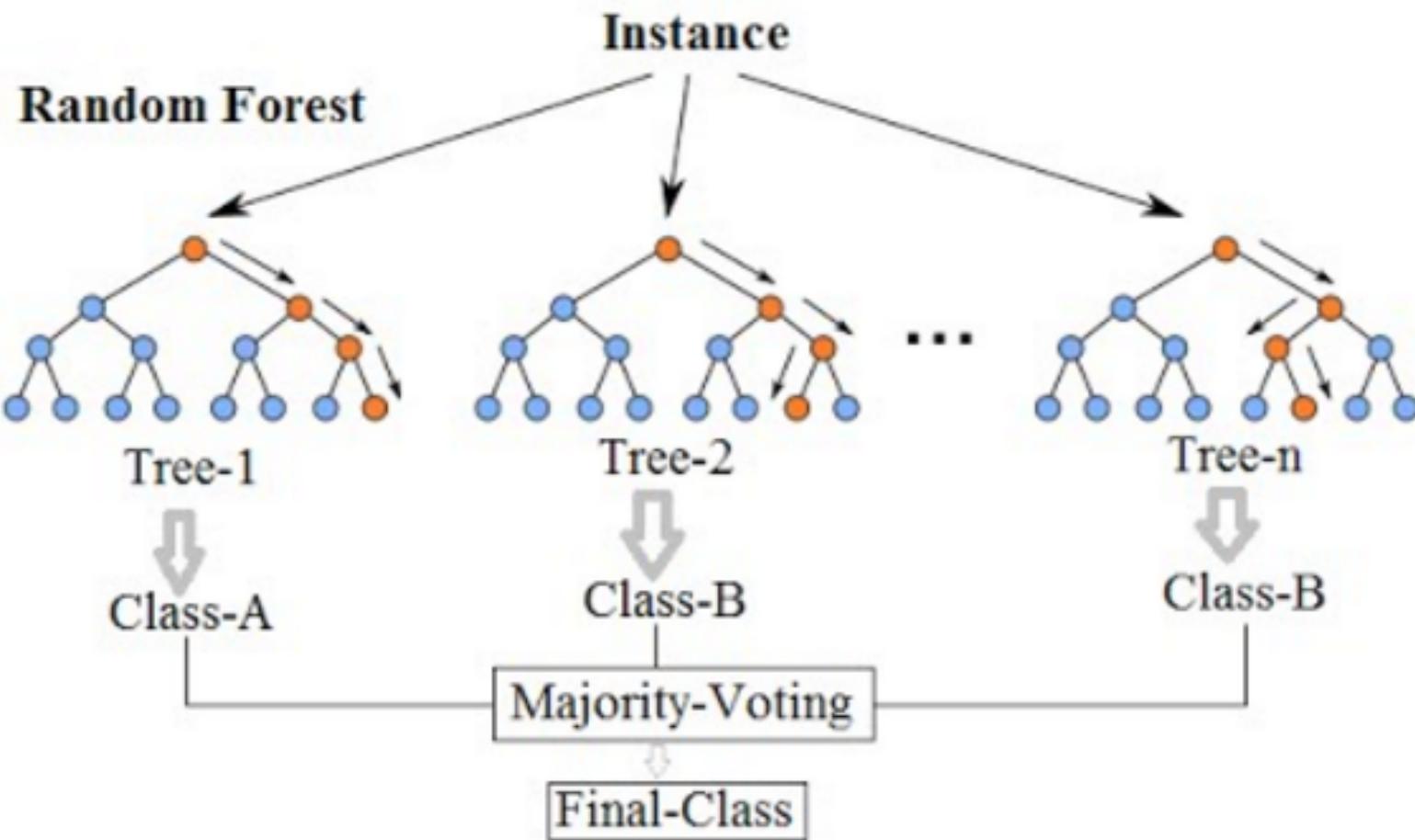


Decision Tree

Gender	Age	App
F	15	
F	25	
M	32	
F	40	
M	12	
M	14	



Random Forest Simplified



Acceptance at a University



Test



Grades

Acceptance at a University



Test



Grades

Student 1

Test: 9/10



Grades: 8/10

Student 2

Test: 3/10



Grades: 4/10

Student 3

Test: 7/10



Grades: 6/10

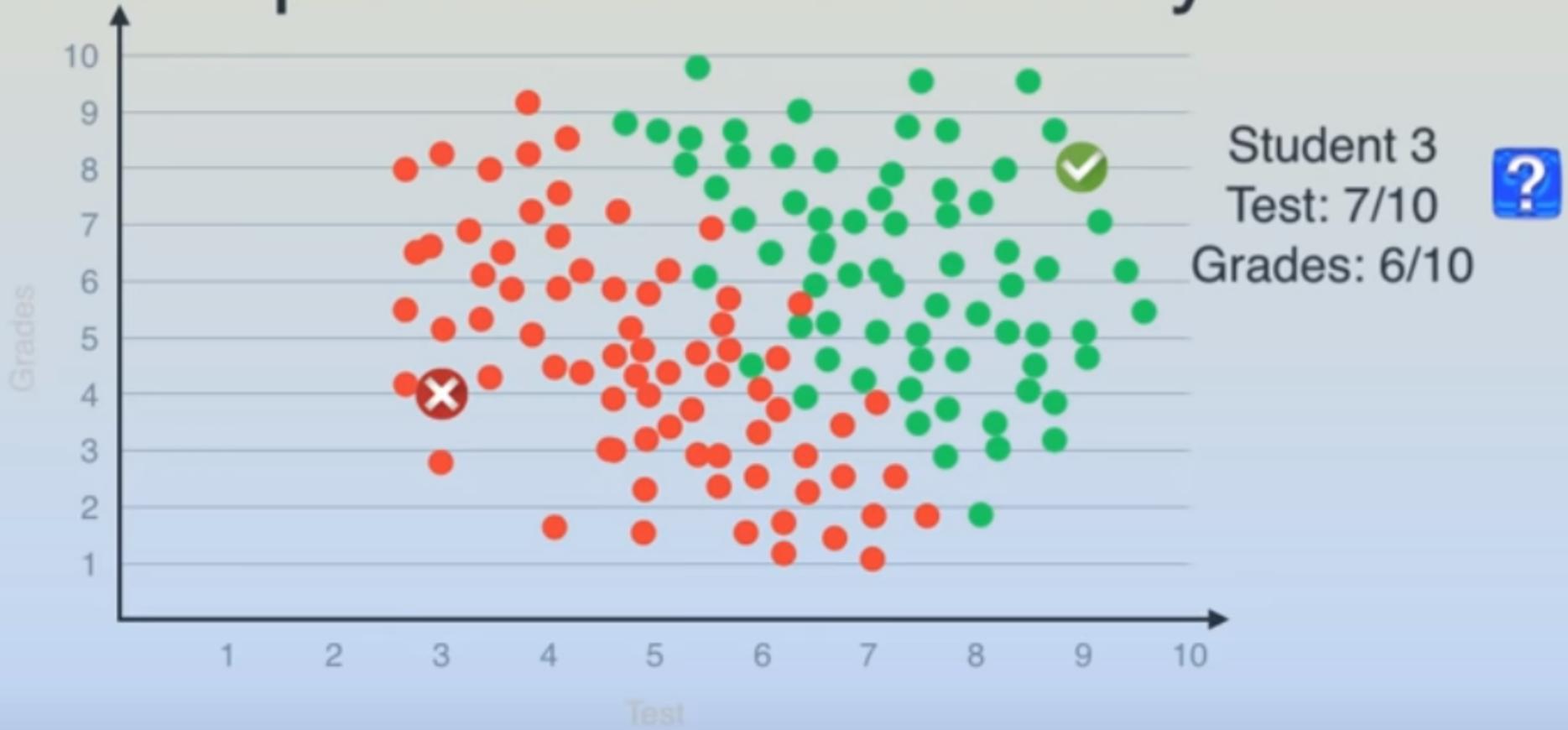
Acceptance at a University



Student 3
Test: 7/10
Grades: 6/10



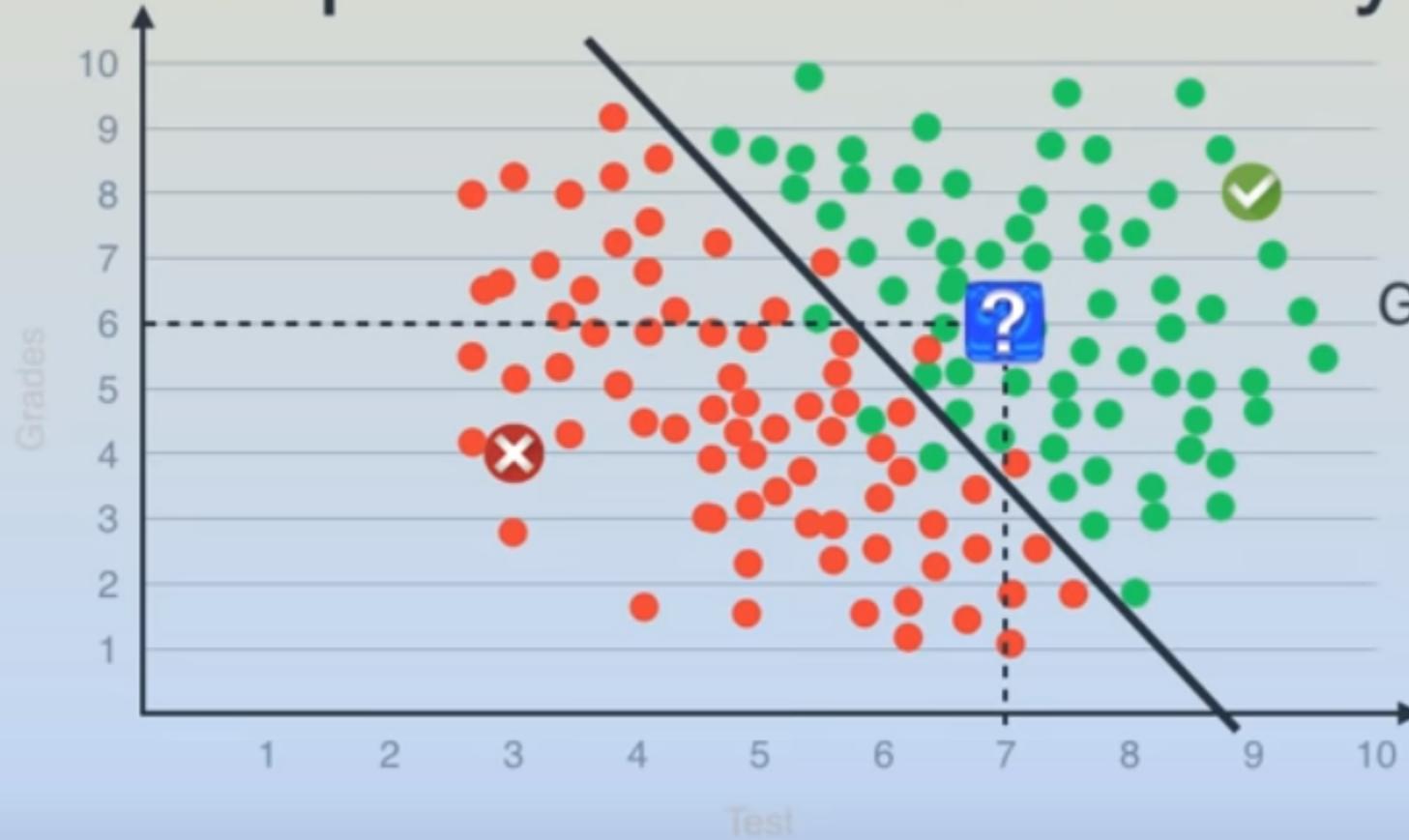
Acceptance at a University



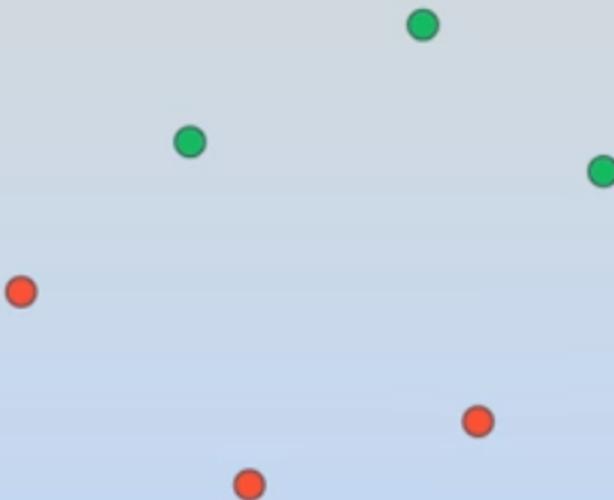
Acceptance at a University



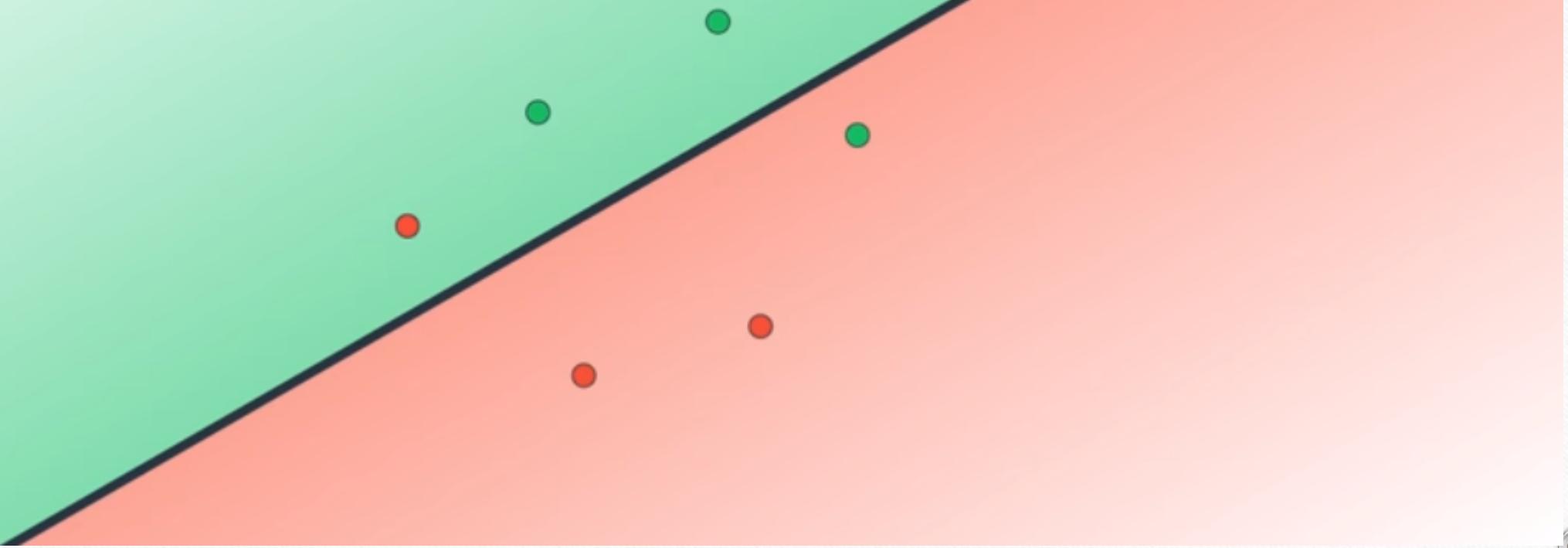
Acceptance at a University



Logistic Regression



Logistic Regression



