science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

SCIENCE SPAZA
www.sciencespaza.org

MACHINE LEARNING

Panel 1: HEY! HOW *COOL* IS THIS...

WHAT?

Panel 2: WHEN I TYPE A TEXT MESSAGE, MY PHONE *KNOWS* WHAT I WANT TO SAY BEFORE I FINISH TYPING...

YEBO... IT LEARNS WHAT YOU ARE GOING TO TYPE FROM WHAT YOU HAVE DONE IN THE PAST.

Panel 3: MY PHONE CAN *LEARN??*

Panel 4: YUP-- AND IT PROBABLY *SPELLS BETTER* THAN YOU TOO!

MACHINES LEARNING!

LIKE A CELL PHONE LEARNS WHAT YOU ARE GOING TO TYPE NEXT, COMPUTERS CAN BE PROGRAMMED TO LEARN. THIS IS CALLED *"MACHINE LEARNING"*.

SCIENCE SPAZA

Researchers at WITS university are working on various projects to program machines to learn.

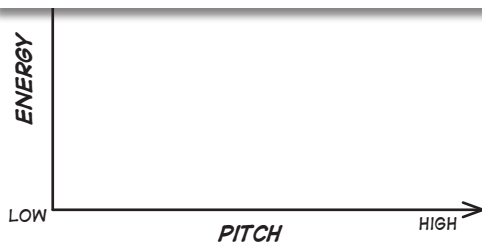KNOWLEDGE IS NCAH!

SCIENCE SPAZA

MUSIC RECOMMENDATION

**1** WORK IN PAIRS. EACH PERSON SHOULD CHOOSE 5 SONGS THAT THEY ENJOY LISTENING TO.

2 DRAW A GRAPH WITH "ENERGY" OF THE SONG (OR THE BEAT) ON THE UPRIGHT (Y-AXIS) AND "PITCH" OF THE SONG (HOW HIGH OR LOW IT IS) ON THE BOTTOM (X-AXIS) PART OF THE GRAPH.

3 ONE PERSON SHOULD PLOT HIS/HER SONGS ON THE GRAPH USING BLACK SPOTS. PUT A SPOT ON THE GRAPH FOR EACH OF THE SONGS THAT YOU CHOSE BASED ON THE ENERGY AND PITCH OF THE SONG. YOU MAY FIND THAT MANY OF THE DOTS ARE CLOSE TOGETHER. GIVE EACH SPOT A SHORT ONE-WORD LABEL FOR THE SONG NAME. NOW THE OTHER PERSON MUST ALSO PLOT HIS/HER SONGS USING A DIFFERENT COLOUR SPOT.
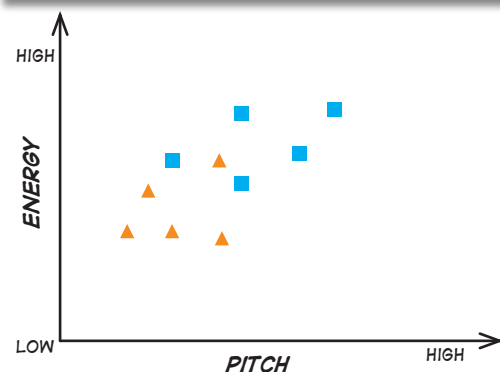
4 NOW DRAW A LINE TO SEPARATE THE DIFFERENT GROUPINGS OF SPOTS ON YOUR GRAPH. IF THE SPOTS OVERLAP THEN TRY TO DRAW THE BEST STRAIGHT LINE WHICH SEPARATES MOST OF THE COLOURED SPOTS.
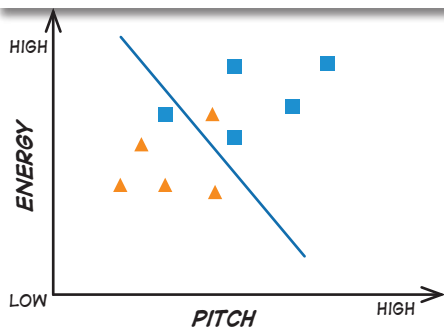
A FAST BEAT WILL BE HIGH **ENERGY** AND A LOW BEAT WILL BE LOW ENERGY. A LADY SINGING WILL GENERALLY HAVE A HIGHER **PITCH** THAN A MALE VOICE.

