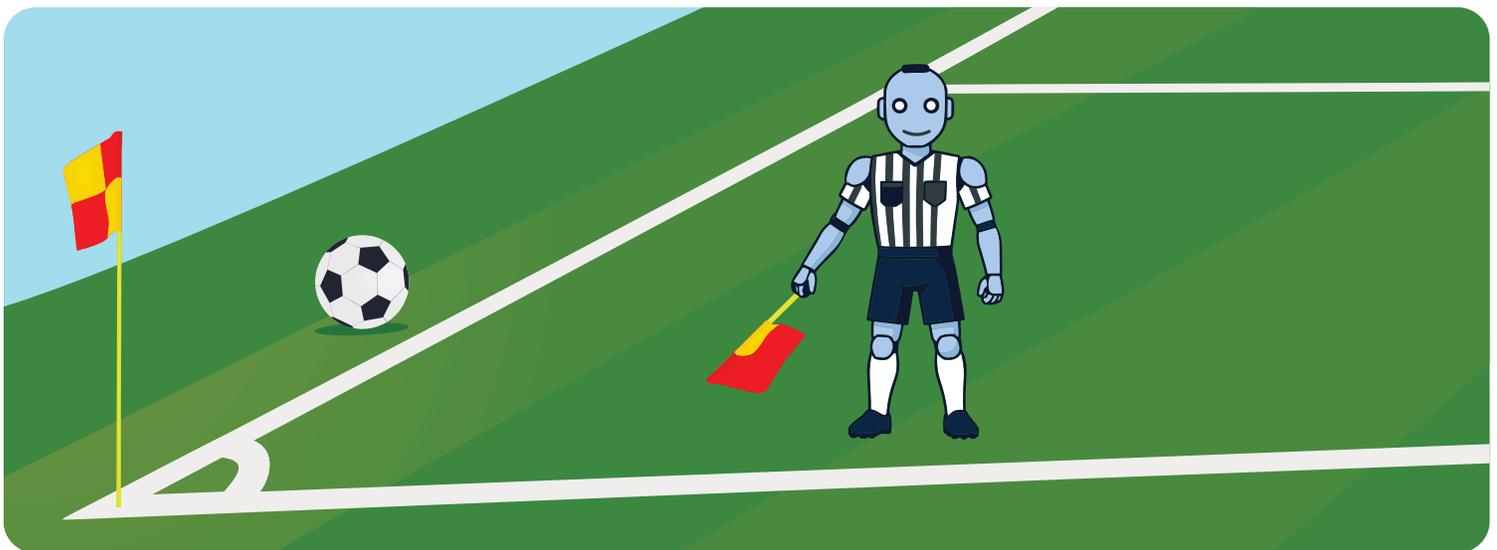


Make the Call on AI Referees

Grade Levels: 3-8

Duration: 45 min

In this lesson, students will explore how AI models are trained by testing a simulated AI referee on judging penalty kicks in soccer. They will work in teams to run a test, decide whether or not the AI referee made an accurate call, and record their findings.



Outline

Frame the Activity	15 min
Activate Prior Knowledge	5 min
Introduce the Activity	10 min
Activity	30 min
Test the AI Referee	20 min
Debrief	10 min

Grade Levels: 3-8

Duration: 45 min

Concepts/Skills

Artificial intelligence, image identification, bias

Objectives

Students will:

- Train the "AI referee" with the provided image data of the calls for a penalty kick.
- Test the AI referee by having it make calls on several plays.
- Reflect on what other data the AI referee might need to be consistently accurate.

Make the Call on AI Referees

Materials and Preparation

Materials and Preparation

Materials

- [Training Data handout](#) (1 per team)
- [Data Collection handout](#) (1 per team)
- Table or desk for each team
- Painter's tape or masking tape for each team to create the goal and out of bounds lines 
- Item for the mini soccer ball (ping pong ball, crumpled ball of paper, etc.) (1 per team) 

Preparation

1. Print out the handouts.
2. Provide an example of the goal and out of bounds tape lines that each team can recreate onto a desk or table (see example below).
3. Try out the activity yourself, with other educators or kids you know. This will give you practice with the resources so you can anticipate student questions.