Logistic Regression

Errors: 2

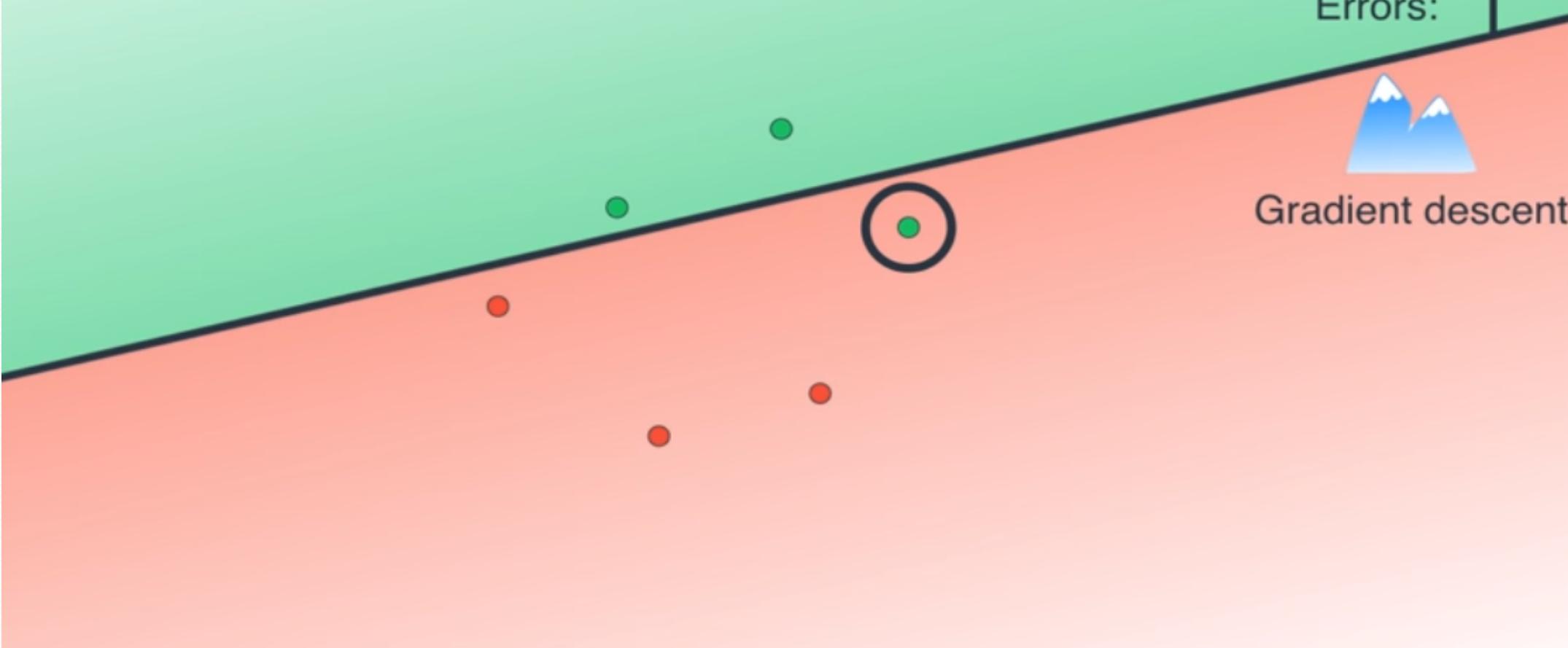


Logistic Regression

Errors: 1



Gradient descent

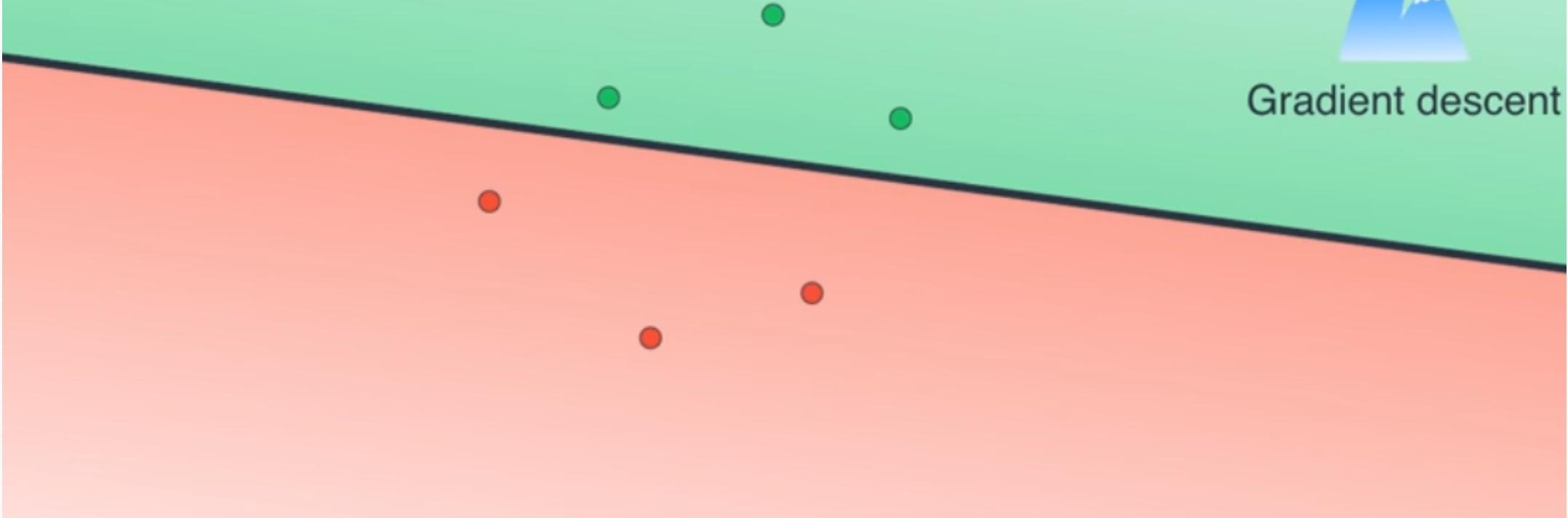


Logistic Regression

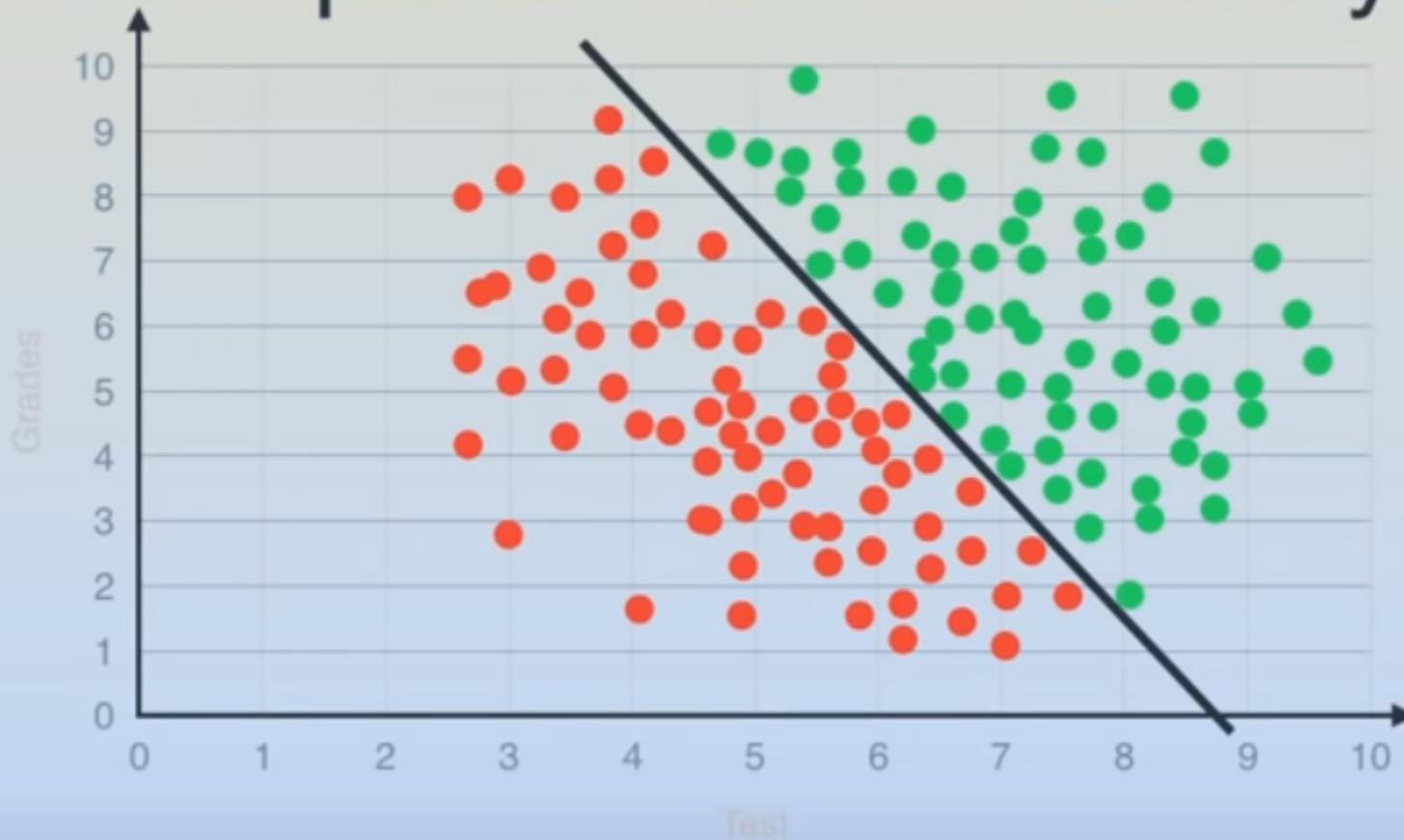
Errors: 0



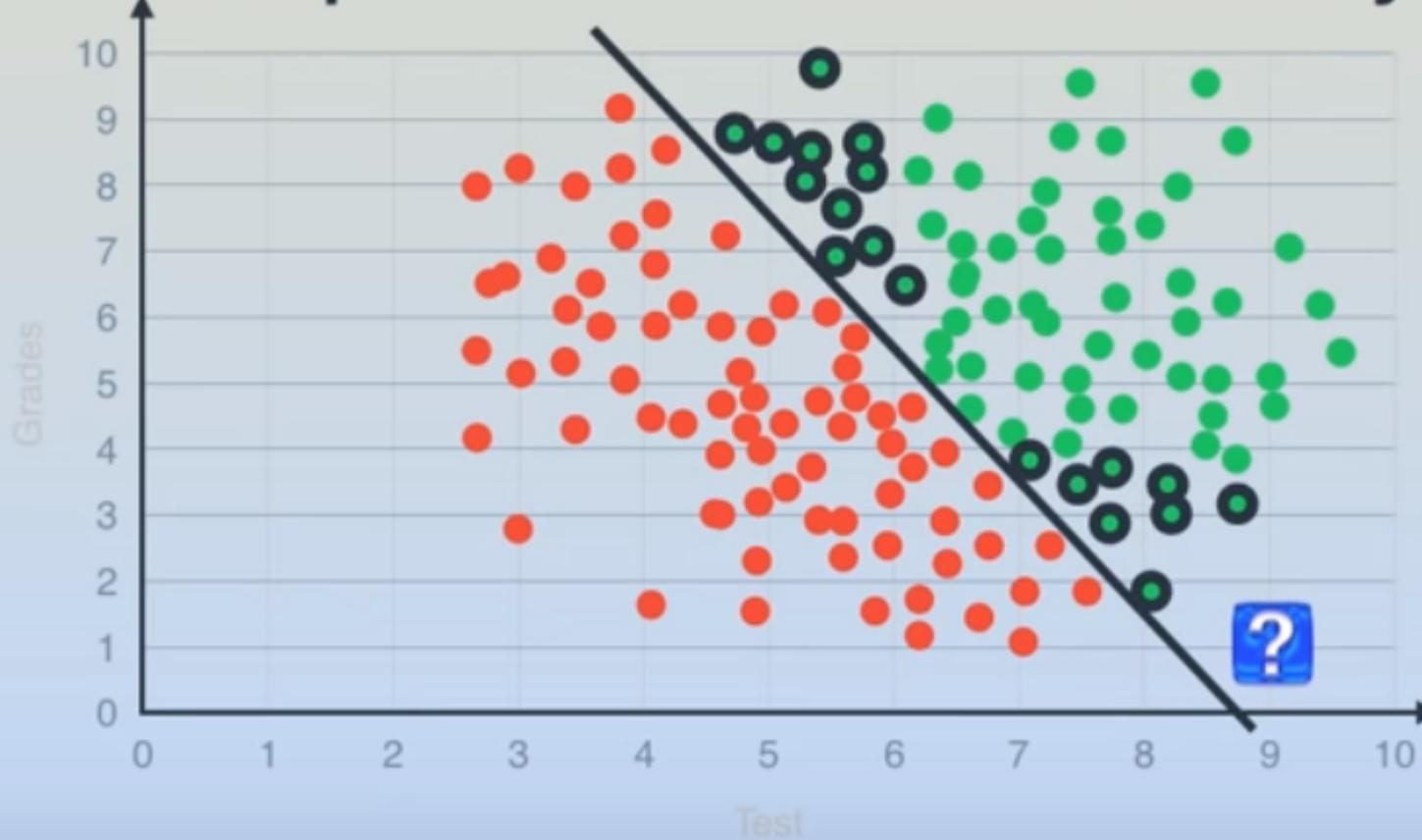
Gradient descent



Acceptance at a University

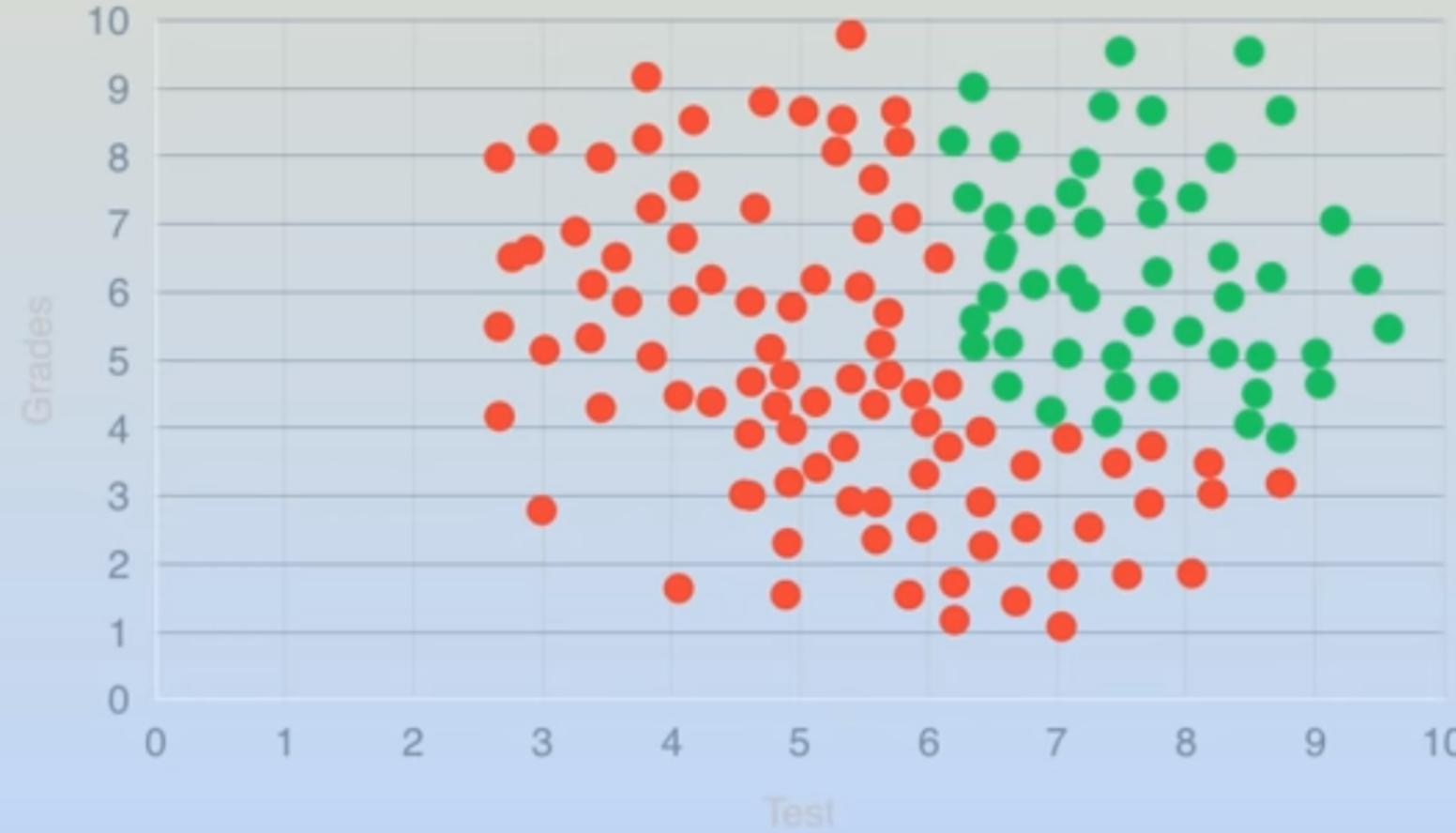


Acceptance at a University

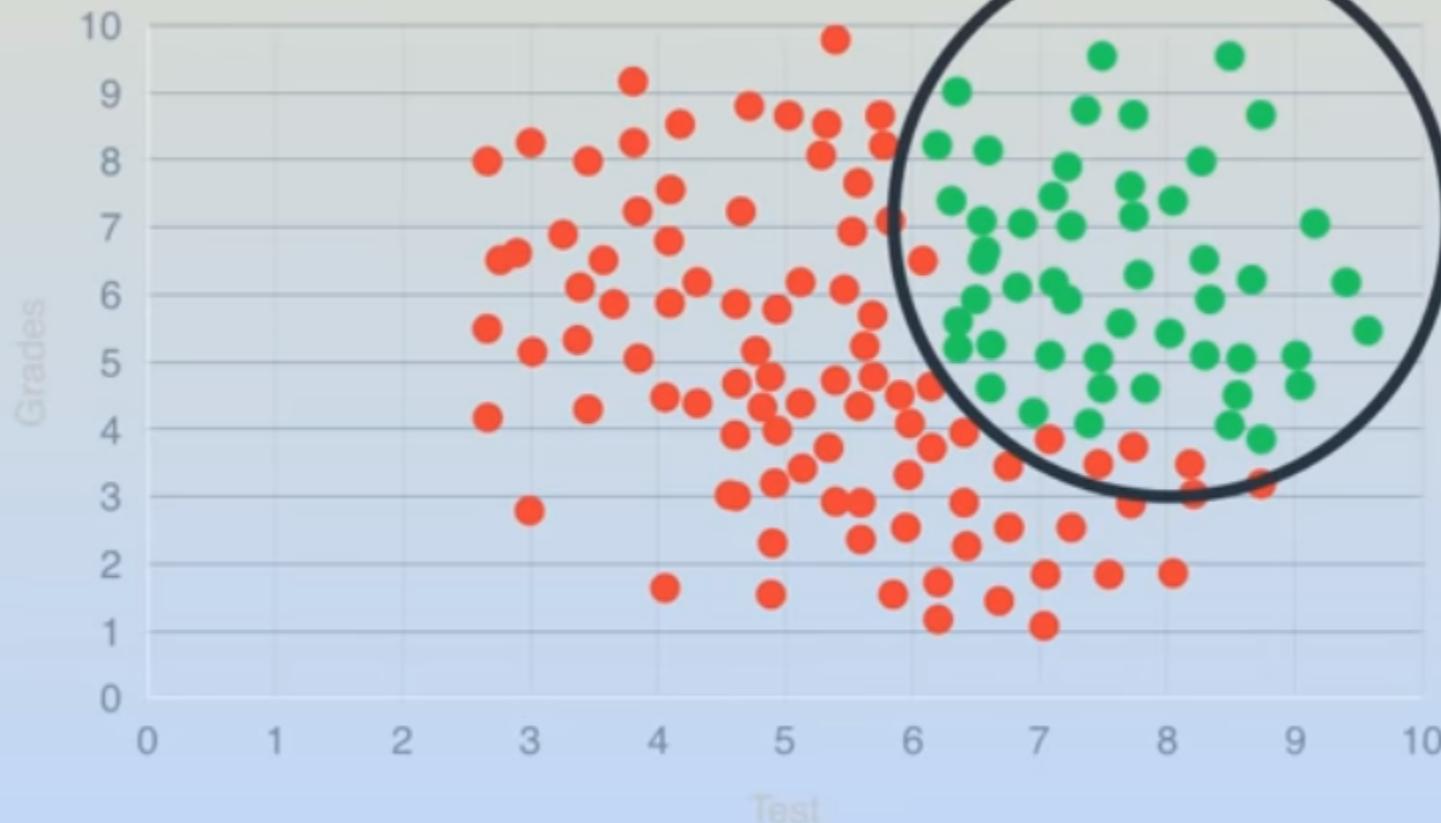


Student 4
Test: 9/10
Grades: 1/10

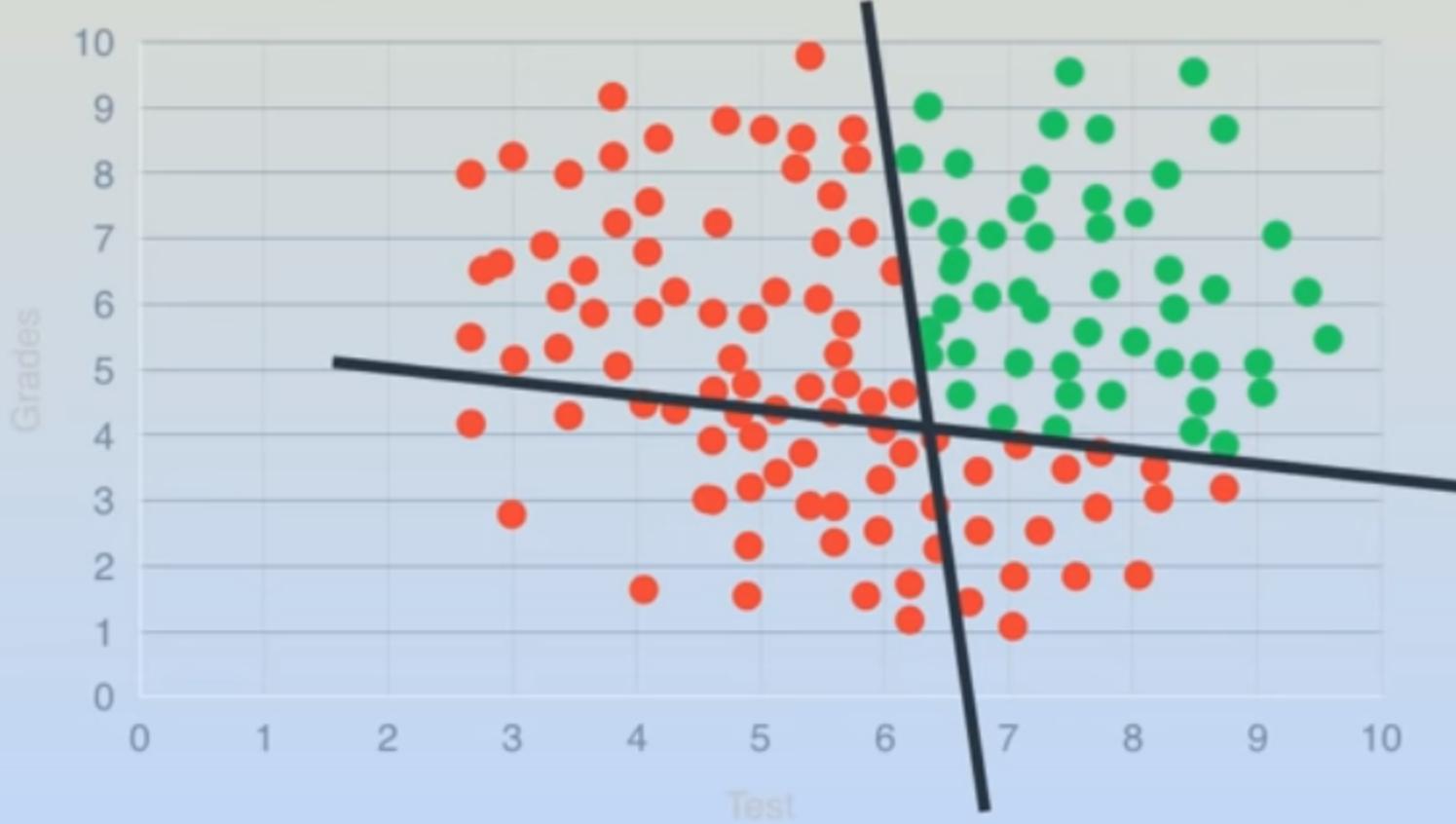
Acceptance at a University



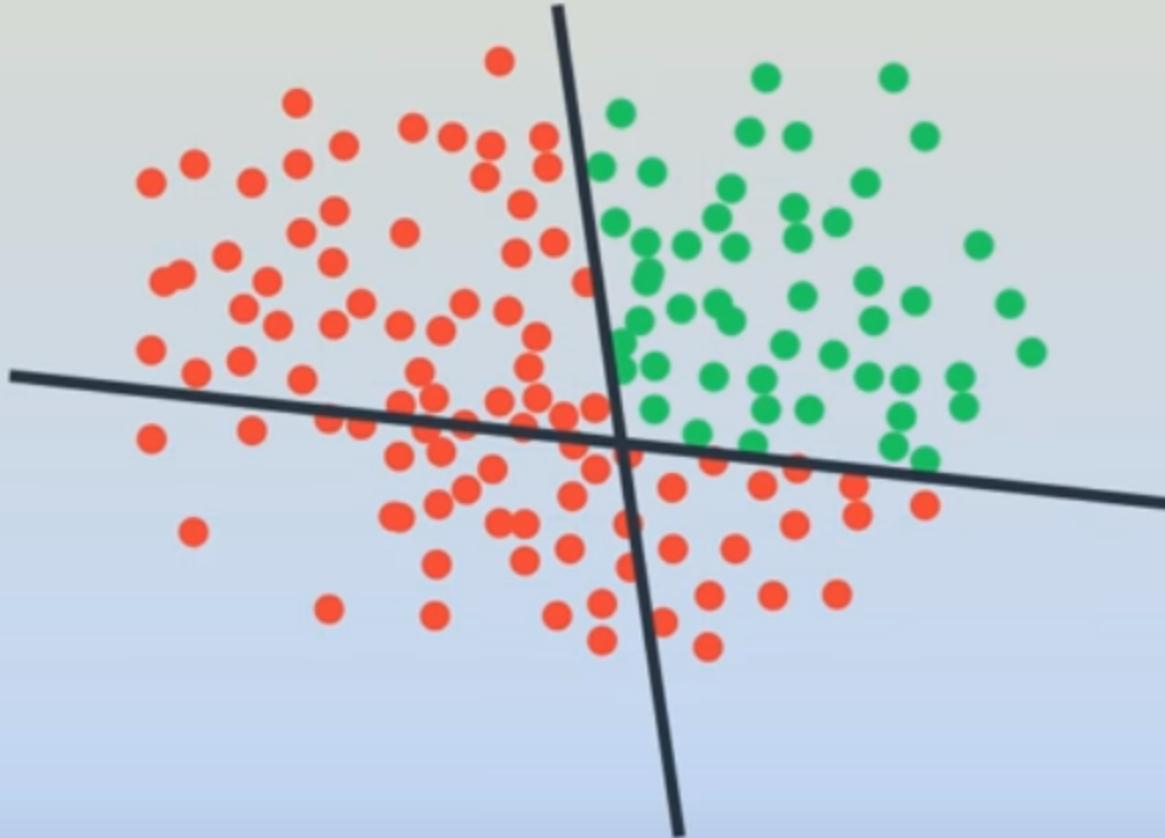
Acceptance at a University



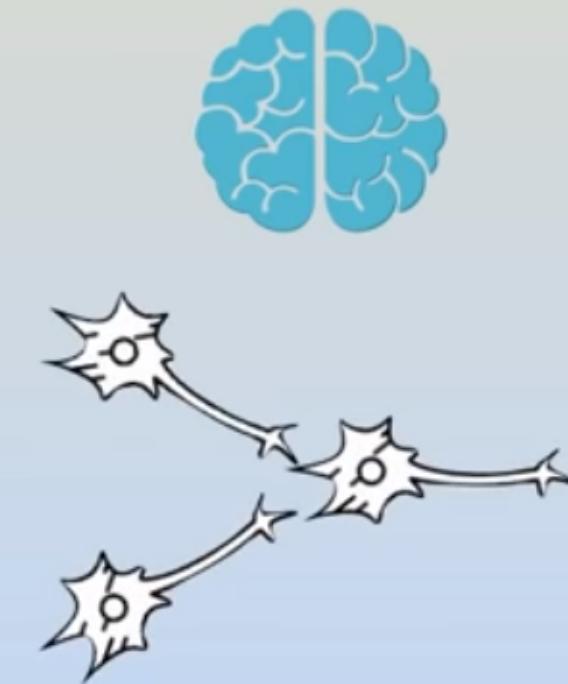
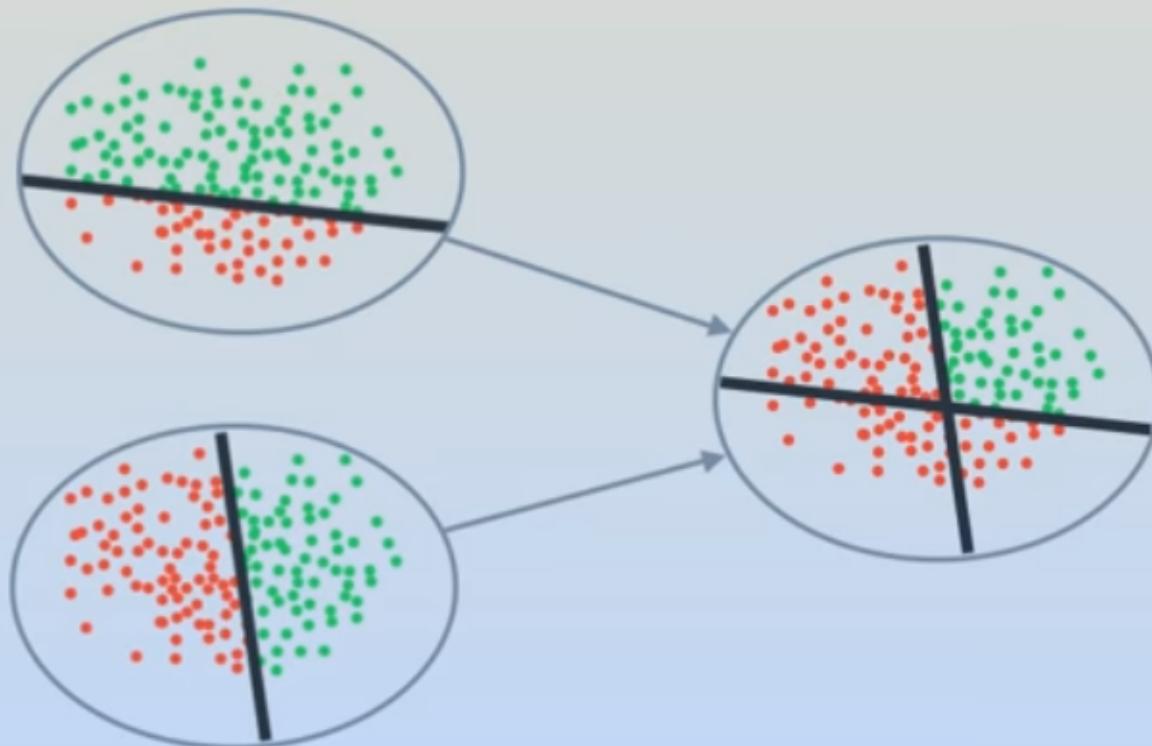
Acceptance at a University



