

Computers Evaluate Cancer Biopsies

Difficulty:

DIFFICULT

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Discussion activities to be done after completing this EA lesson

Today's report looks at promising developments in the diagnosis of cancer. Where are the researchers in the report based? In what new ways do they think computers will be able to improve healthcare for cancer sufferers? What studies have the researchers carried out so far to make them think this is possible?

Extension discussion topics

A. Talking about and going over the specific topic / idea / issue in listening text

Introduction = What can the powerful computers in the report do, and who trained them?

1. Where are the researchers based, and what do you know about them?
 - they are a team based at Stanford, (a private research university in California).
 - they described their recent work developing the computerized pathologist system "C-Path" in an article in the journal "Science Translational Medicine" (an interdisciplinary medical journal).
 - Daphne Koller, a member of the research team, was interviewed for the radio report.
 - Andrew Beck was the lead author of the article which appeared in the journal.
2. How did they train their computers to evaluate the cancer biopsies?
 - they took a set of breast cancer biopsy slides which are used for training pathologists.
 - they scanned them into powerful computers that have sophisticated software.
 - the software measured thousands of characteristics of each biopsy image.
 - the researchers plugged the computer into an algorithm that assessed the information.
 - the researchers then had to decide how important or relevant the different pieces of data were.
 - they introduced a second set of breast cancer biopsy slides from a different hospital and from a different section of the population, and saw that the computers did better than human pathologists at recognizing relevant information.

Are you surprised that a computer can be used in this way?

3. What do the researchers see as the future for C-Path?

- they are currently working to extend its use to cancers other than breast cancer.
- they stress that it is not designed to replace doctors, but that it could be very useful in resource-poor settings (e.g., in developing countries where skilled pathologists are in short supply).
- they feel that it will be easy to use C-Path over the Internet.

B. Expanding on (one of) the topics / ideas / issues in listening text

Topic = Algorithms.

1. An algorithm takes its name from Al-Khwarizmi, a Persian mathematician from the 8th century. It is a detailed list of instructions designed to take you from a starting point to an end point. Algorithms are used many areas of modern life, for example in calculating, in data processing, and in automated reasoning (systems which seem to allow computers to “think”). Have you heard of Al-Khwarizmi before? Can you think of obvious examples of algorithms being used in your everyday life?
2. Have you ever played chess against a computer, or do you know anyone who does? If so, who wins? Does it seem as if the computer gains in expertise as it plays more games?
3. Do you play video games, or do you have a friend or family member who does? Which games? Why are these your / their favorites? Give examples of how the algorithms move the game along.
4. Do you use a GPS when you are driving? Why / Why not? What are the different possibilities that the algorithms in the GPS allow us to factor in to our instructions? How do the algorithms cope if we don't do what it tells us?

OR, Topic = Al-Khwarizmi.

Find out what you can about the 8th century Persian mathematician Al-Khwarizmi and give an oral presentation of your findings to a partner or to your teacher.

You could start here: <http://en.wikipedia.org/wiki/Al-Khw%C4%81rizm%C4%AB>

C. Extending discussion of (one of) the topics / ideas / issues in listening text

Topic = Computers and algorithms.

1. Computers need algorithms because they can only follow instructions. They can't make a sudden leap of inspiration like humans can! Can computers guess and have intuition? Do you think this situation will ever change? Explain your answer.

2. In what ways does this report on the analysis of breast cancer biopsies show that computers can be superior to humans in the field of pathology? In what ways are they inferior? Can you give examples of other skilled specialist computers which are already used in medicine? Do you think computers will become more and more skilled in the field of medicine? How?
3. Imagine a world where robots rule - give a description of such a world! Could such a world become a reality? Would you still be here? Would you want to be?

Audioscript

Cancer treatment may have just taken a big leap into the computer age. Stanford University researchers are reporting significant success in training computers to analyze microscope slides of breast cancer biopsies with a keener eye than any human pathologist.

Since the early twentieth century, pathologists have been squinting into microscopes, looking for a handful of features in biopsied tumor samples that enable them to classify how aggressive the cancer is.

That information helps doctors decide how to treat a patient.

Today, armed with sophisticated software, powerful computers are getting quite skilled at pattern recognition. Identifying faces, for example. The Stanford researchers thought computers might be able to learn to evaluate cancer biopsies, too.

To do that, Daphne Koller and her colleagues started with a set of biopsy slides that are used to train pathologists. The slides were scanned into the computer, which measured not just the handful of features a human pathologist might review, but thousands of characteristics on each image.

"And we plugged it into a machine-learning algorithm that looked at survival data, and tried to figure out which of those features were good features in terms of survival, which were bad features, and which were not relevant at all."

In fact, Koller says, the system identified previously unrecognized features on the biopsy slides that help predict how aggressive the cancer will be.

"It turned out that some of the most significant features were in parts of the tumor that pathologists don't look at at all right now."

After the training phase, "C-Path", as the system is known – that's short for Computational Pathologist – C-Path evaluated a second set of pathology slides, which came from a different hospital and which were medically and demographically different from the training group. It actually did better than human pathologists, although Koller stresses that C-Path is not designed to replace doctors looking through microscopes.

She says the computerized system could have its biggest impact in resource-poor settings - in developing countries, for example - where skilled pathologists are in short supply.

"Our technology can be easily applied even over the Web, where a local physician extracts a sample and puts it on a slide and scans it into a computer and sends it over the net, and out comes a prediction about survival and ultimately other aspects of the sample that can help guide treatment."

The researchers are currently working to extend the computerized pathology system to other cancers. It's still some years away from use in patient treatment. Daphne Koller, lead author Andrew Beck and their colleagues describe the computerized pathologist system in the journal *Science Translational Medicine*.

That's today's health brief. This is Art Chimes reporting.