Background Information

Artificial intelligence (AI) has been used in sports in a variety of ways for many decades. One the biggest examples has been using AI technology to help the referee make calls. For example, tennis has used motion capture and algorithms to determine if a ball is out of bounds since the mid-2000's. As AI technology advances, sports leagues have invested even more in developing systems that can assist human referees in making calls during games.

Our hometown, the City of San Jose, is hosting several 2026 FIFA World Cup matches. So this lesson will examine the topic of AI referees through the lens of soccer.

FIFA World Cup 2026

For the 2026 World Cup, FIFA and Lenovo partnered to develop Football AI Pro, a football (soccer) interaction tool that can analyze and deliver insights to over 2,000 different metrics. This tool allows analysts to compare patterns using video clips and 3D avatars, while also helping coaches explore how different tactical changes might work against other teams.

Want to learn more? Check out these resources on AI refereeing tools in professional sports:

- ["How the World Cup's Instant Replay Works."](#) VOX, 2022.
- ["Is VAR the villain of the World Cup?"](#) Aljazeera, 2022.
- ["The big VAR debate: with, without or change its scope?"](#) BBC, 2026.
- ["Leveling the Playing Field: Football AI Pro Powers Intelligence Across the Game."](#) Lenovo, 2026.
- ["Everything you need to know about the new ABS Challenge System."](#) MLB, 2026.
- ["ABS Challenge System Explained: The New Era of Balls & Strikes in 2026."](#) Simple Sabermetrics, 2025.





Frame the Activity

Activate Prior Knowledge (5 min)

1. Start by having learners share their knowledge of soccer.
 - Who has played on a soccer team before? Currently?
 - Do you ever watch **FIFA** or other soccer matches on television?
 - Think of a time you or somebody you know disagreed with a referee call when playing or watching sports – what happened and how did you feel?
 - What are some of the rules for playing soccer? How does the **referee** know what calls to make?

Note: Although we recognize that most of the world calls this sport “football,” or “European football,” we will refer to the sport as soccer throughout this lesson as the primary audience will be American students and educators.

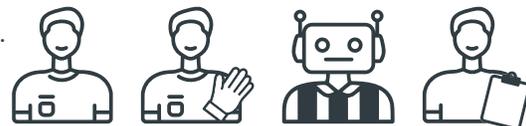
2. Let learners know that, in addition to the referee being able to review video footage, professional soccer leagues are starting to utilize artificial intelligence (AI) to assist them in making their calls.
 - While individual AI referee systems will work in different ways, they all use large amounts of visual **data** to make calls, usually video data from multiple field perspectives.
3. Ask learners to consider how incorporating AI referee technology could affect the game.
 - How could this be helpful? How could it be a problem?
 - How can we make sure it is making accurate calls?
 - How do we improve the AI’s abilities?
4. Explain that for today’s activity, they will be exploring how much data an AI referee would need to make correct calls on a **penalty kick**.
 - Define a penalty kick as a single shot a player makes at the goal after being fouled. It can only be defended by the opposing team’s goalie.

Introduce the Activity (10 min)

1. Introduce the scenario:

The local soccer league wants to try out a new AI ref program to assist the human ref with calls. However, they are not confident that the program has been given enough data to make correct calls yet. They have asked you to help train the AI ref using images and collect data on how it performs.

2. Let learners know that for this activity, they will be working in teams of 4 students. Each of them will be taking on a different role, including:
 - Two soccer players total: one offensive player and one goalie.
 - The AI referee.
 - Optional: A data collector who records the calls.
 - Note: If there are some teams with only 3 students, this role can also be performed by one of the soccer players.
3. Point learners to the example goalie and out of bounds tape lines. Ask for volunteers to demonstrate one of the plays.
 - The offensive player will try to kick the “ball” into the goal using their fingers from the designated position while the goalie guards the goal.
 - After the play is over, the AI referee will need to decide what call to make. Their options are:



- Goal
- No goal
- Out of bounds (over the out of bounds tape lines or off the table)



4. Introduce learners to the **Training Data handout**.
 - They will be using the image data on the handout to train the AI referee on how to judge a penalty kick.
 - Emphasize that data is the only information the AI has to understand how to make the correct call.
 - Remind learners as needed that they are playing roles with this activity. Even if the person playing the AI has more knowledge on penalty kicks than what the handout tells them, they will need to pretend to only know the available data.
5. Introduce learners to the **Data Collection handout**.
 - After each play, the whole team will need to decide whether the call was correct or not (including whoever is playing the AI).
 - The data collector will record the team’s decision on the data collection handout.
6. Ask learners to repeat this test until the designated time is up.