Neural Network



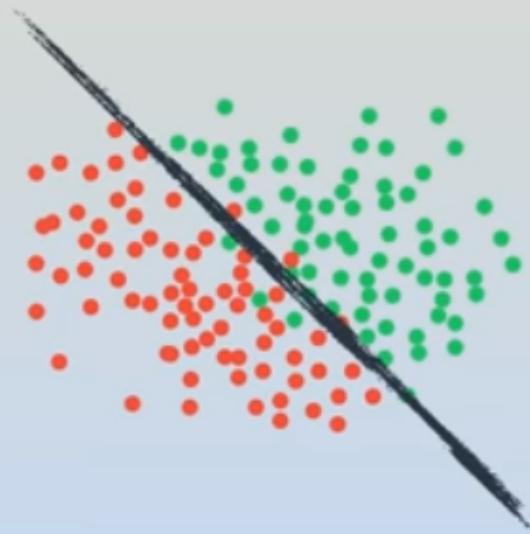
Neural Network



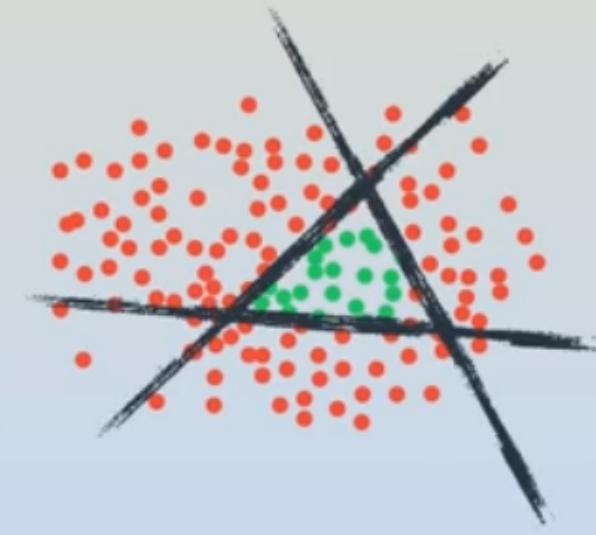
Logistic Regression & Neural Networks



Logistic Regression

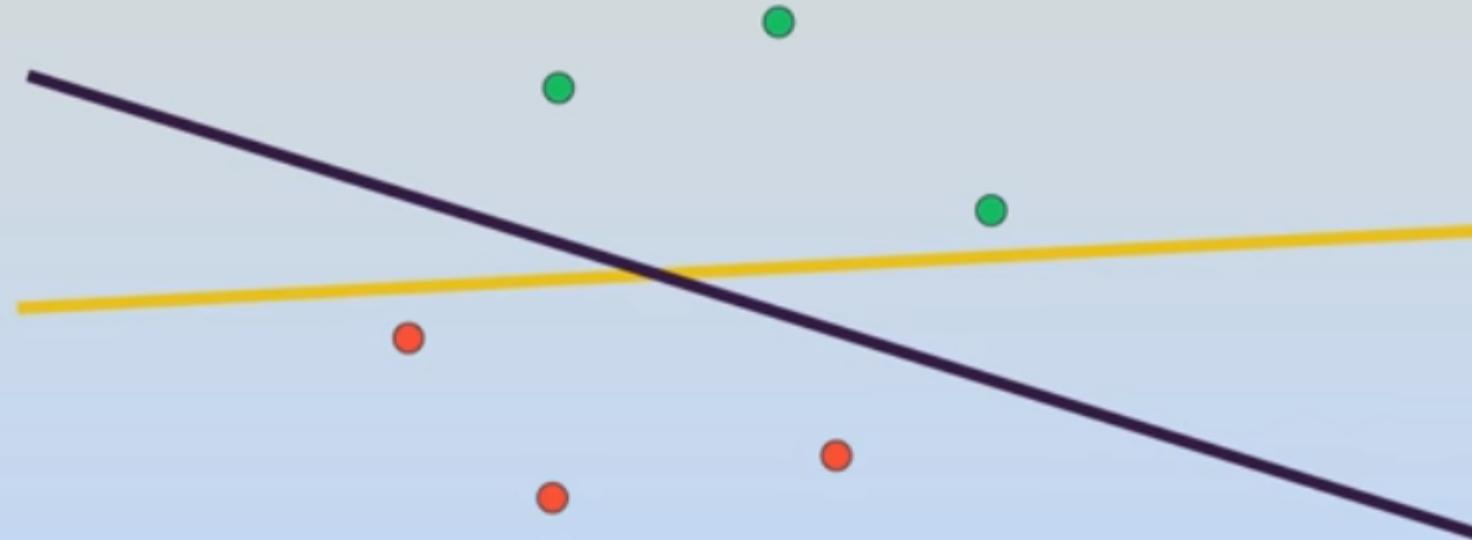


Neural Network



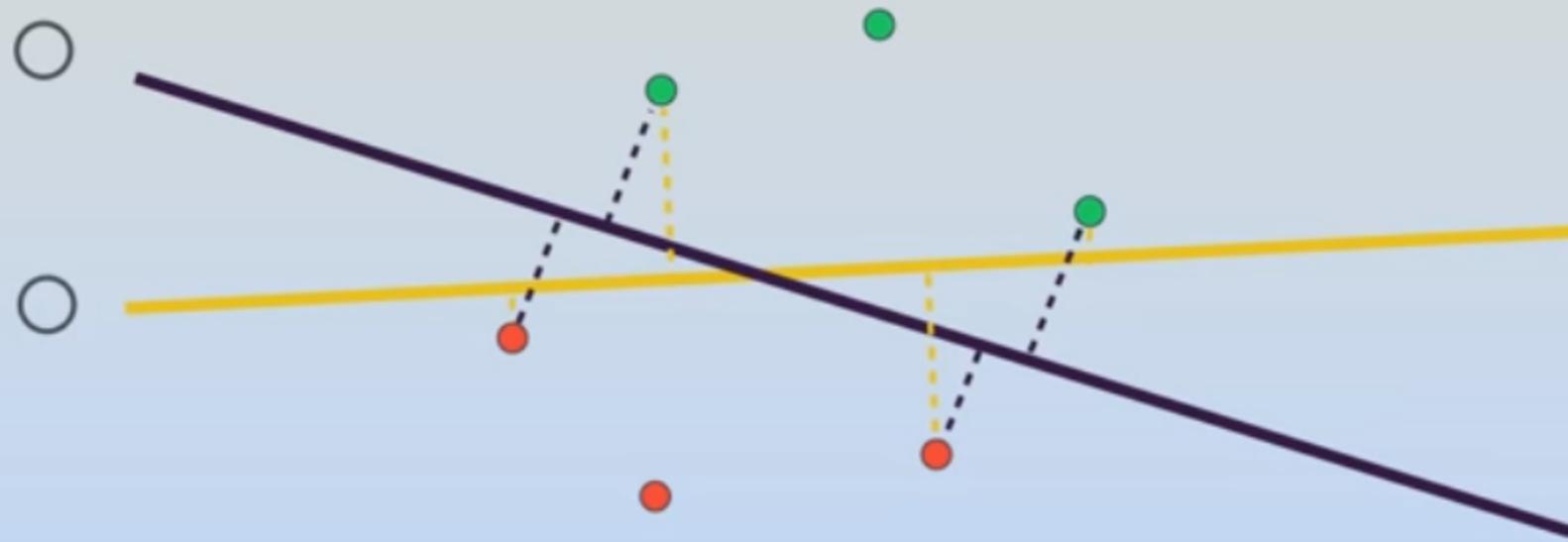
Cutting data with style

Quiz:
Which one is a
better line?



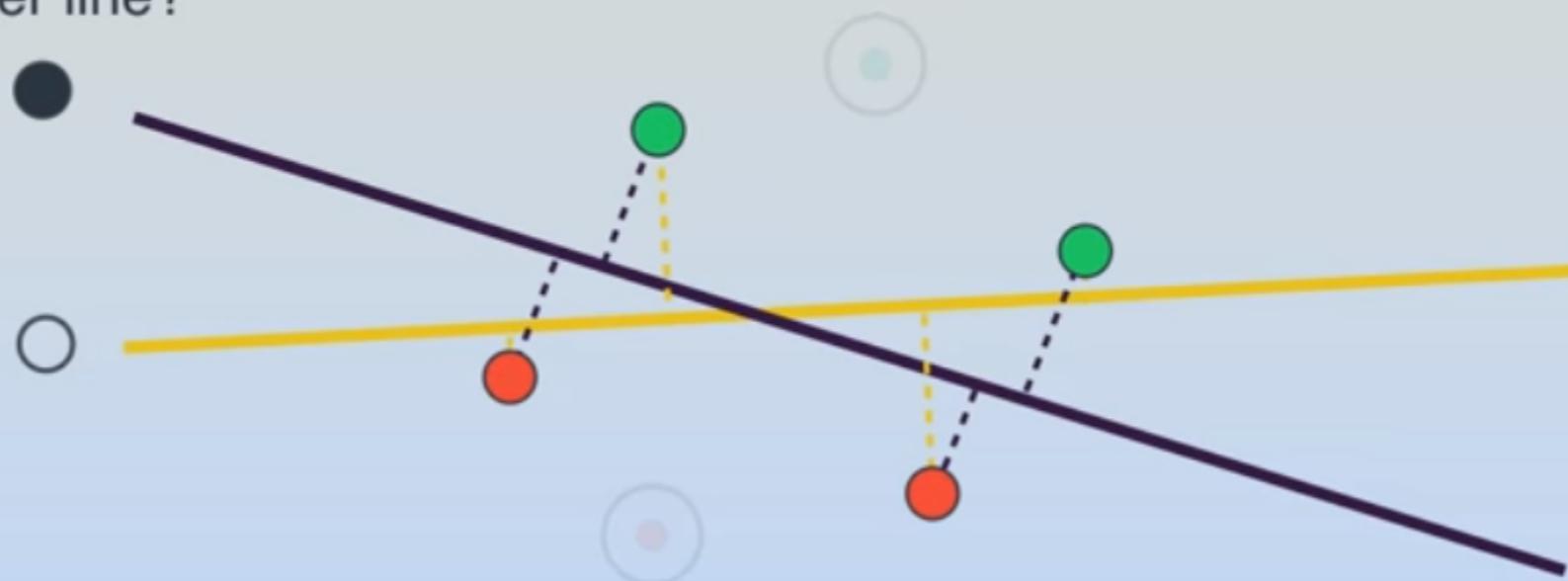
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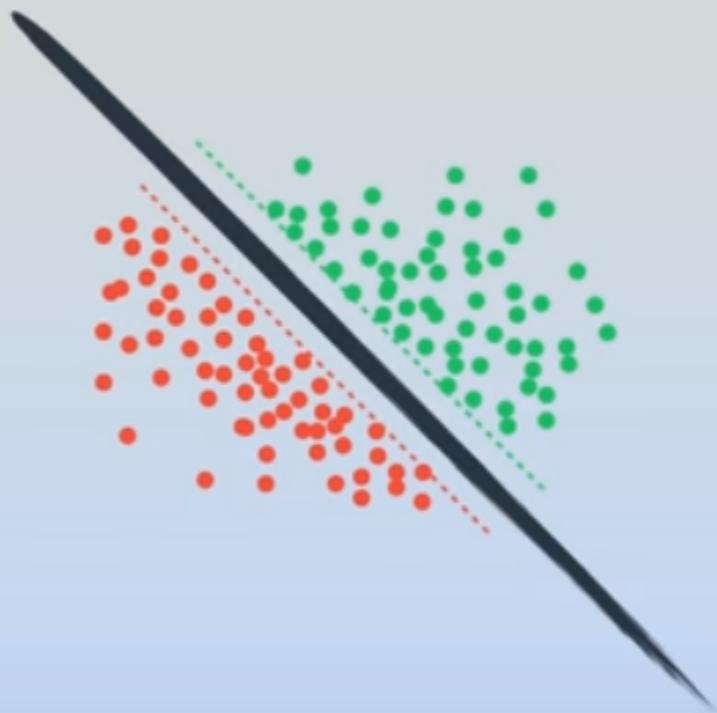


Cutting data with style

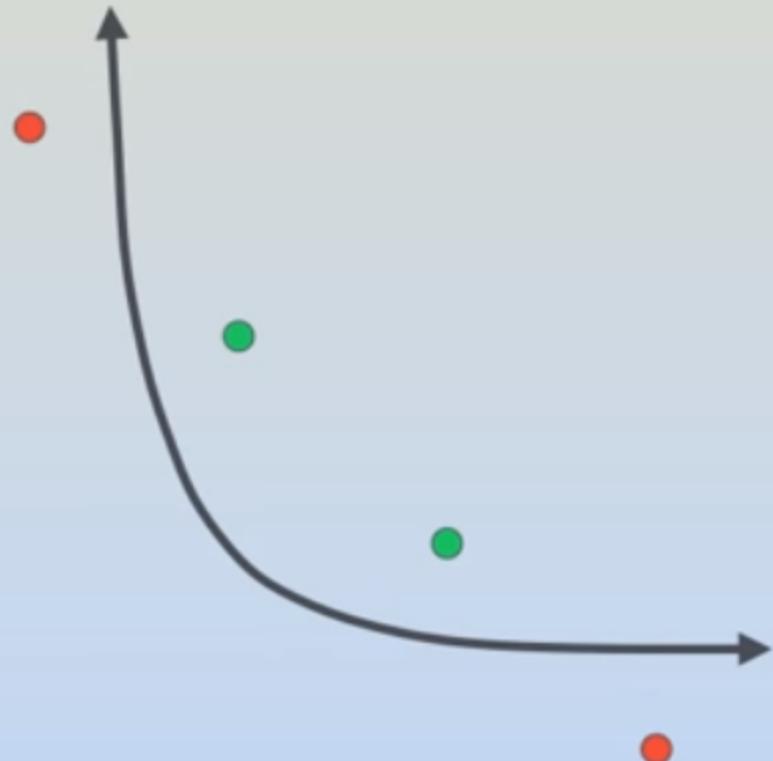
Quiz:
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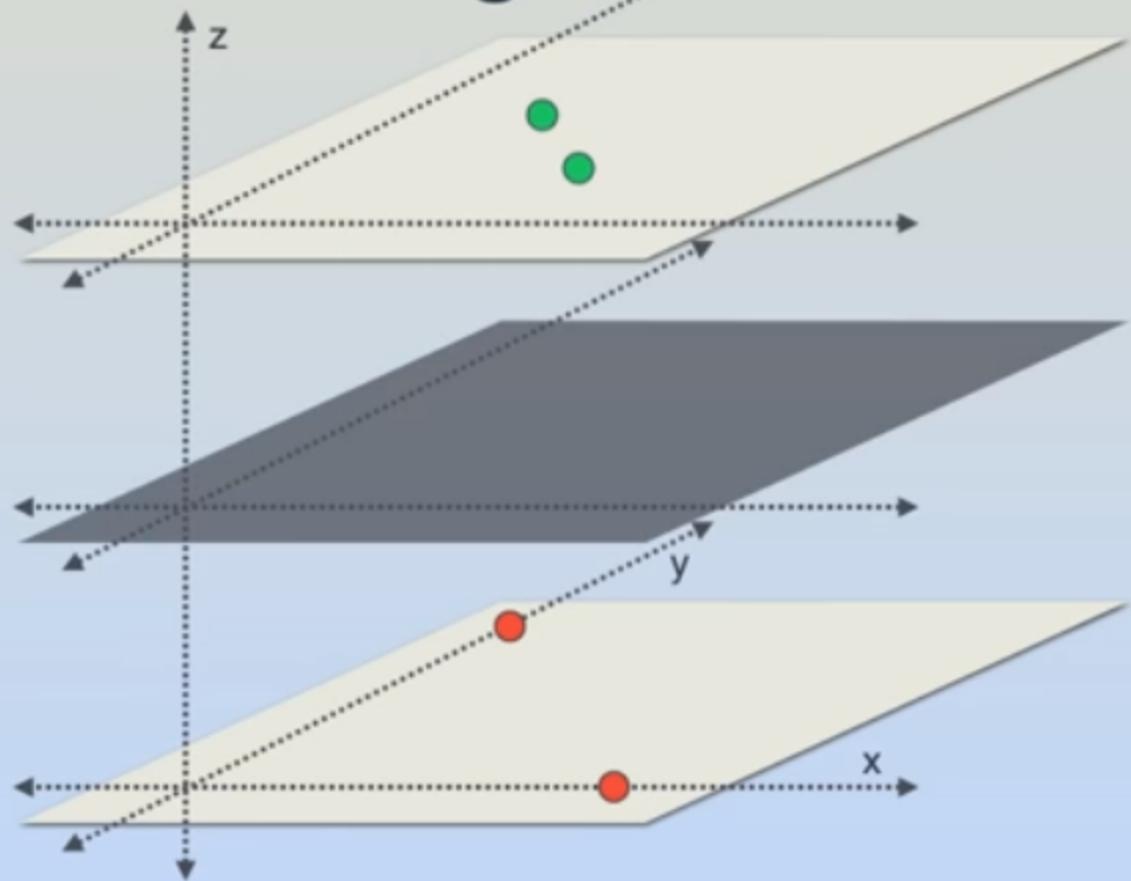
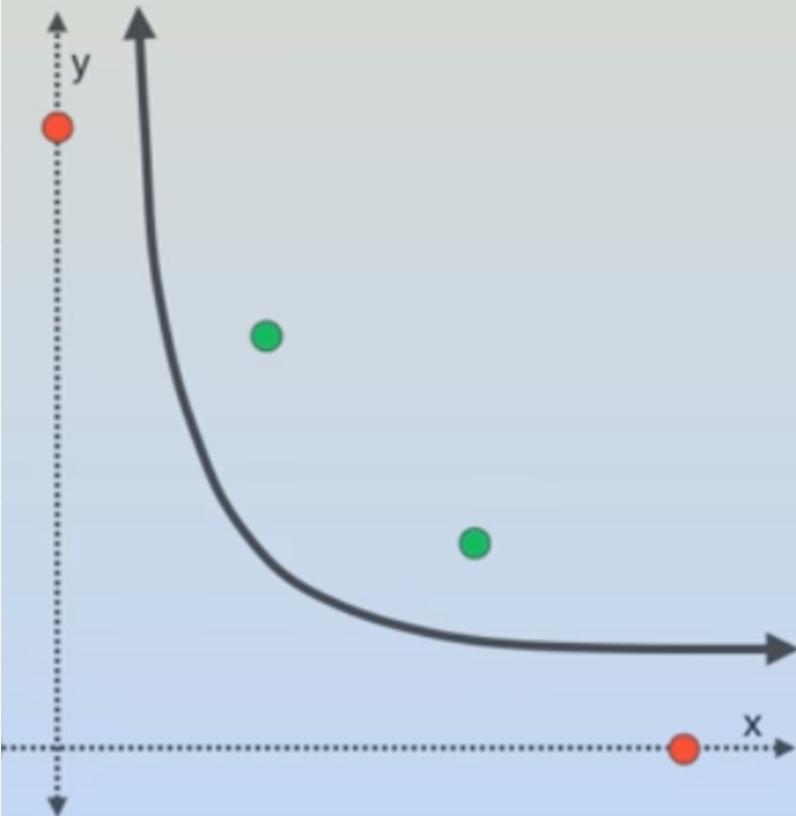
Support Vector Machines



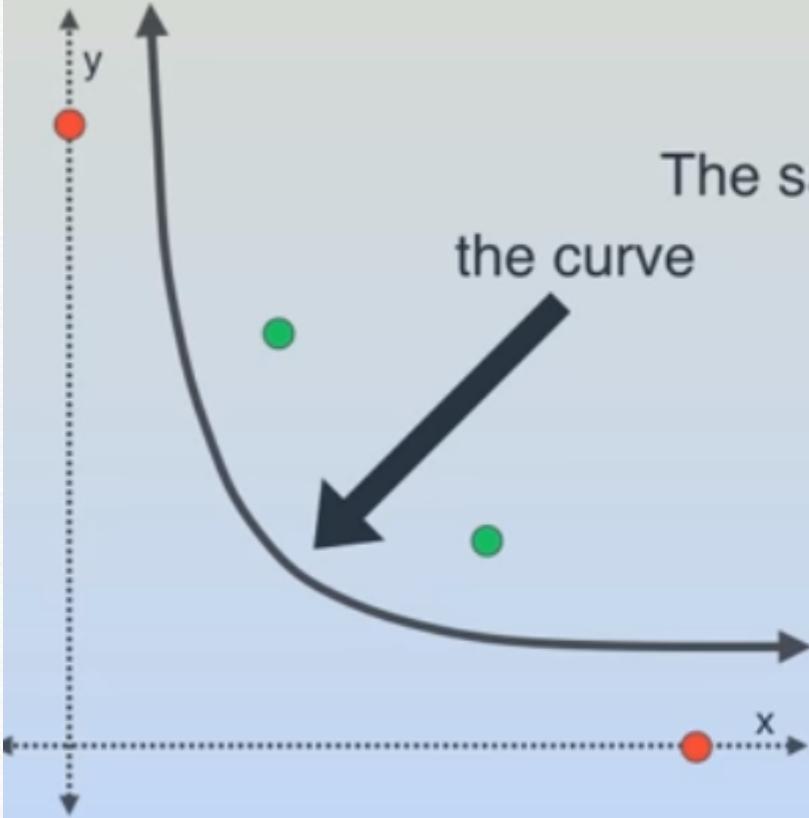
When a line is not enough...



When a line is not enough...