5 YOUR PARTNER IN YOUR PAIR MUST NOW SEE IF THEY CAN FIND A SONG THAT YOU LIKE BY LOOKING AT THE SPOTS OF THE GRAPH THAT ARE CLOSER TOGETHER. THE LINE YOU DREW WILL HELP TOO, BECAUSE IF THE NEW SONG FALLS ON THE SIDE OPPOSITE TO WHERE THE SPOTS ARE, IT IS LESS LIKELY THAT YOU WOULD LIKE IT. THEN SWOP AND SEE IF YOU CAN PICK A SONG THAT YOUR PARTNER LIKES.

HOW MACHINES LEARN

When you looked at your friend's graph, it gave you a good idea of what kind of song they liked. If most of them were low energy songs, you were not going to choose a high energy song for them!

In the same way machines can be made to **recommend** music. They understand information (or data) by using **features** — like energy and pitch — to describe it. They then can make decisions based on the descriptions — like which music you like! Clever hey?! These kinds of machine are called **"Support Vector Machines"**.

There is a lot more to a song than energy and pitch. A machine will be able to take all the things that make up a song and **guess**, often quite accurately, what songs you would like.

SCIENCE SPAZA

PARKING SOLUTION

There is a problem at Wits University! Because of the number of student cars, it is often difficult for students to find a parking. One way to solve the problem would be with *Machine Learning!*

THE IDEA IS ...., WHEN A STUDENT DRIVES ONTO THE CAMPUS, THEY CAN SWIPE THEIR **STUDENT ID CARD.** THE COMPUTER HAS INFORMATION (DATA) LOADED INTO IT THAT TELLS IT WHERE THEY NEED TO BE ON CAMPUS AND TELLS THEM WHERE THE NEAREST PARKING SPACE IS. **HOW AWESOME IS THAT?**

CAREERS:

Computer programmers write programs that make computers perform tasks. They can instruct computers to learn to predict and recommend things.

Statisticians are important in machine learning. They are skilled in making "models" (or predictions) from information or data. They also are able to test to see if these models are working correctly.

Ritesh Ajoodha is a computer programmer who works specifically with machine learning. Ritesh defines machine learning as "computers that are able to learn to perform tasks without being specifically programmed for that task". He would like to be involved in computers that can work out what disease someone has. He says that every job you can think of has already been improved by a computer system, or is soon to be improved by one – a good reason to consider computer science as a career.

CURRICULUM LINKS

- **Grade 7, 8, 9: Mathematics –** Numeric and Geometric Patterns (Investigate and Extend Patters), Graphs (Interpreting Graphs, Drawing Graphs).

- **Grade 10, 11, 12 : Mathematics –** Number Patterns Sequences and Series, Statistics.

Knowledge is Ncah!

SCIENCE SPAZA

WHAT IS NEXT?

HAVE A LOOK AT THE FOLLOWING PATTERNS.
LOOKING AT THE DATA THAT IS ALREADY THERE, CAN
YOU PREDICT WHAT THE MISSING ONE WILL BE?

PUZZLE A

Your answer:

1	2	3

PUZZLE B

$$1 + 5 = 12$$

$$2 + 10 = 24$$

$$3 + 15 = 36$$

$$5 + 25 = \text{?}$$

PUZZLE C

Your answer:

1	2

3	4

PUZZLE D

Your answer:

1	2	3

4	5	6

START YOUR OWN SCIENCE SPAZA

Do you want to start a science club at your school? Send us the following information, and Science Spaza will contact you.

School: _____

Name: _____

Telephone number: _____

Email address: _____

Postal address: _____

_____

_____

_____

Visit www.sciencespaza.org, email info@sciencespaza.org, sms or WhatsApp us on 076 173 7130 or write to us at PO Box 22106, Mayor's Walk, 3208.

WE WANT YOUR FEEDBACK!

TELL US HOW ACCURATELY YOUR FRIEND COULD CHOOSE A SONG YOU LIKED USING YOUR GRAPH.