Activity

Test the AI Referee (20 min)

1. Have learners get into teams of 4.
2. Pass out tape to each team and ask them to create the goal and out of bounds lines on one of their desks.
 - Ask learners to raise their hands when they are done.
 - Once you see they have recreated the tape lines accurately, give them the “ball” and both handouts.
3. During the activity, if you notice learners making calls that seem impossible based on the data available:
 - Remind them as needed that the AI referee can only use the image data provided.
 - Their goal is to see how accurate the AI referee is with just the provided data.
4. While teams are testing the AI referee, support them with open-ended **Guiding Questions** to guide the process:
 - *What makes it challenging to pretend to be an AI referee? How are you working around it?*
 - *Would this look different if we were testing an AI referee for another sport?*
 - *Are there other referee calls or aspects of the game that we should be testing?*
5. Bring the whole class back together when the time is up.

Debrief (10 min)

1. Emphasize that one team’s test results would not be enough information to know whether the AI referee is working accurately.
2. Ask each team to share the amount of correct and incorrect calls.
 - Write their responses on the board.
 - At the end, calculate how many total correct and incorrect calls were made for the whole class.
3. Discuss the results with the class:
 - *Was the AI referee on your team consistently accurate, inaccurate or in between?*
 - *After seeing all the team’s results, would you conclude that the AI is ready, or does it need to be given more image data? Why or why not?*
 - *Sometimes real life referees make calls that are confusing or debatable. How might having an AI referee help? Are there ways it could potentially cause more confusion?*



Extensions

Draw the Data: Try having learners demonstrate what image data they think is missing by having them sketch examples of penalty kick data.

Explore More: Want more activities around AI and sports? Check out [IBM SkillsBuild](#) for more fun explorations around the role AI is taking in professional sports leagues.

CSTA Computer Science Standards

Grades	Standard	Description
3-5	1B-DA-06	Organize and present collected data visually to highlight relationships and support a claim.
3-5	1B-AP-15	Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.
6-8	2-CS-03	Systematically identify and fix problems with computing devices and their component.
6-8	2-DA-09	Refine computational models based on the data they have generated.
6-8	2-AP-17	Systematically test and refine programs using a range of test cases.
9-10	3A-IC-25	Test and refine computational artifacts to reduce bias and equity deficits.
11-12	3B-AP-11	Evaluate algorithms in terms of their efficiency, correctness, and clarity.
11-12	3B-AP-08	Describe how artificial intelligence drives many software and physical systems.

Vocabulary

Term	Definition
Artificial Intelligence	A device or program designed to mimic aspects of human intelligence to complete complex tasks and make decisions.
Data	Information that can be collected, analyzed, and used to inform decisions.
FIFA	Fédération Internationale de Football Association. The international governing body for European football.
Penalty kick	A method of restarting play in a soccer where a player is allowed to take a single shot at the goal while it is defended only by the opposing team's goalkeeper.
Referee	An official in a variety of sports and competition responsible for enforcing the rules.

Student Handouts

Title

- [Training Data handout](#)
- [Data Collection handout](#)

AI Ref: Training Data

Goal:



No Goal:



Out of Bounds:



Data Collection Handout

Making the Call on AI Referees

AI Ref: Data Collection

Name: _____

Date: _____

Use this data collection sheet to record each call the AI ref makes and whether the call was correct.

AI Ref Call #1

Was the call correct?

-  Goal
-  No Goal
-  Out of Bounds

Yes
No

AI Ref Call #1

Was the call correct?

-  Goal
-  No Goal
-  Out of Bounds

Yes
No

AI Ref Call #1

Was the call correct?

-  Goal
-  No Goal
-  Out of Bounds

Yes
No

AI Ref Call #1

Was the call correct?

-  Goal
-  No Goal
-  Out of Bounds

Yes
No

AI Ref Call #1

Was the call correct?

-  Goal
-  No Goal
-  Out of Bounds

Yes
No

AI Ref Call #1

Was the call correct?

-  Goal
-  No Goal
-  Out of Bounds

Yes
No

AI Ref Call #1

Was the call correct?

-  Goal
-  No Goal
-  Out of Bounds

Yes
No