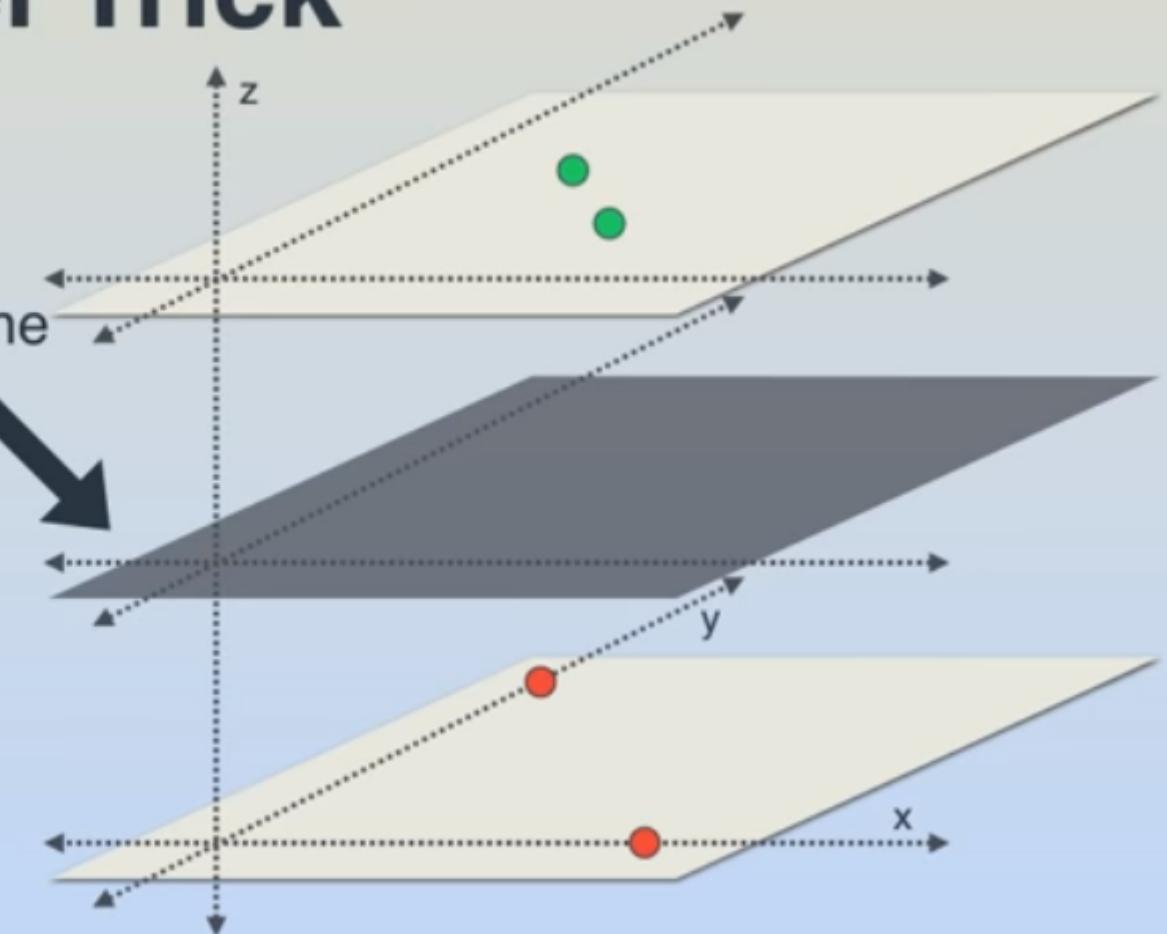


Kernel Trick

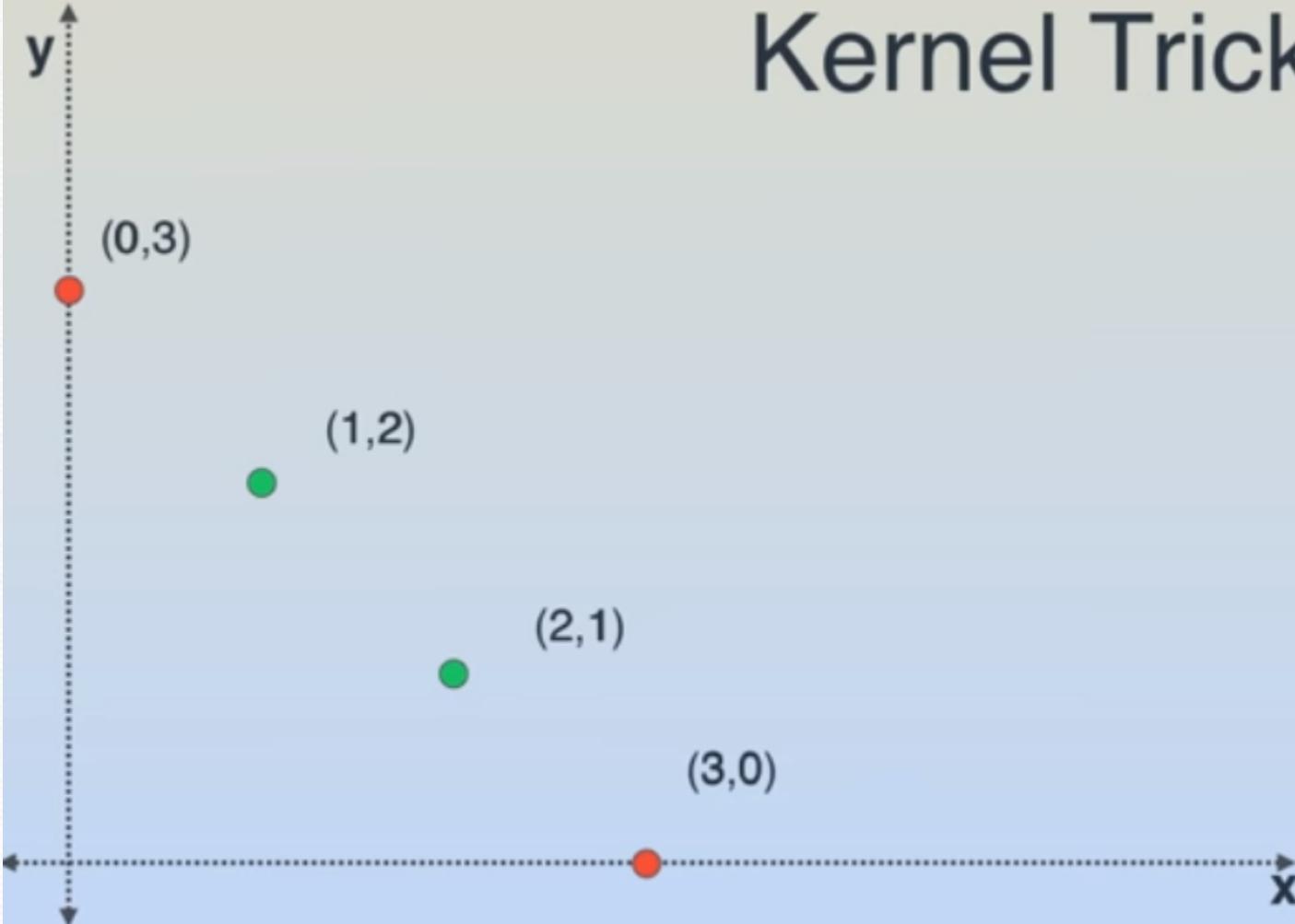


The same!

the plane

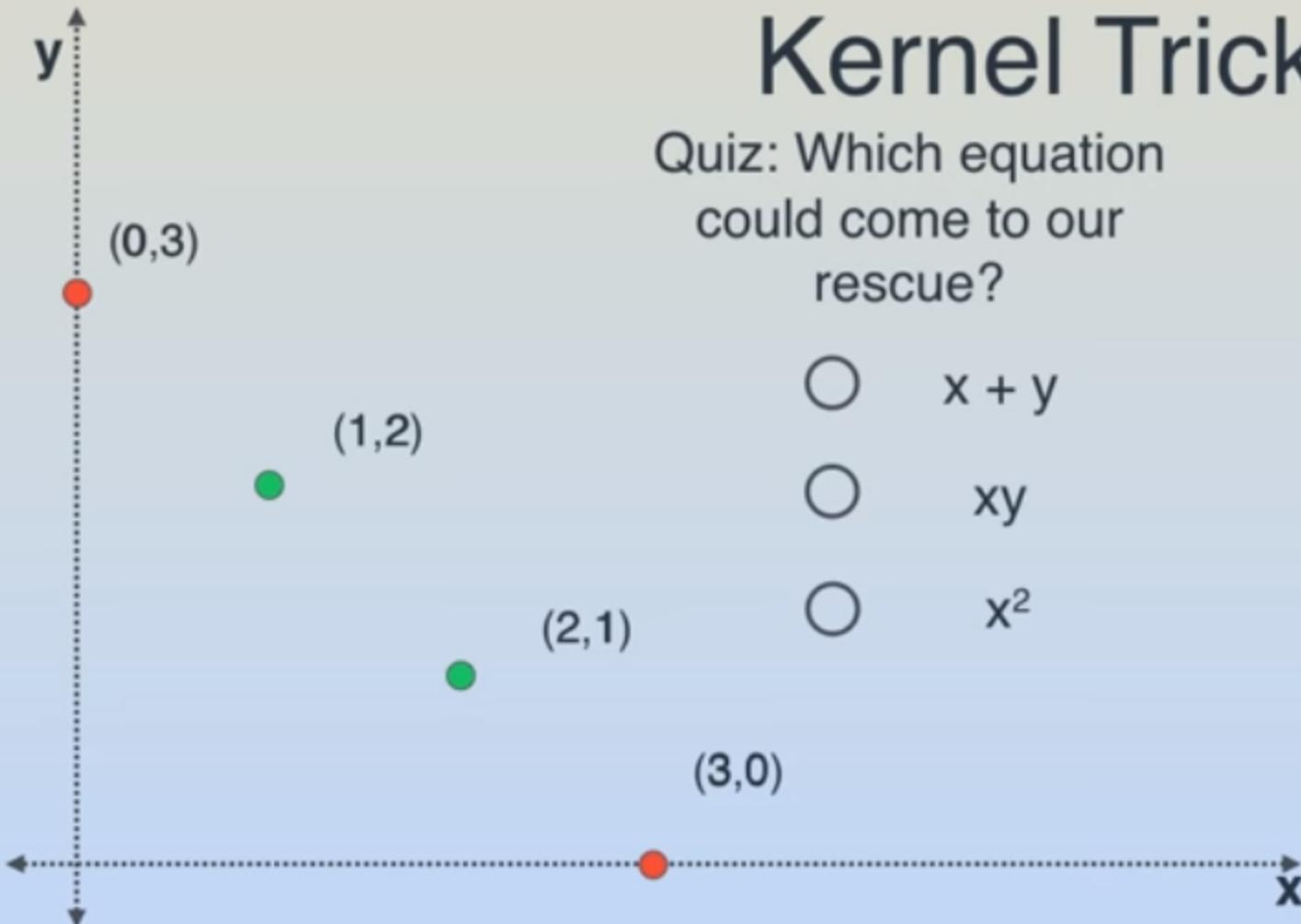


Kernel Trick



Kernel Trick

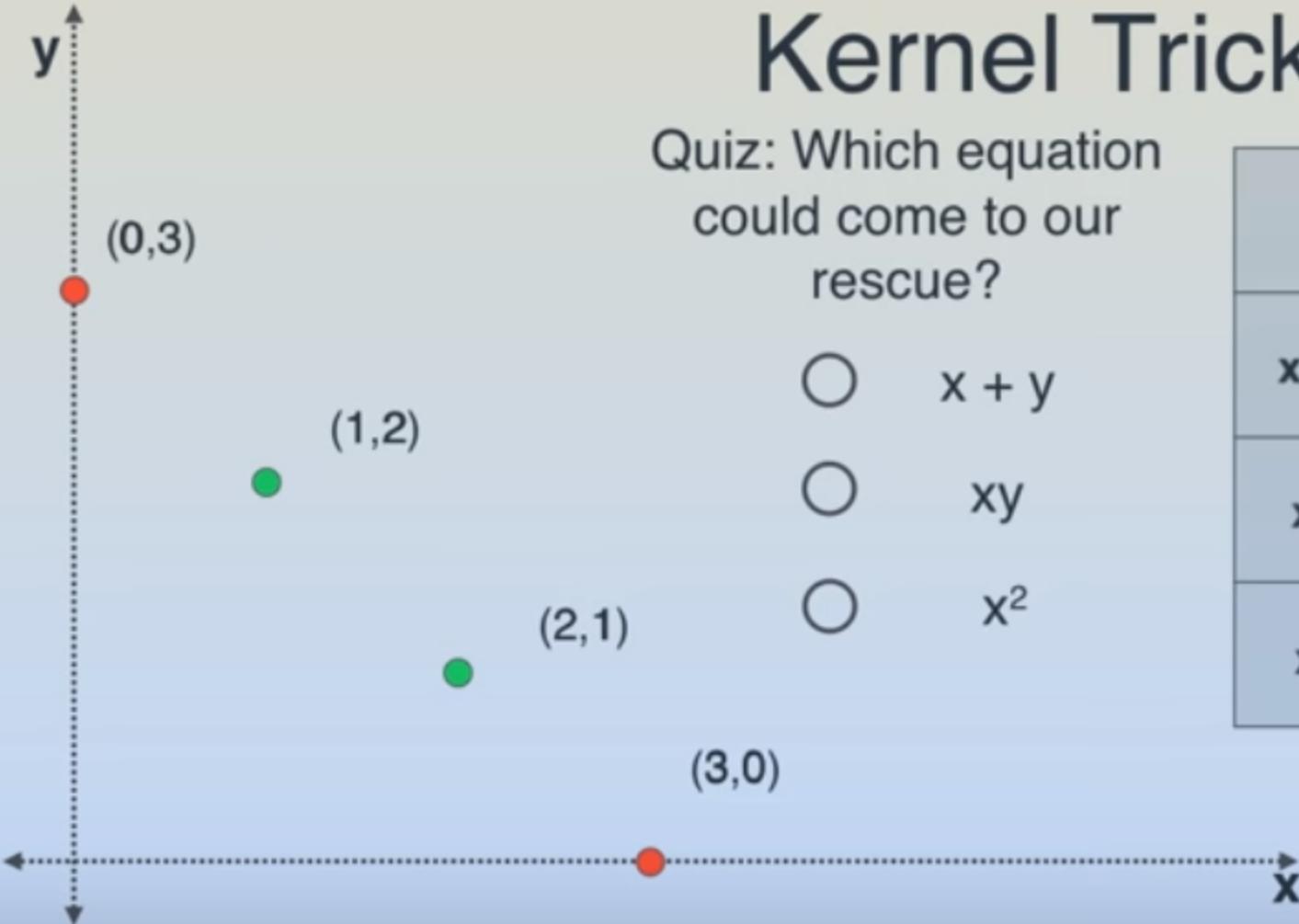
Quiz: Which equation
could come to our
rescue?



Kernel Trick

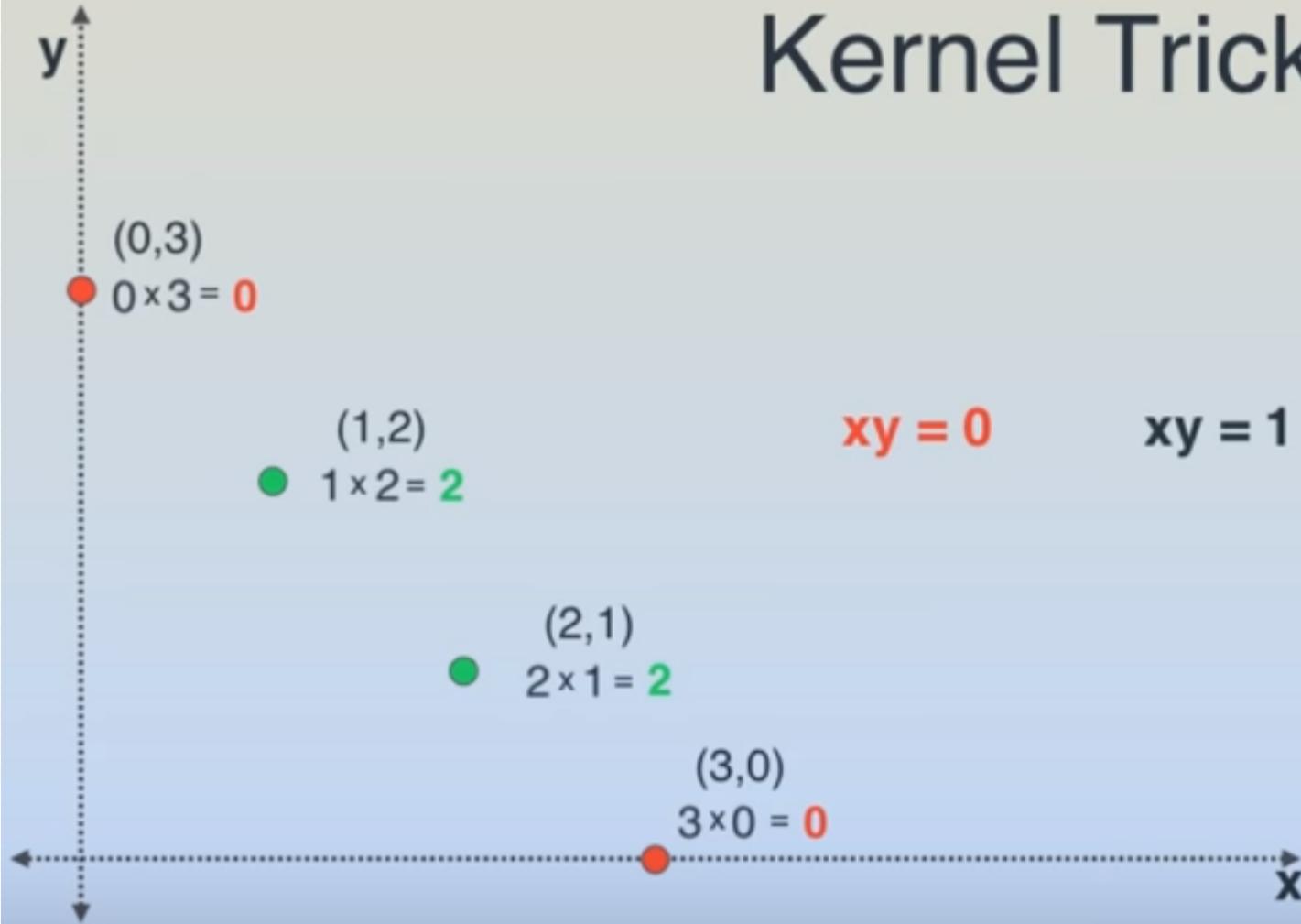
Quiz: Which equation could come to our rescue?

- $x + y$
- xy
- x^2

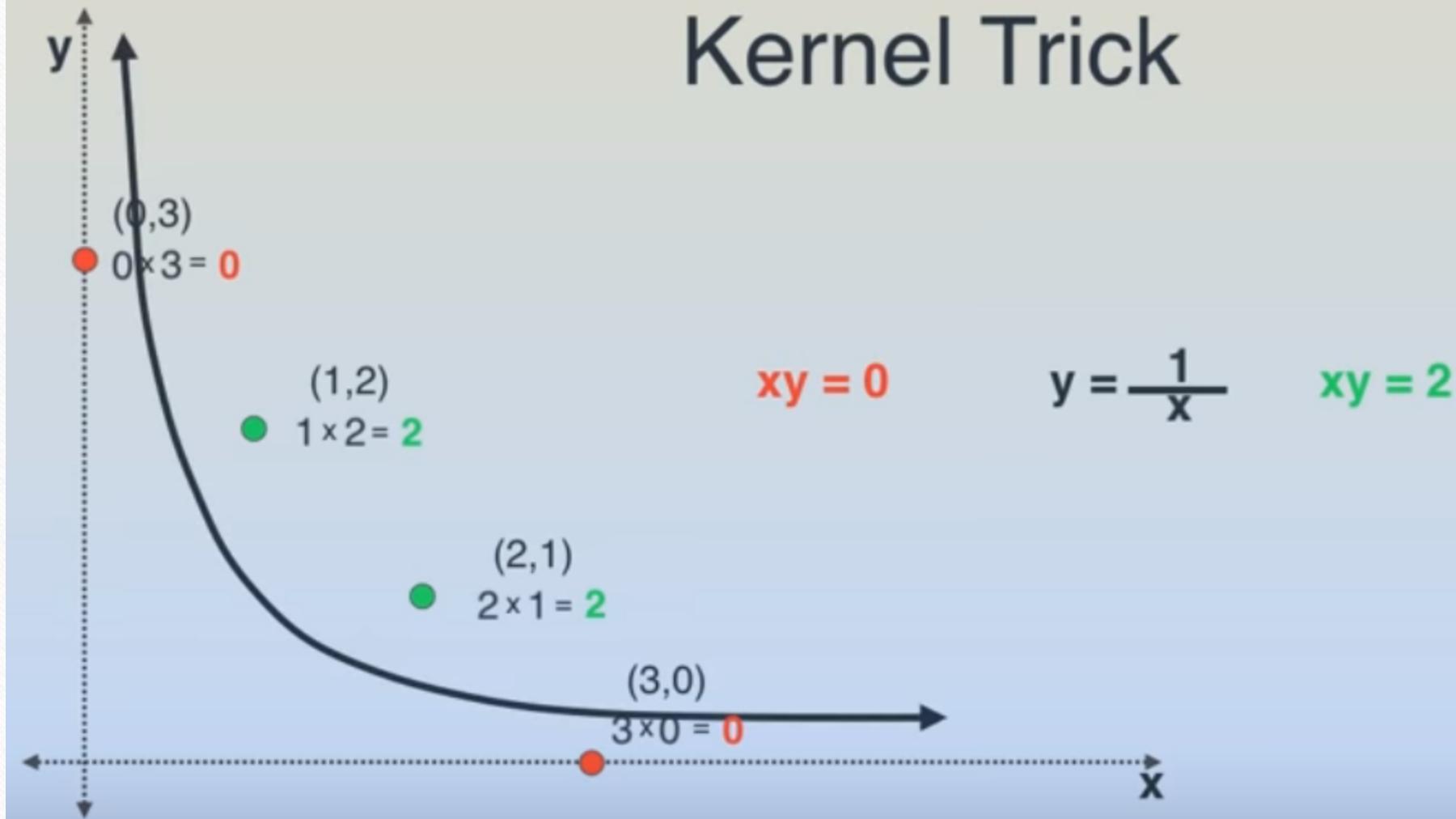


	(0,3)	(1,2)	(2,1)	(3,0)
$x+y$	3	3	3	3
xy	0	2	2	0
x^2	0	1	4	9

Kernel Trick



Kernel Trick

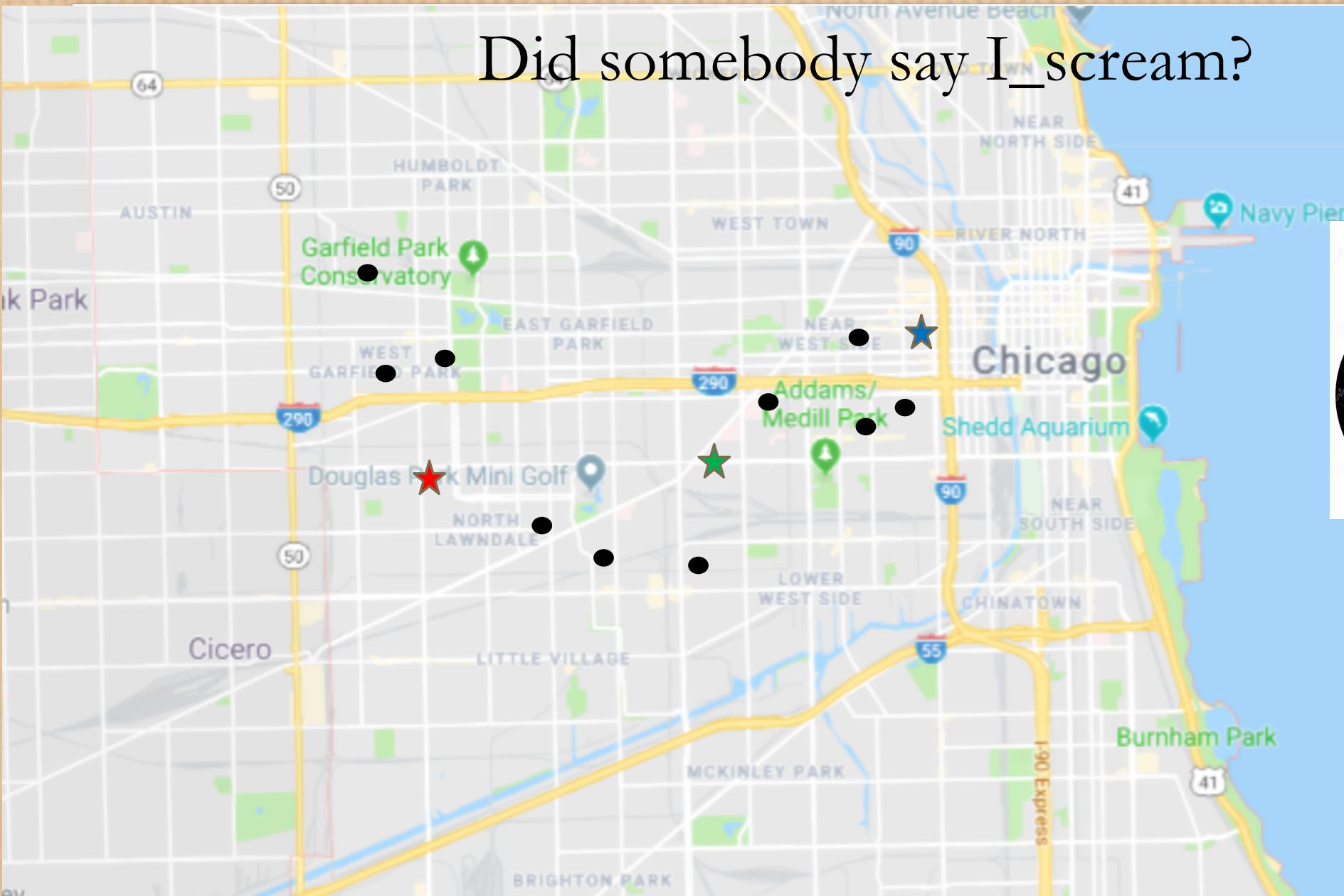


Kernel Trick

$$\begin{aligned}(x,y) &\longrightarrow (x,y,xy) \\(0,3) &\longrightarrow (0,3,0) \\(1,2) &\longrightarrow (1,2,2) \\(2,1) &\longrightarrow (2,1,2) \\(3,0) &\longrightarrow (3,0,0)\end{aligned}$$



Did somebody say I_scream?



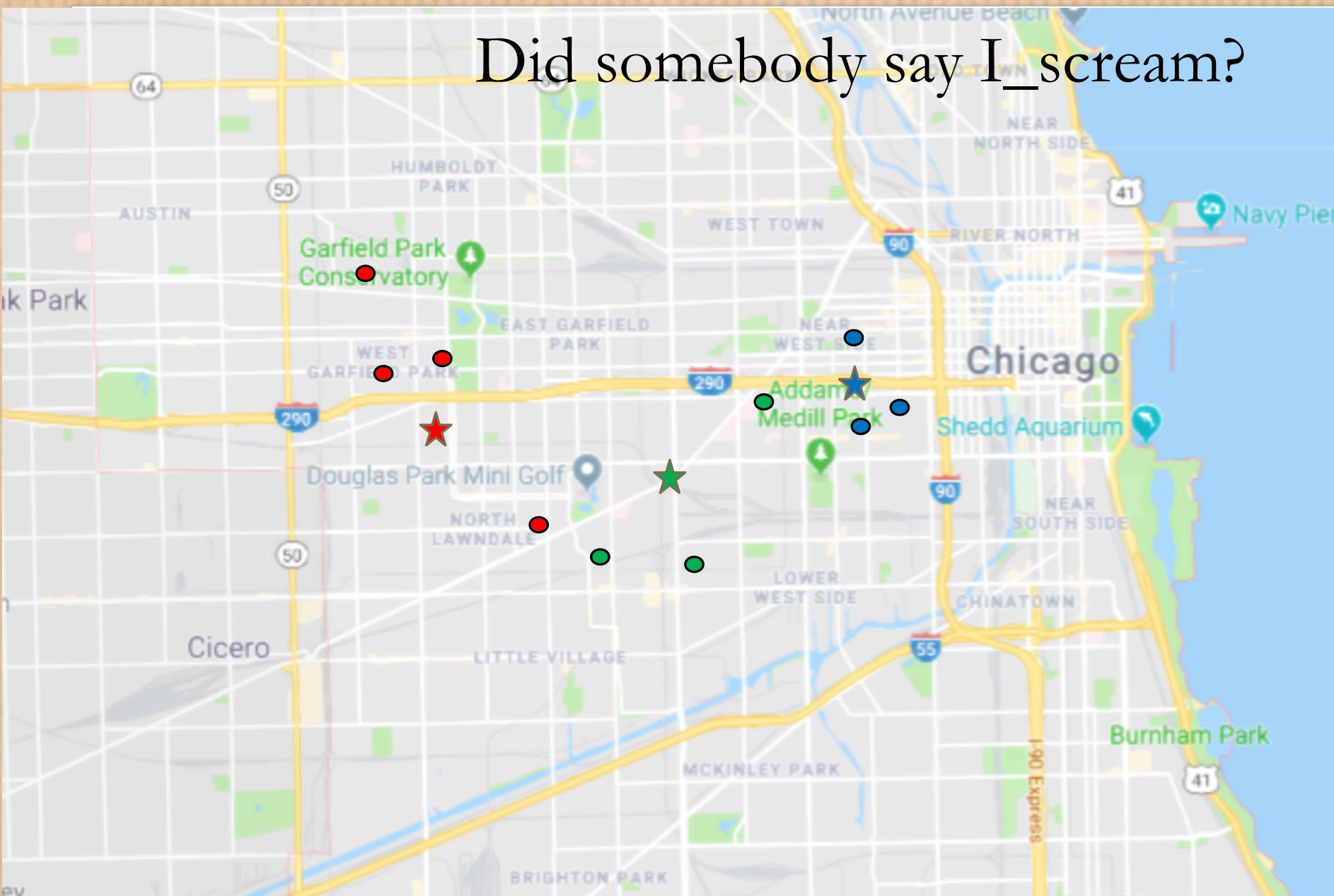
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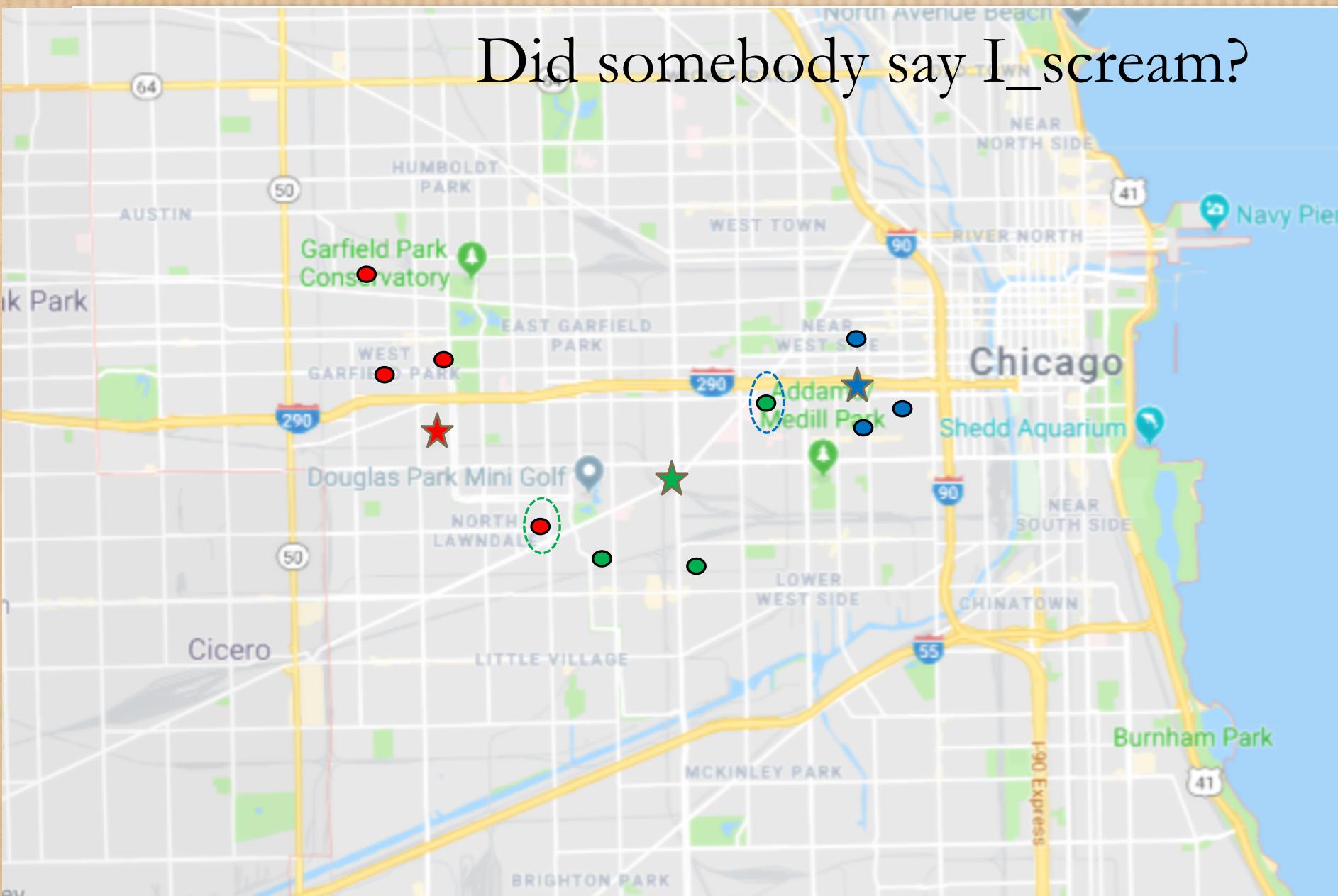
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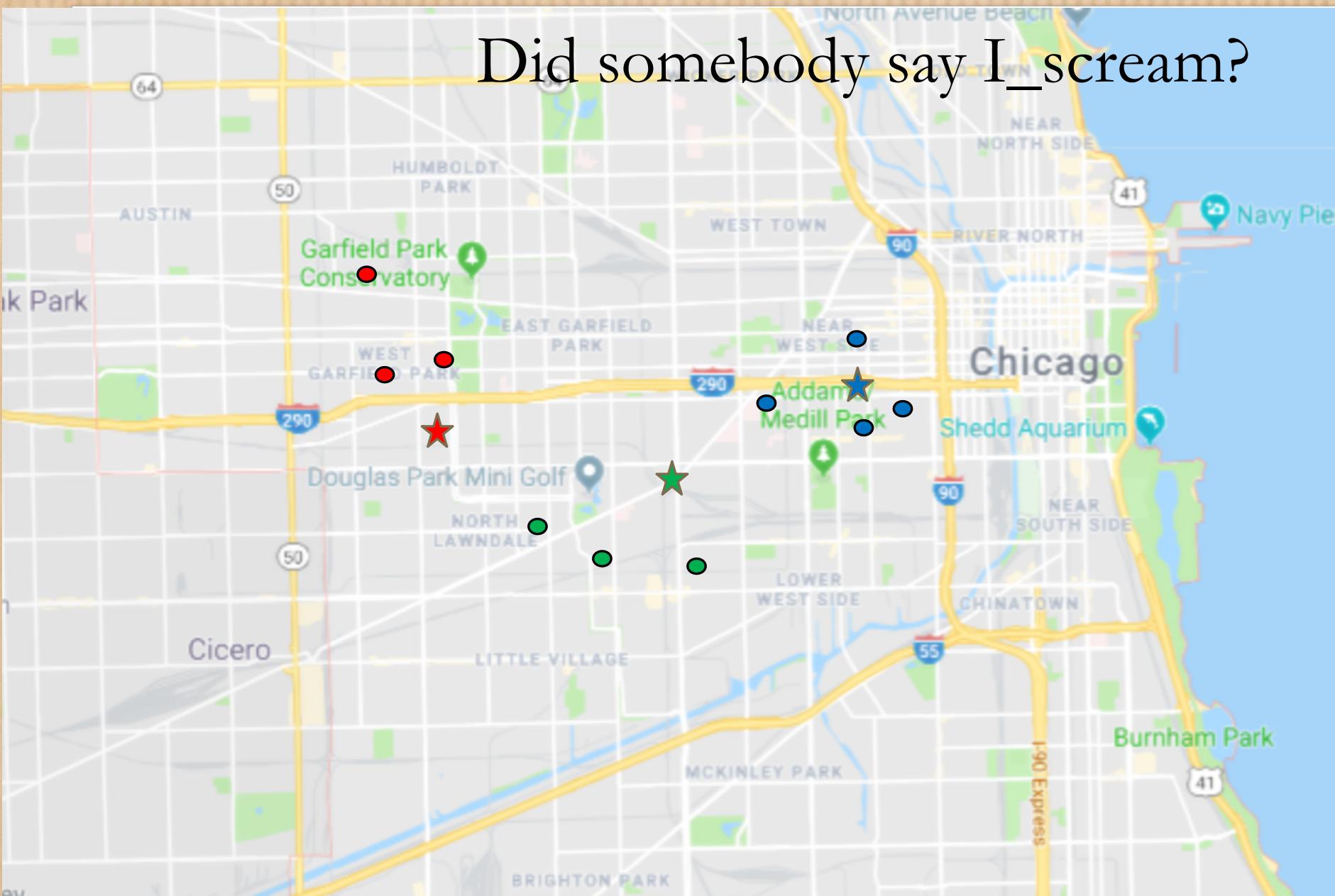
Did somebody say I_scream?



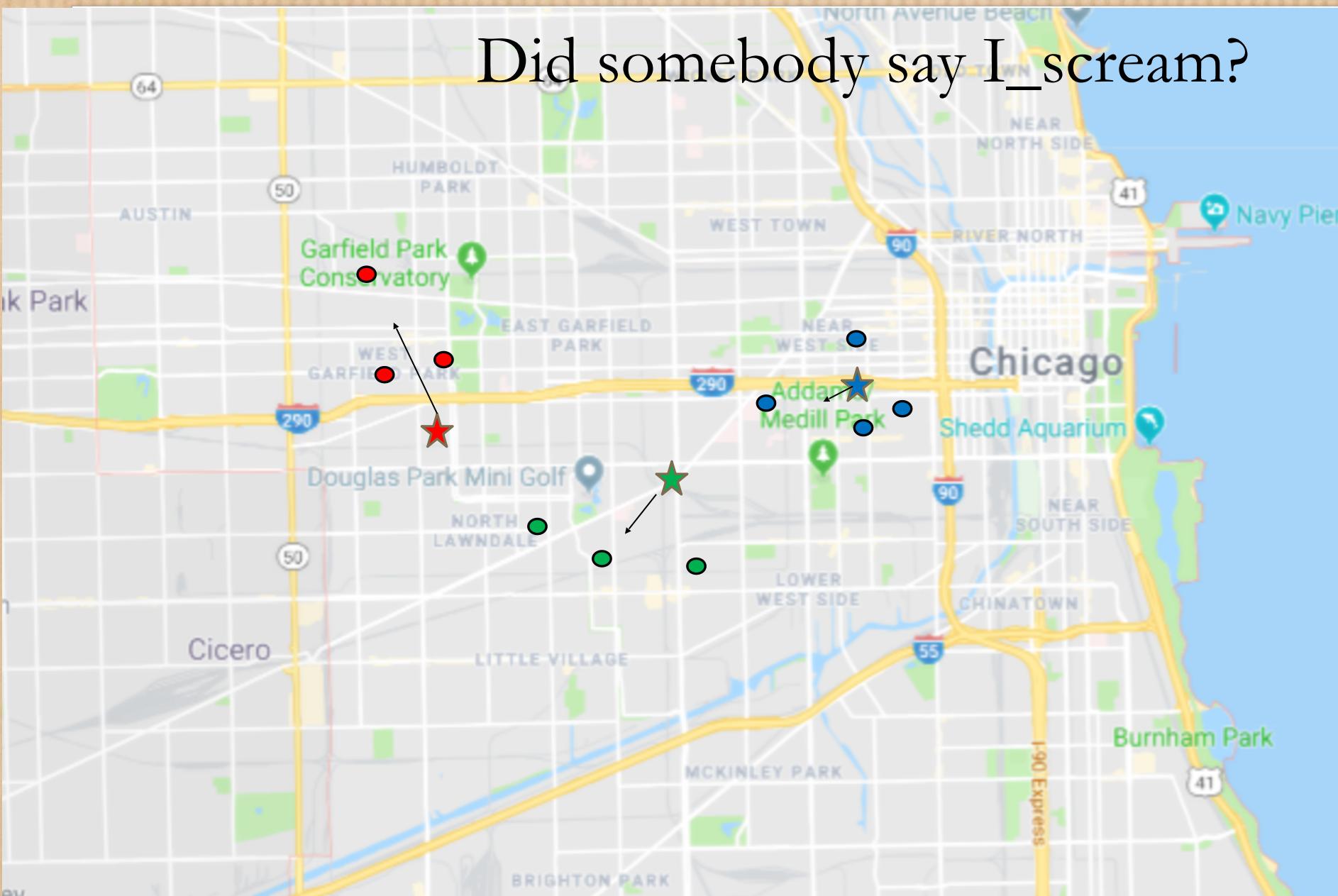
Did somebody say I_scream?



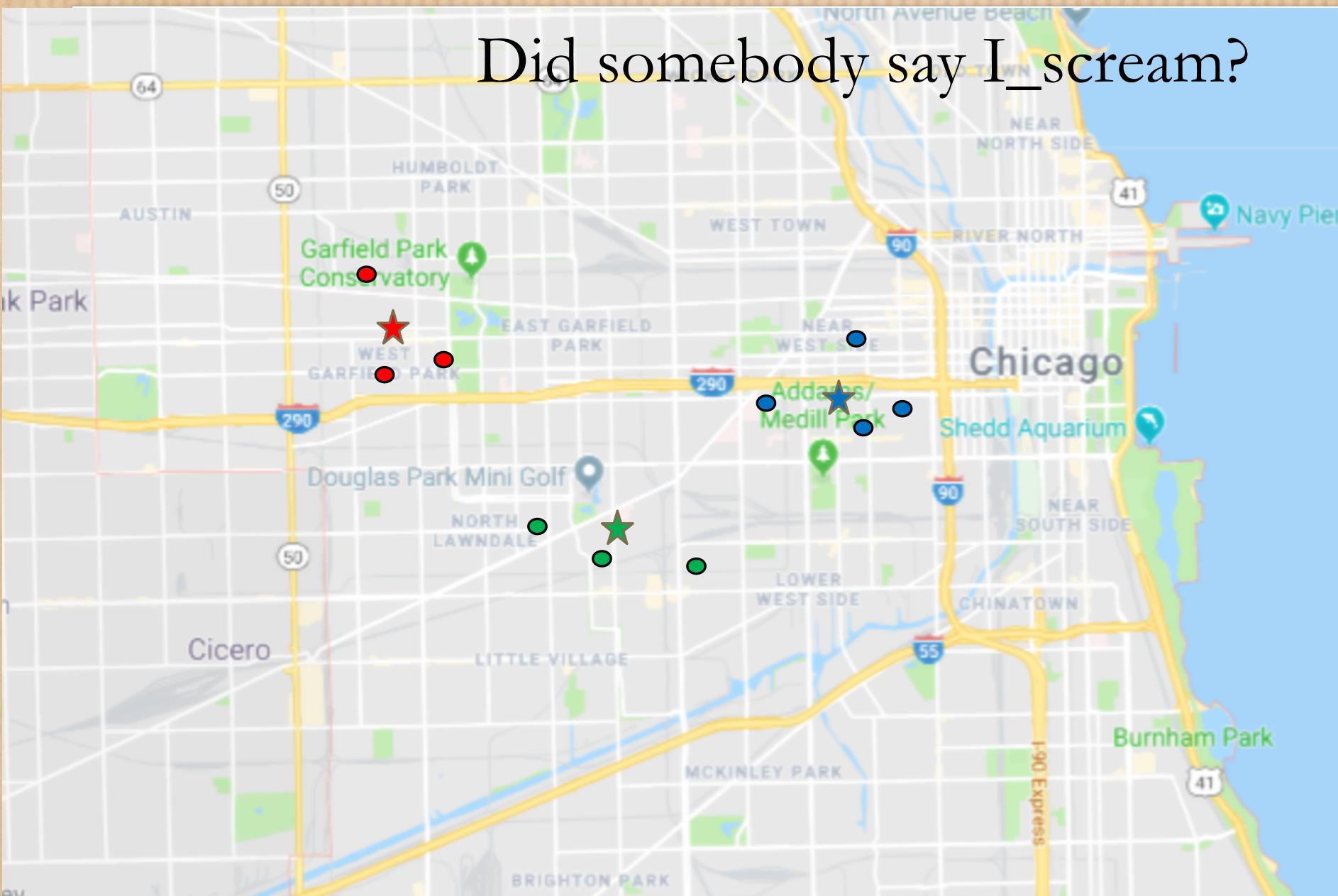
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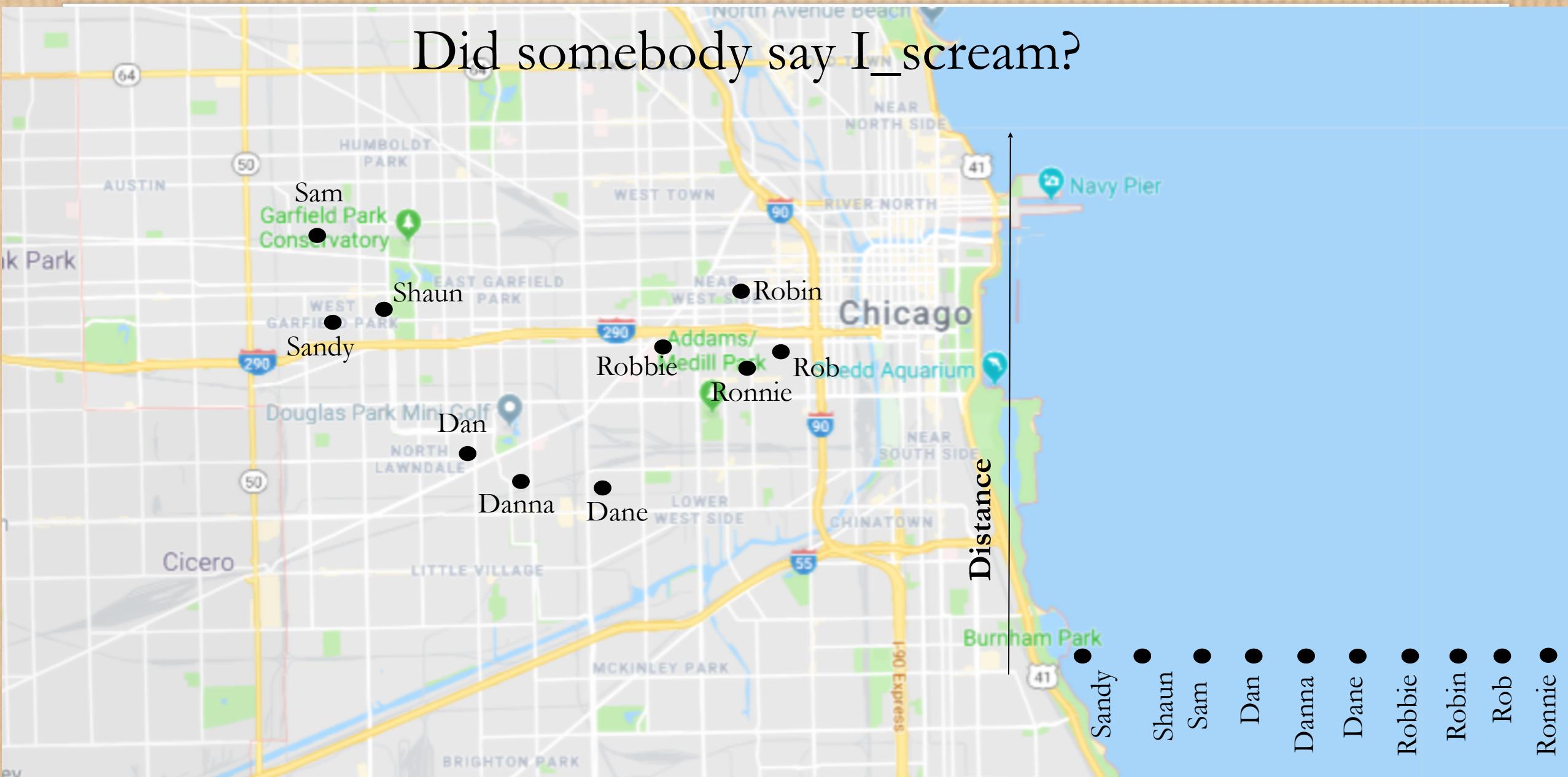
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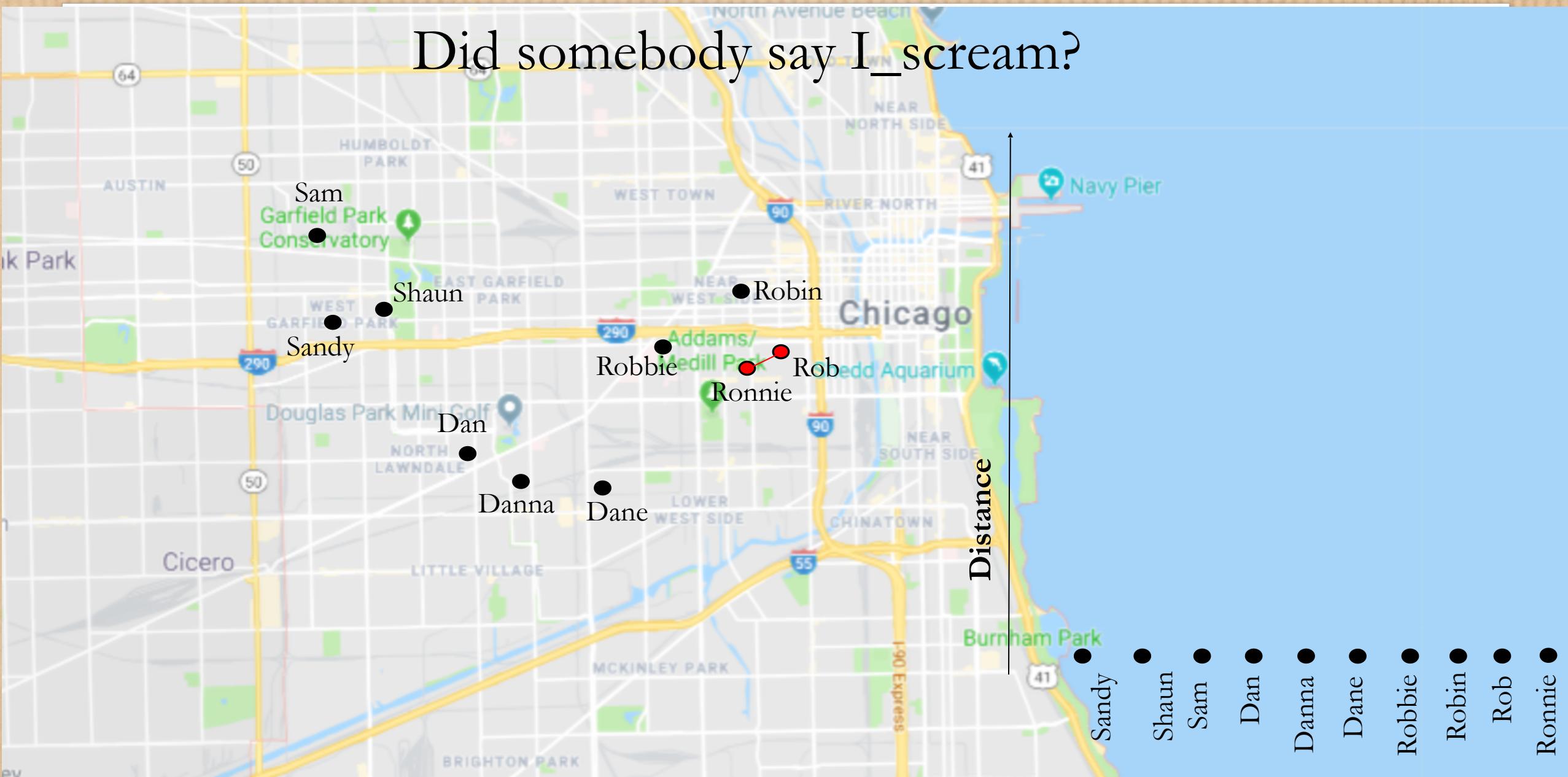
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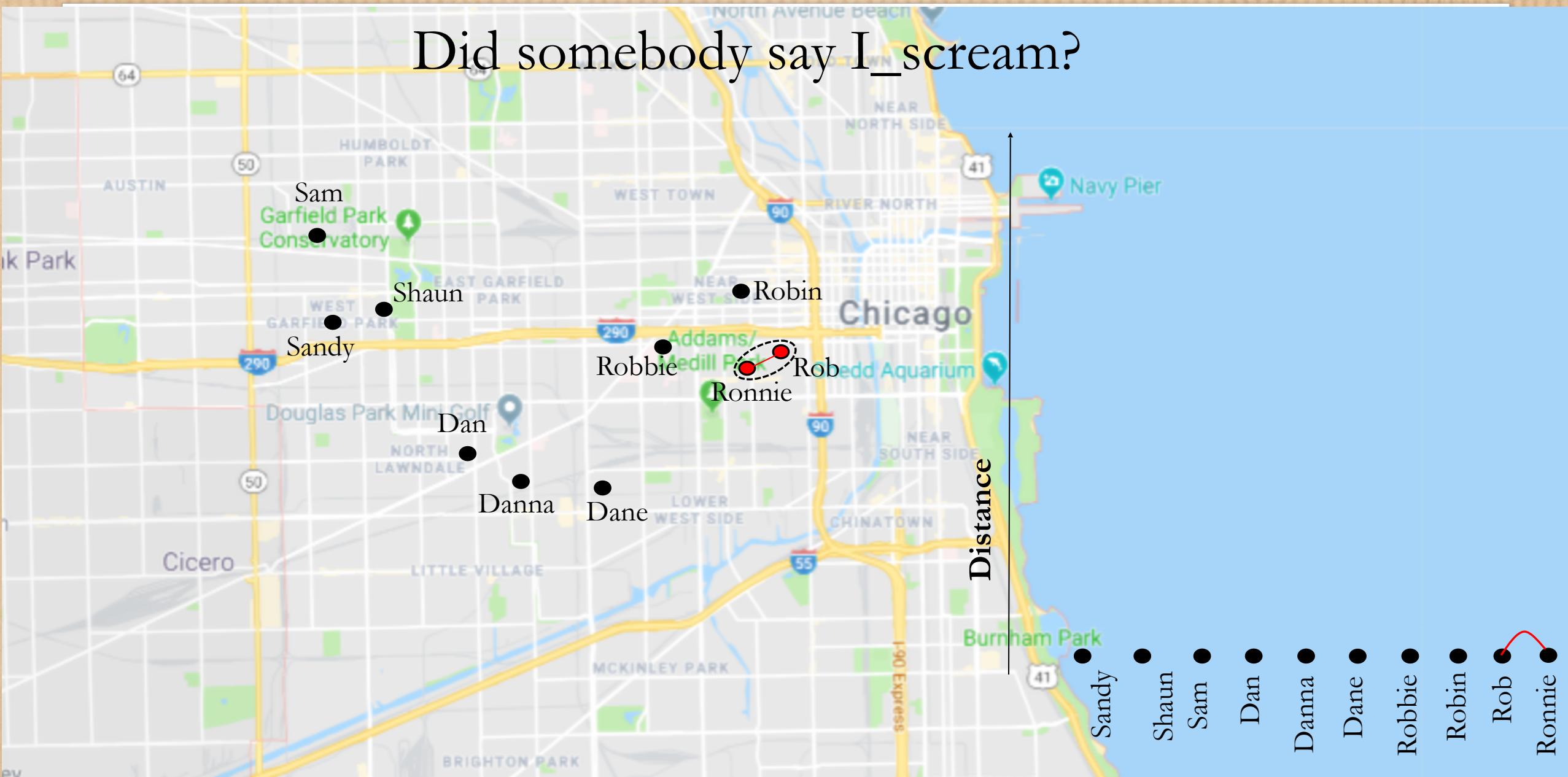
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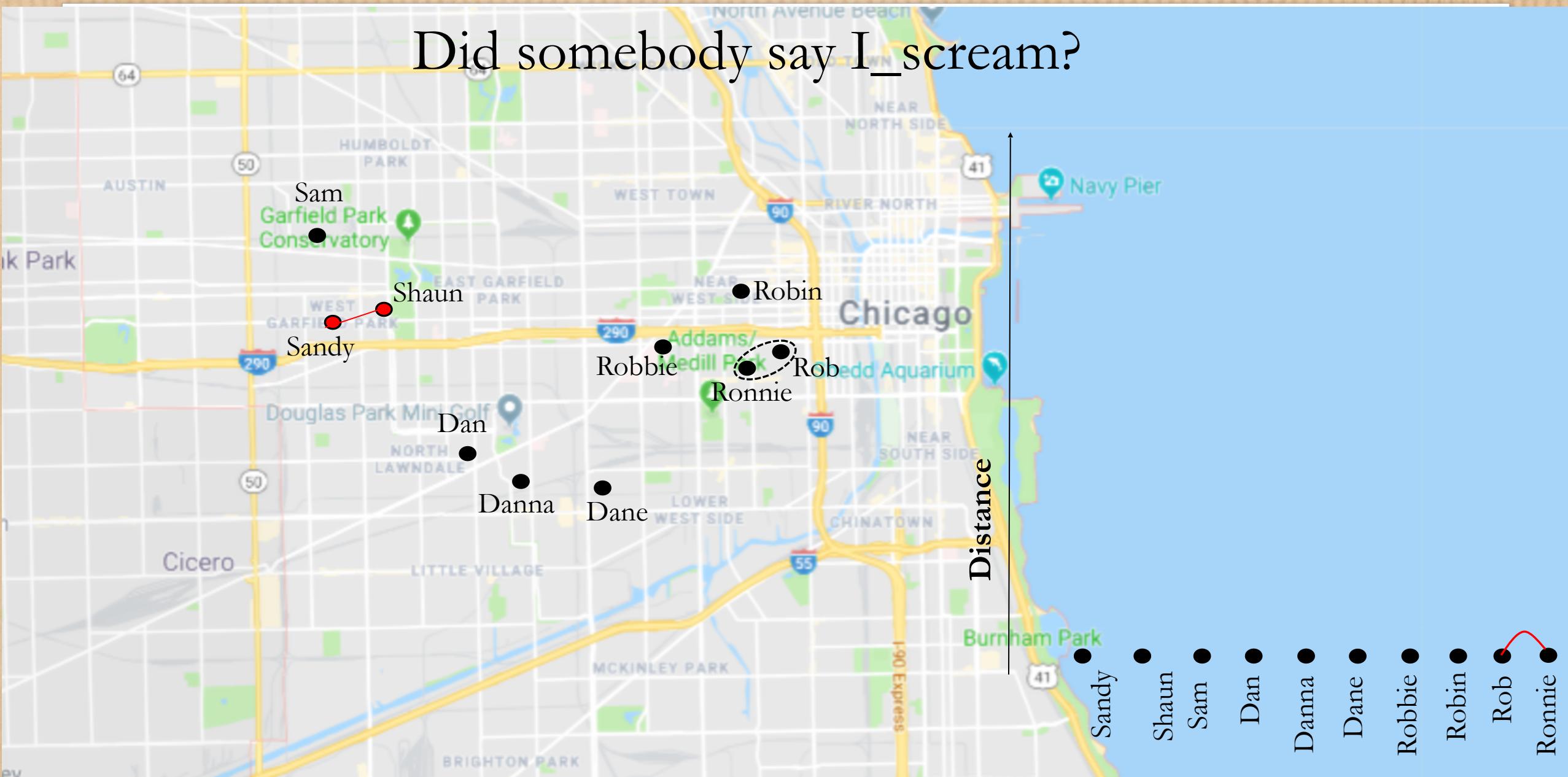
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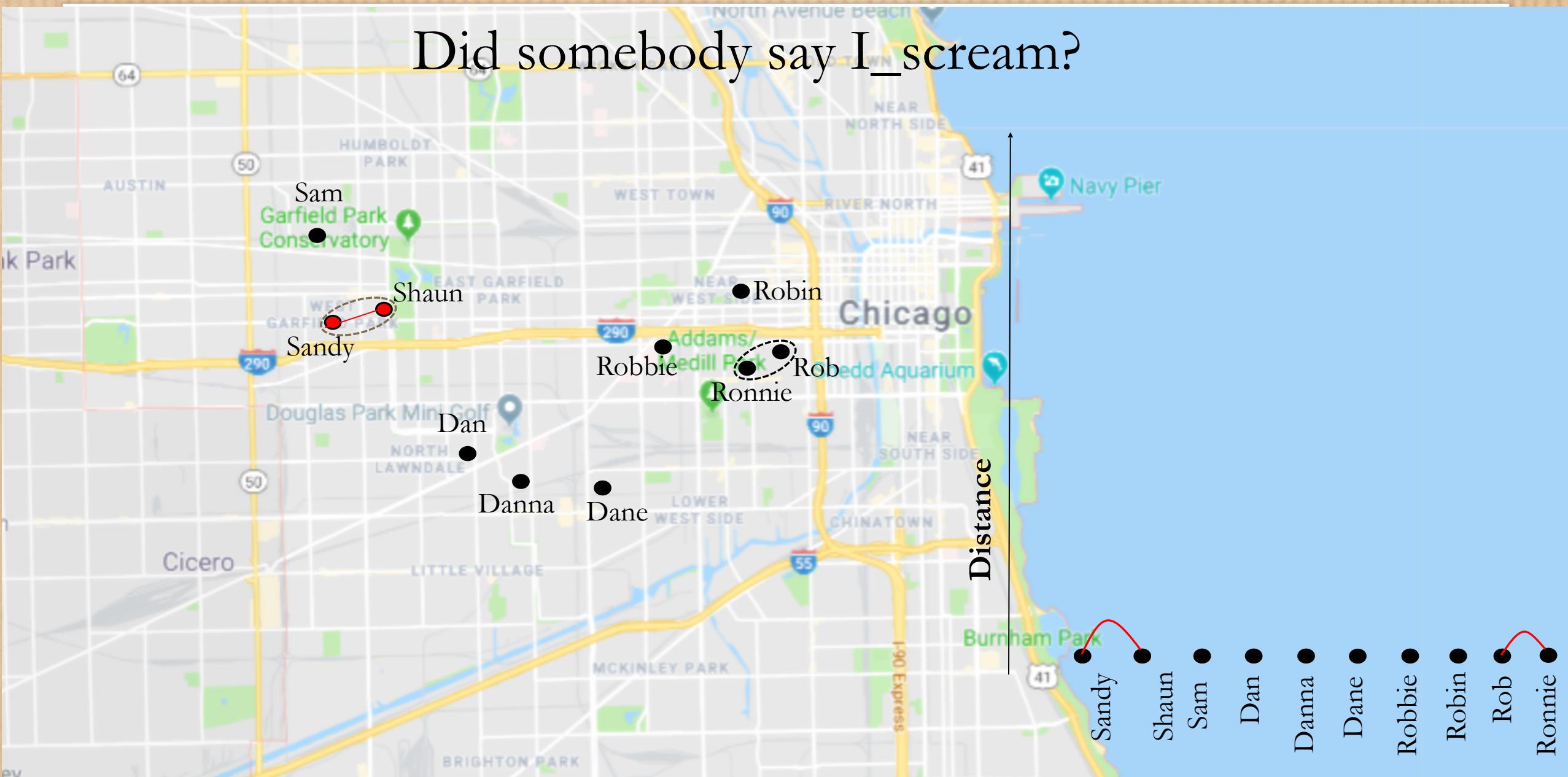
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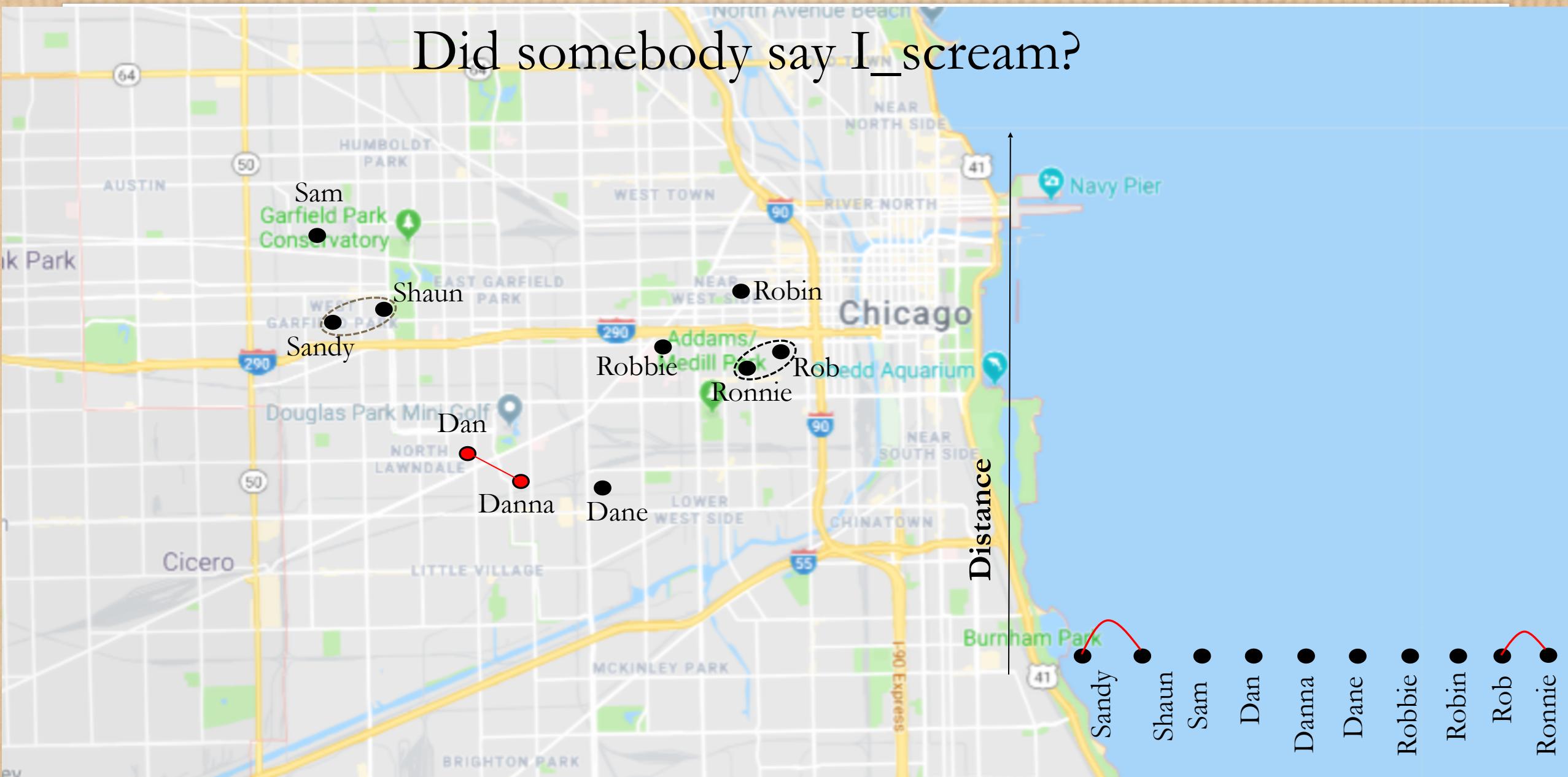
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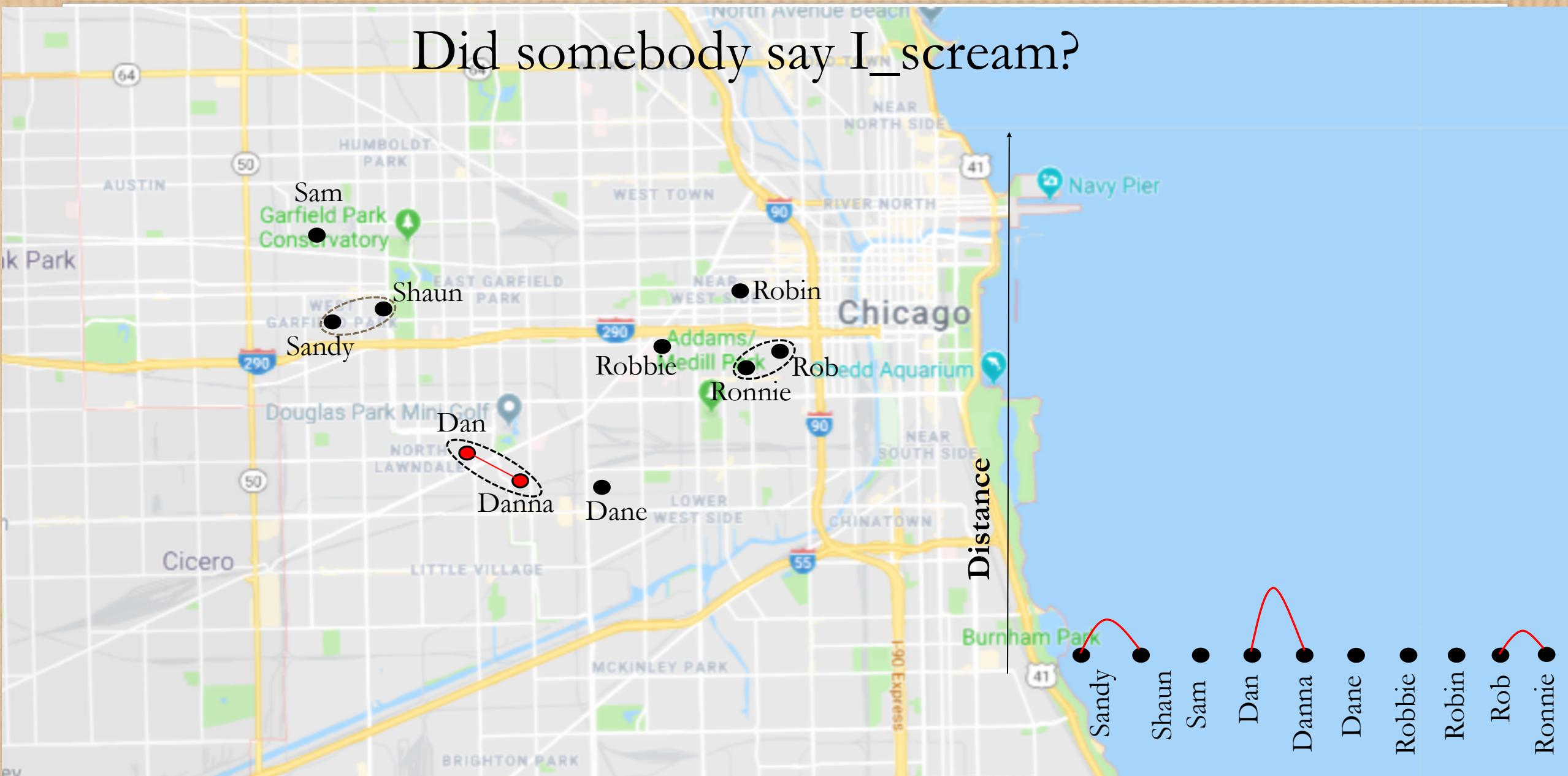
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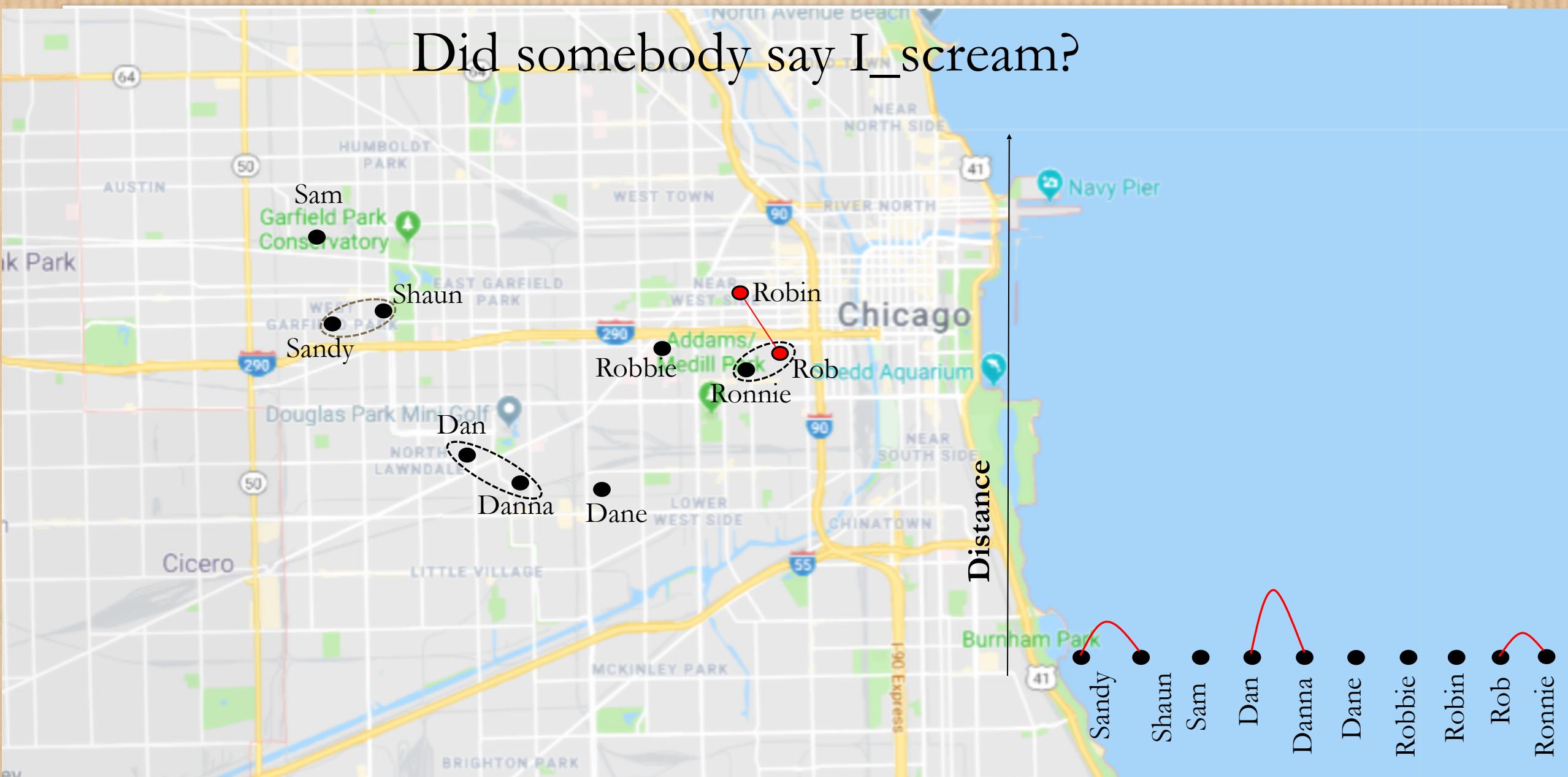
Did somebody say I_scream?



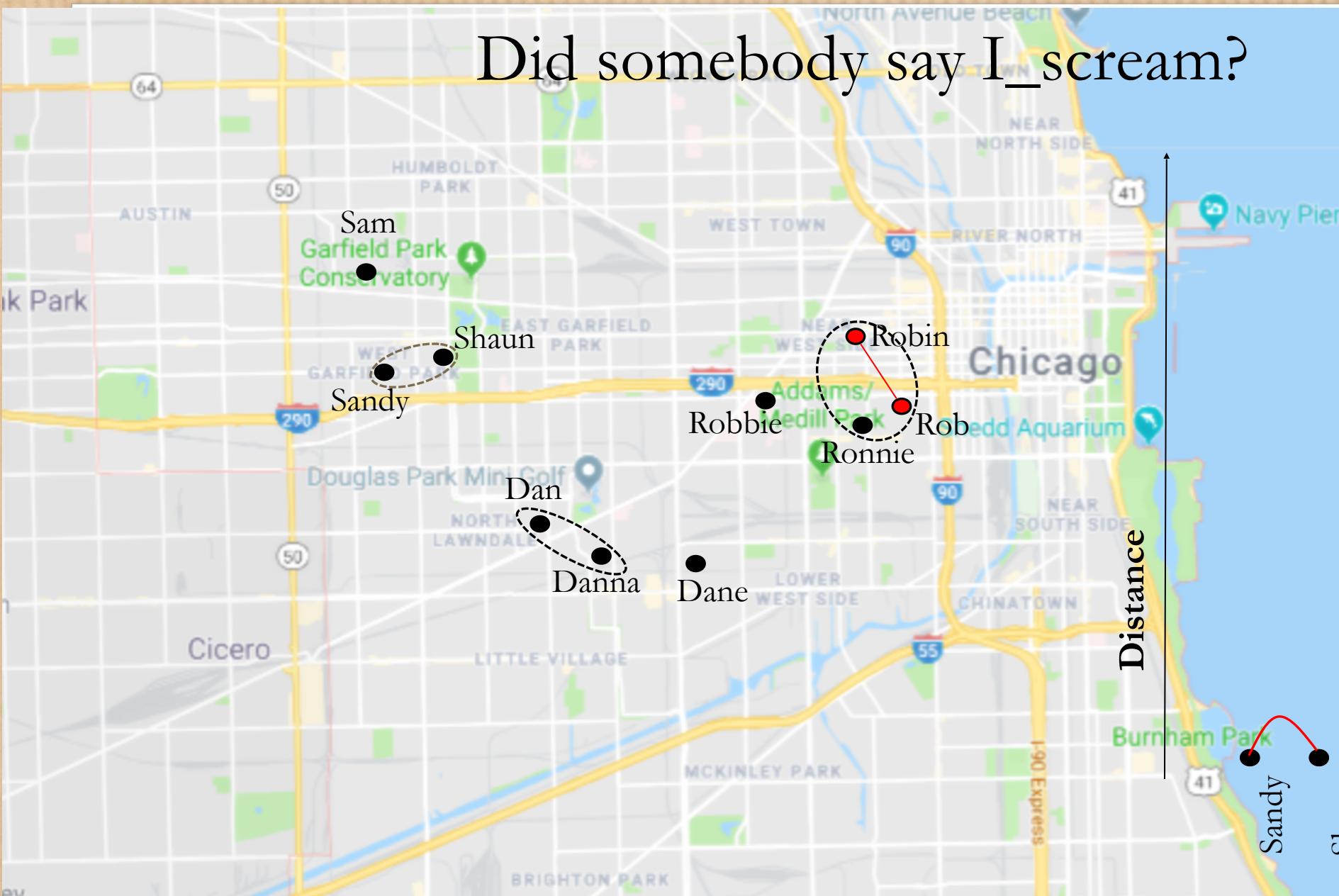
Did somebody say I_scream?



Did somebody say I_scream?



Did somebody say I_scream?



Distance

Burnham Park

Sandy

Shaun

Sam

Dan

Danna

Dane

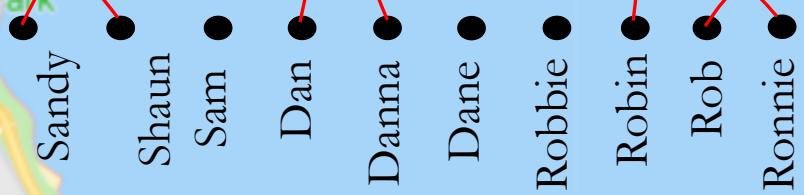
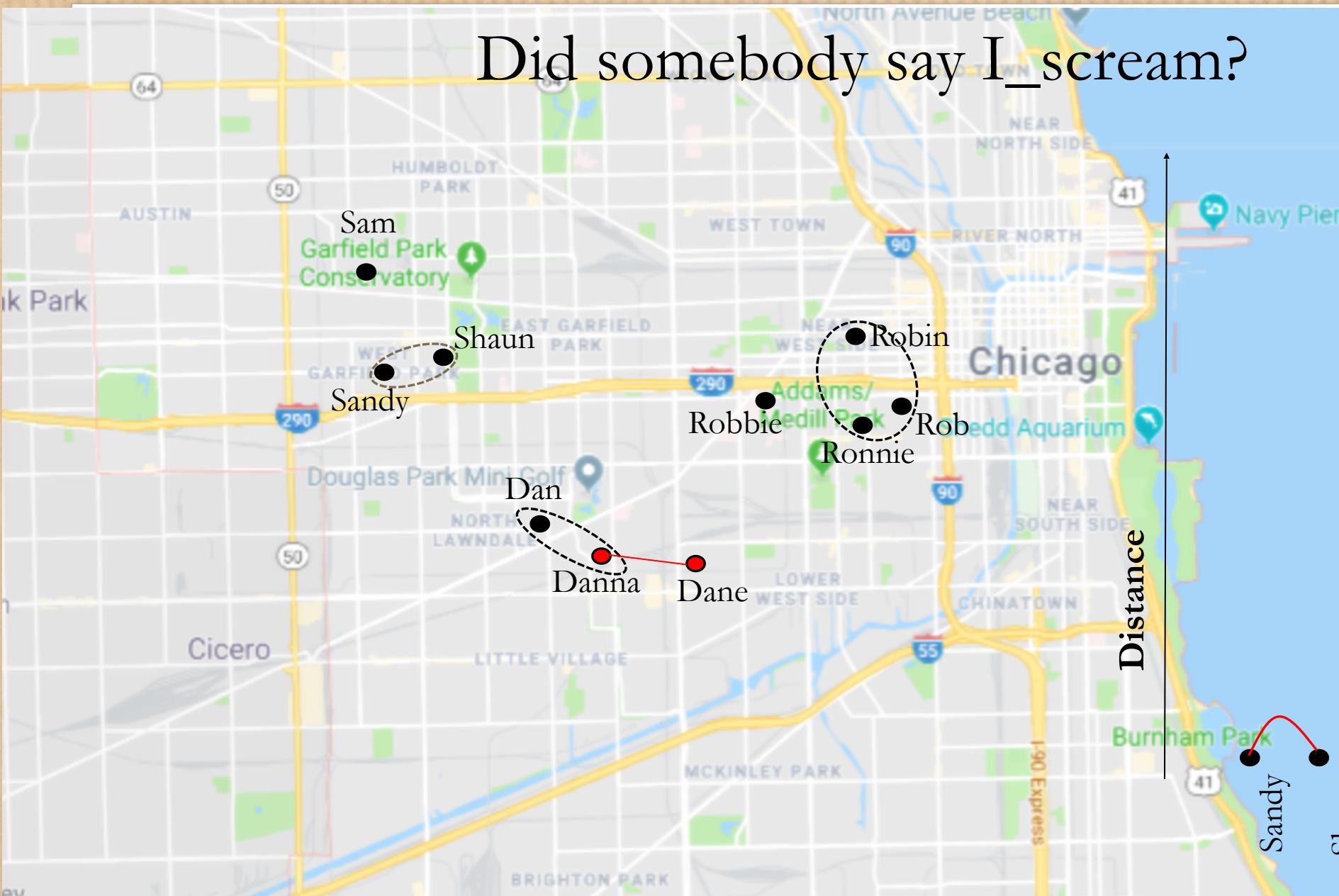
Robbie

Robin

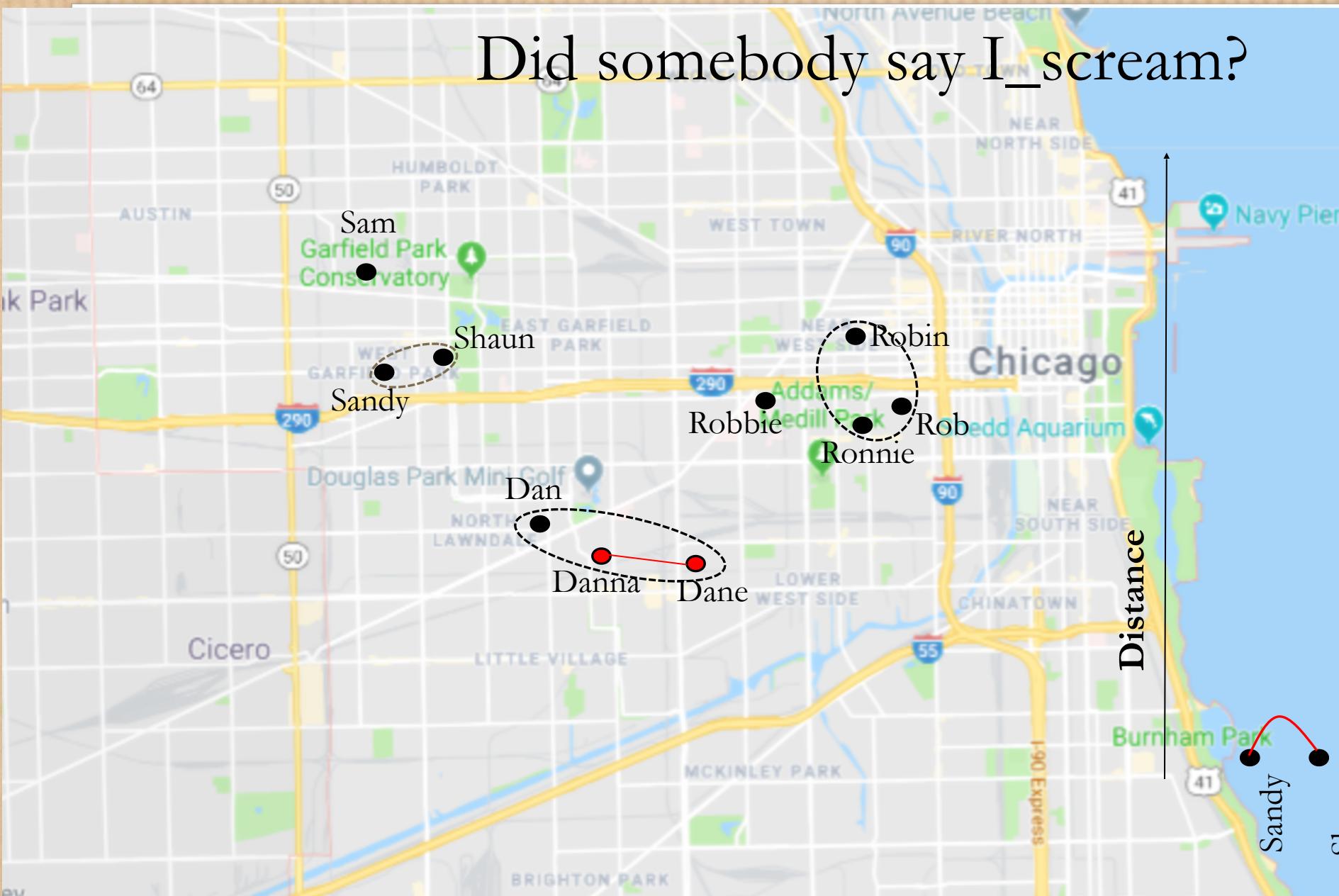
Rob

Ronnie

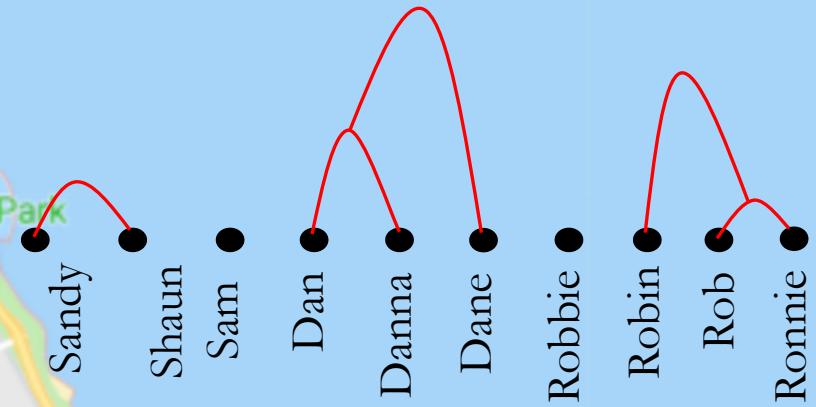
Did somebody say I_scream?



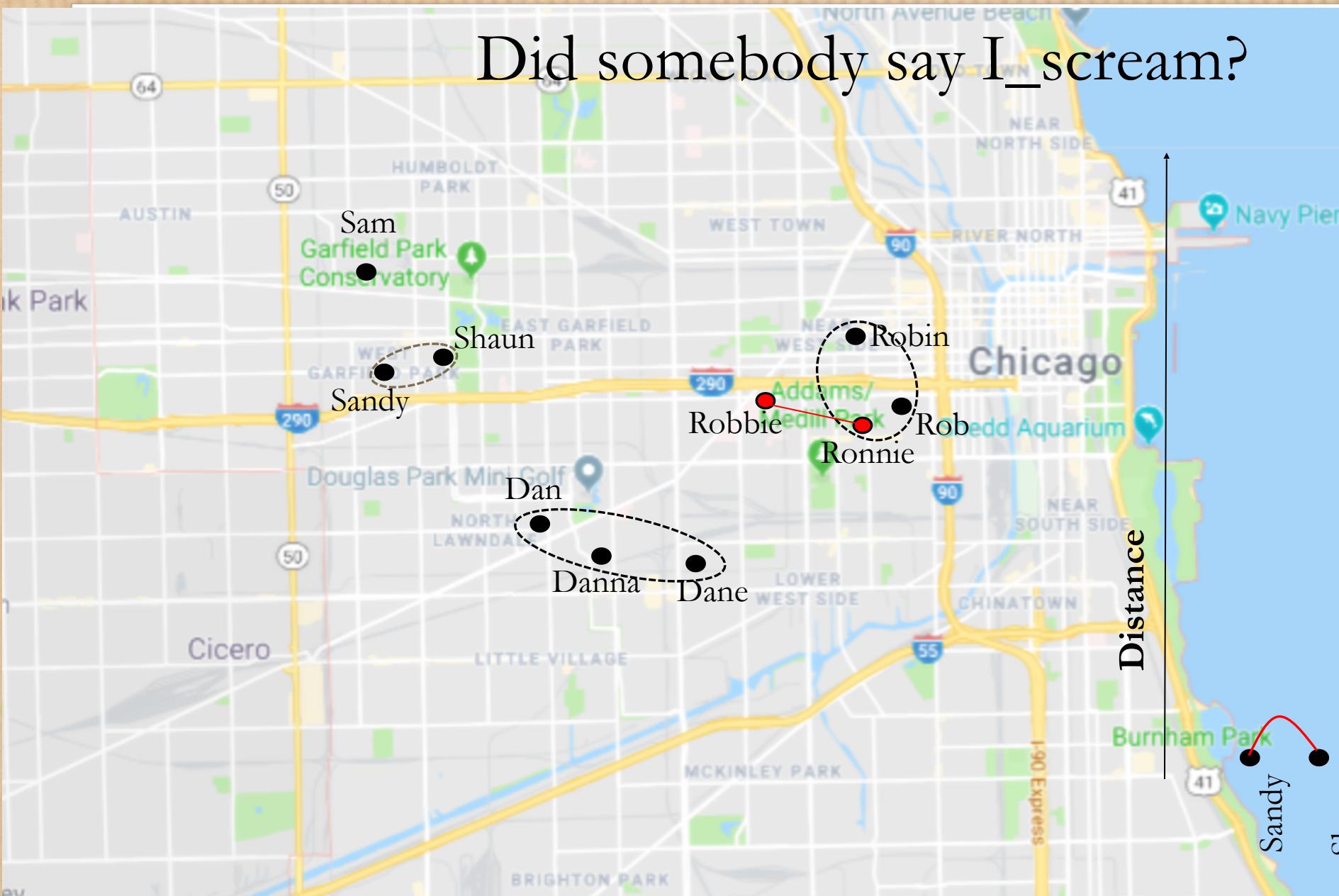
Did somebody say I_scream?



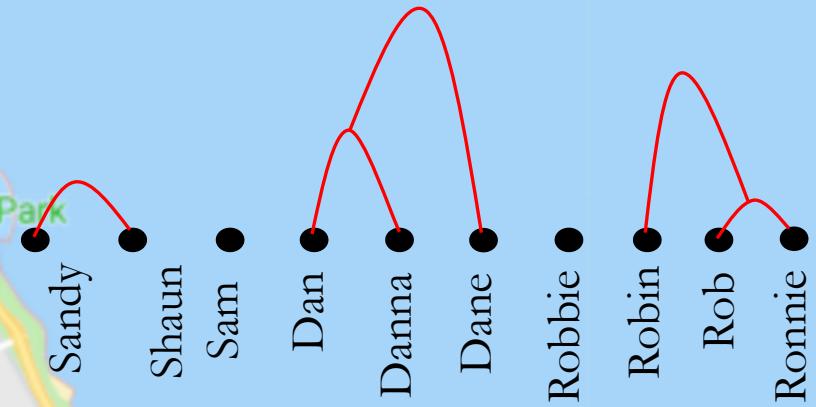
Distance



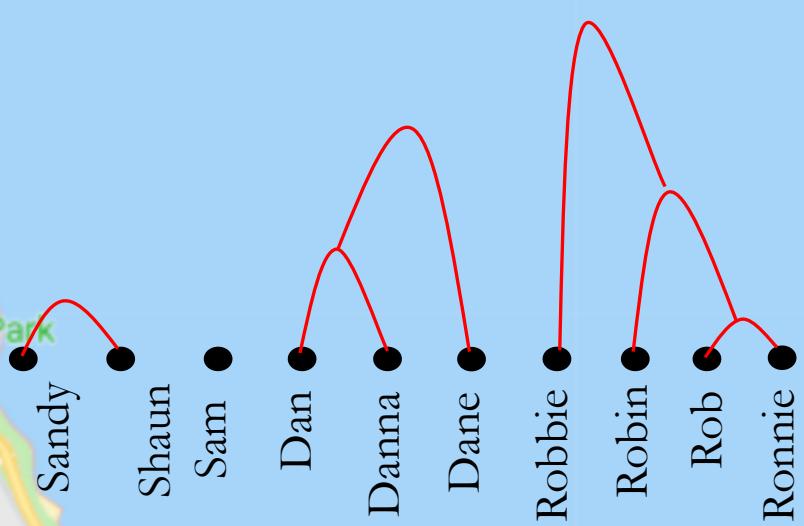
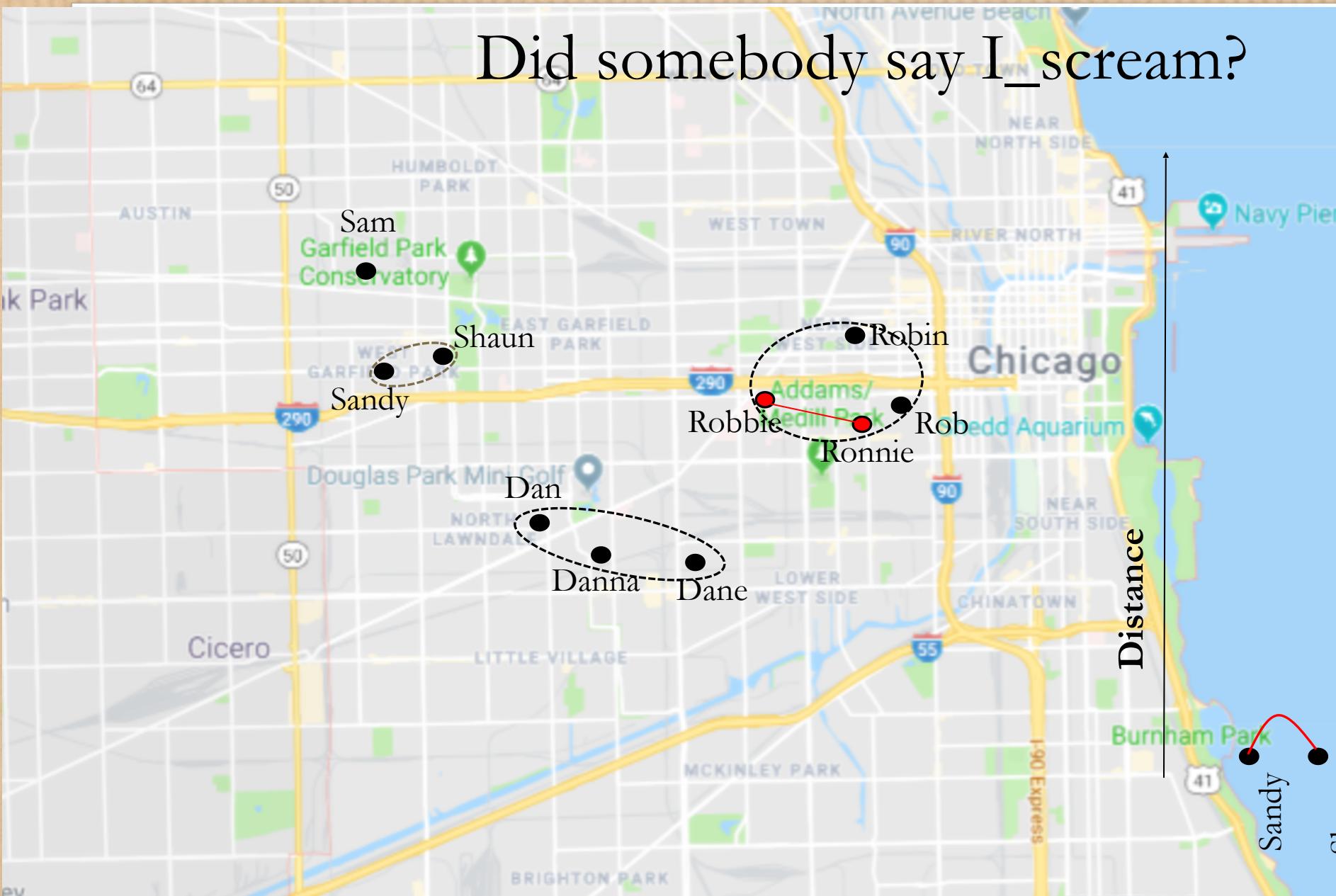
Did somebody say I_scream?



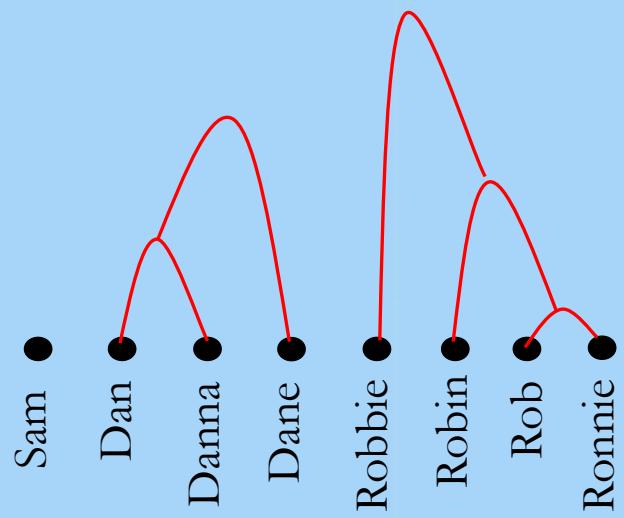
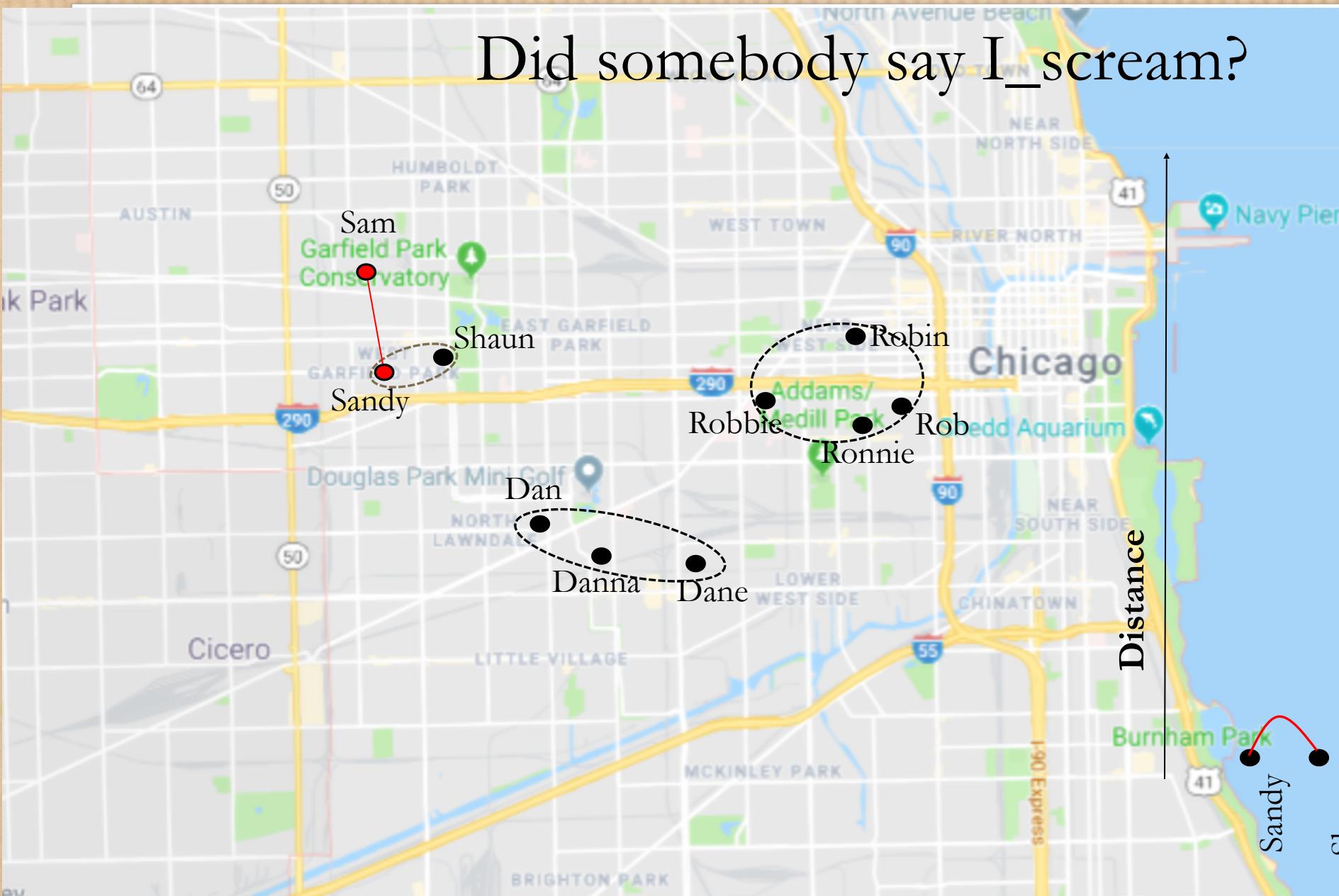
Distance



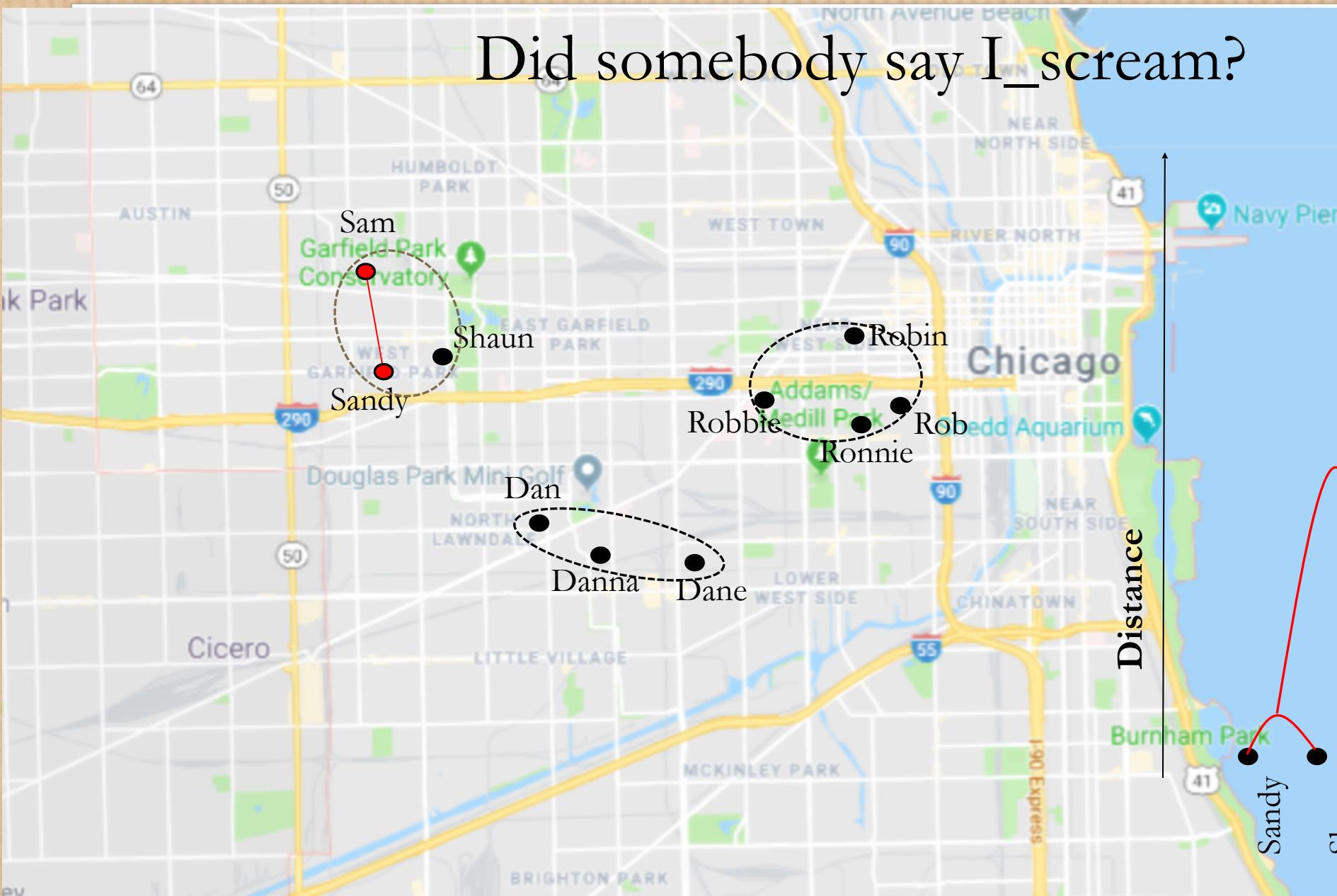
Did somebody say I_scream?



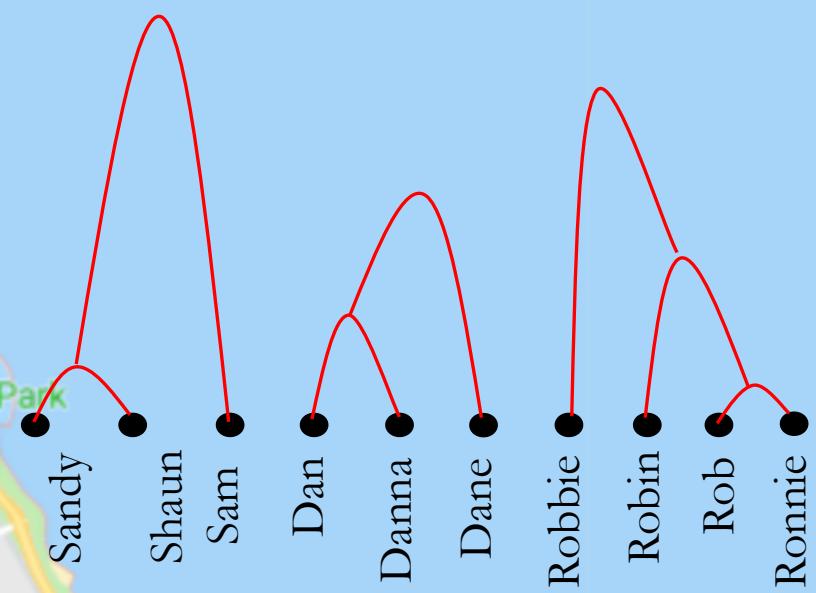
Did somebody say I_scream?



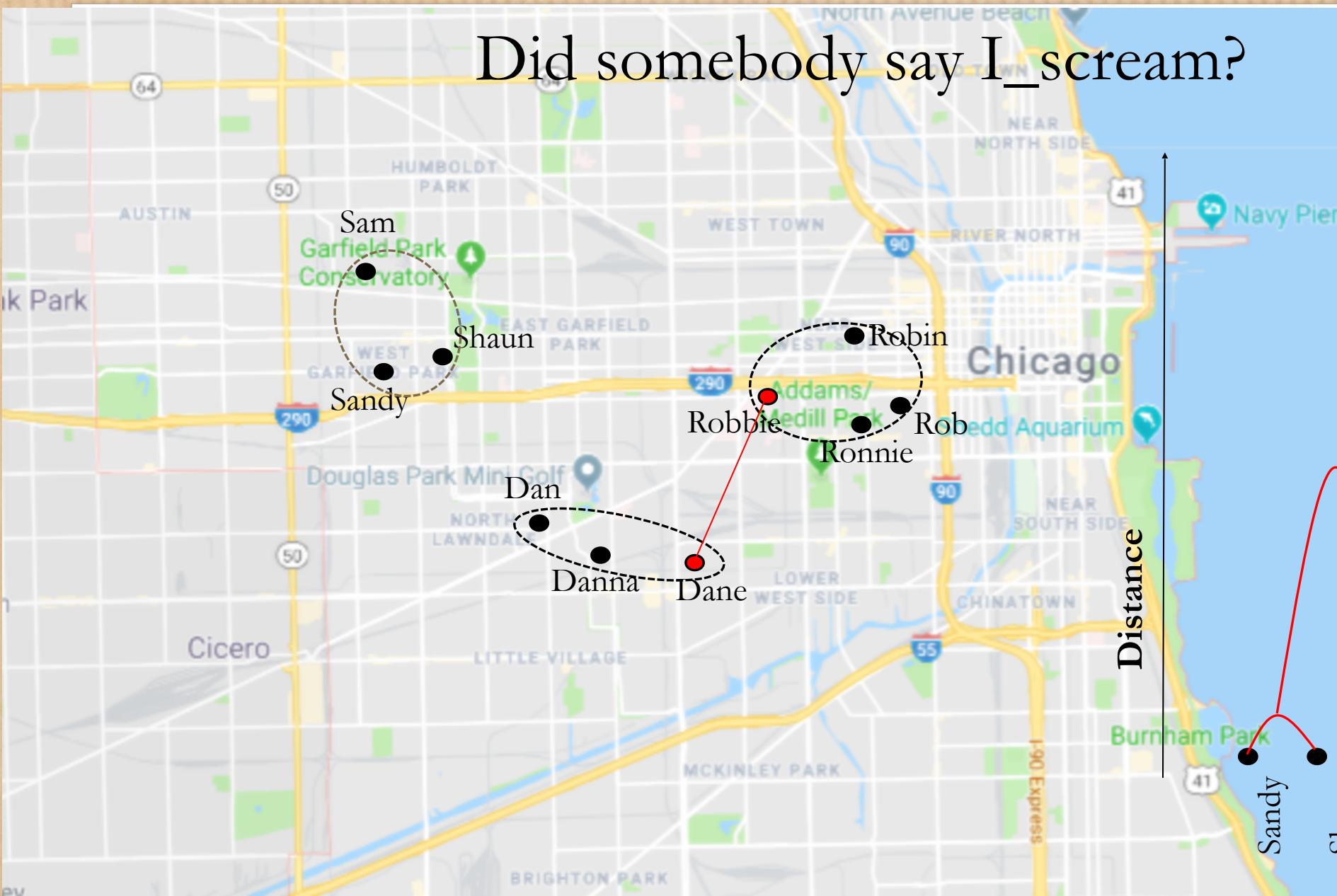
Did somebody say I_scream?



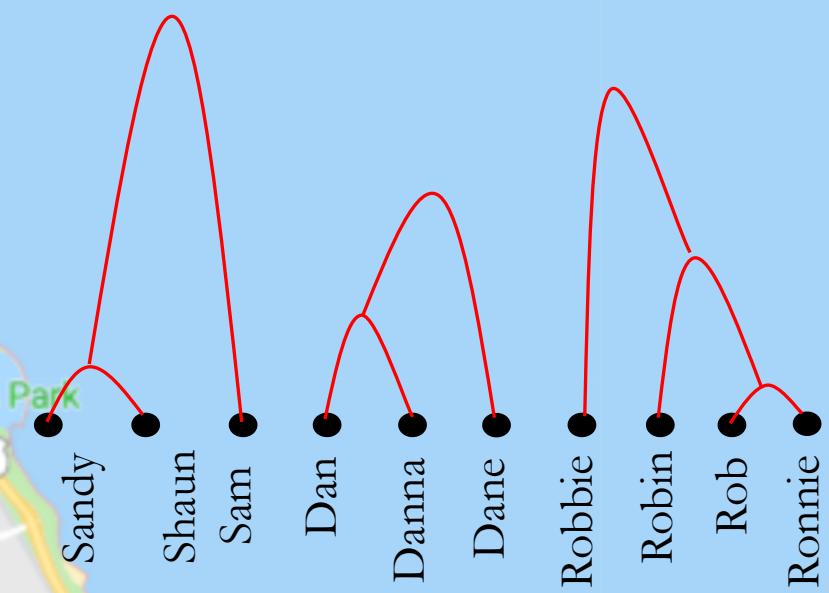
Distance



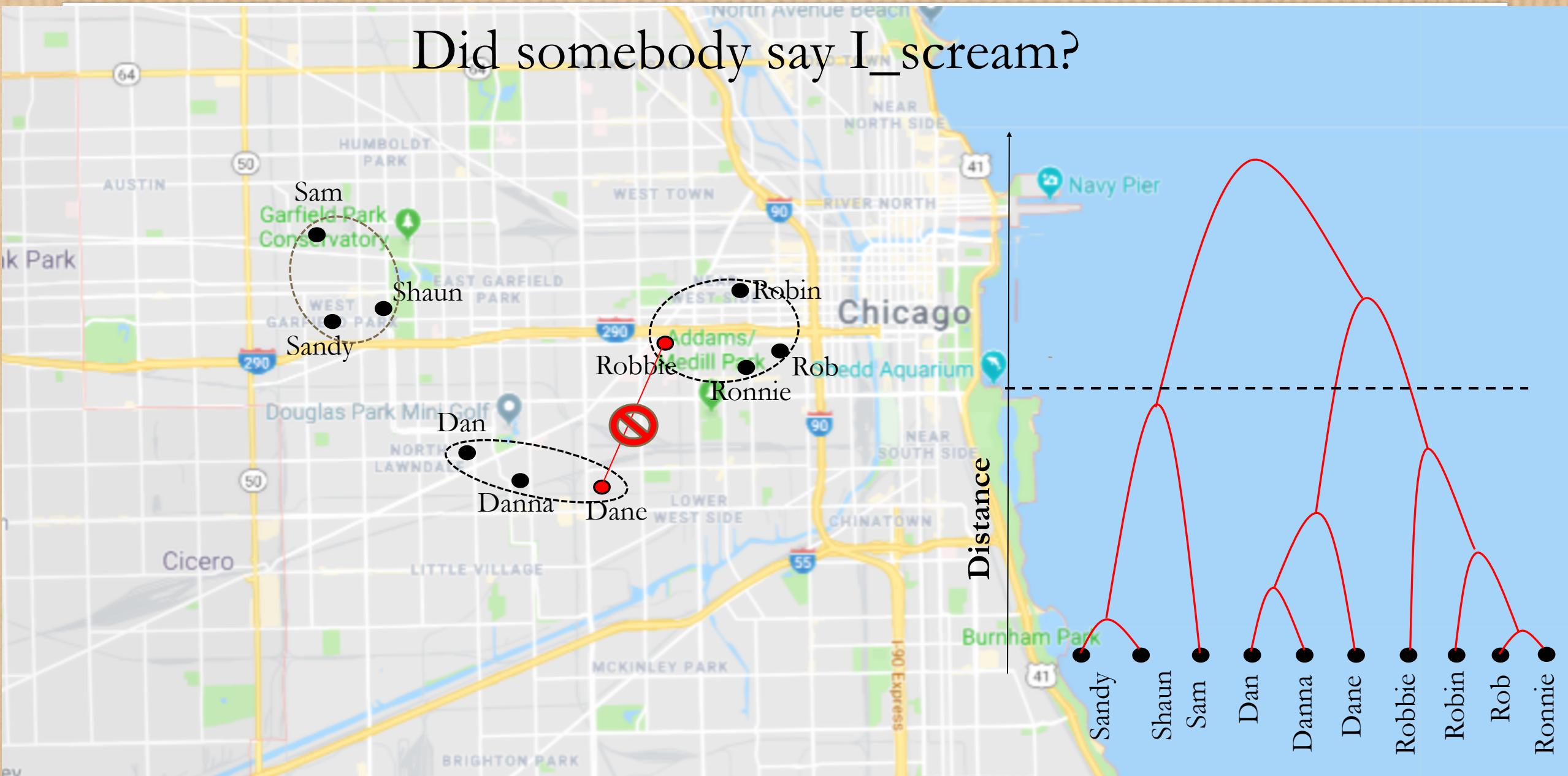
Did somebody say I_scream?



Distance



Did somebody say I_scream?



Types of Machine learning

- Supervised
- Unsupervised

Summary



Logistic Regression



Linear Regression



Neural Networks



Naive Bayes



Clustering



Decision Trees



Support Vector Machines

What's next?



-
- Are there more algorithms?
 - Which one to use?
 - How to compare or evaluate them?
 - Application on projects (Kaggle is recommended)

Discussion



Thank you!!!!!!

