Google Science Fair winner builds neural network to fight cancer

This summer, Florida high school student Brittanny Wenger was awarded first place in the Google Science Fair. She created a cloud-based neural network to help doctors better detect breast cancer using a less invasive form of biopsy.

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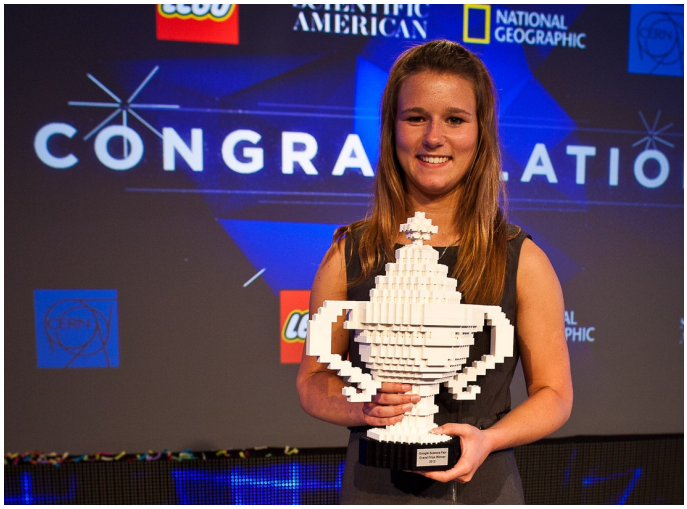

Yes, that trophy is made out of Lego.

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European editor

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summer, Florida high school student Brittanny Wenger was awarded first place in the Google Science Fair. She created a cloud-based neural network to help doctors better detect breast cancer using a less invasive form of biopsy, known as Fine Needle Aspiration (FNA). As well as being awarded a $50,000 college scholarship, Wenger, who has just turned 18 years old, won a trip to CERN as part of her prize. iSGTW caught up with her on the final day of her visit...

Please tell us about your project in your own words...

I taught a computer how to diagnose breast cancer - to determine whether breast masses are malignant or benign. This is really important because one in eight women are inflicted with breast cancer; these statistics are startling and they're on the rise. It's really important that these women can have the cheapest, most accurate, least invasive, and quickest test available. Unfortunately though, FNA is often so inconclusive, so a lot of doctors won't use it - despite it being the cheapest, the least invasive, and the quickest.

I created an artificial neural network, which is a type of program that's coded to think like the brain, so it can actually detect patterns that humans can't detect, in order to provide doctors with a tool to analyze FNAs, so as to revive them and put them back into hospitals. Currently, the neural network that I built is working really well. I've deployed it to the cloud, so it's accessible to hospitals worldwide.

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This means that I can get more data and I can get it into hospitals, helping real people. It's also 99.1% sensitive to malignancy, so this means that most cancer patients are being diagnosed correctly.

What inspired the project?

In 7th grade, when I was 13 year old, I took a course on futuristic thinking and I was researching the technologies of the future when I came across the concept of artificial intelligence. I was enthralled. I went home and ordered a college programming textbook. I'd never coded anything before, but I started learning to code and eventually I did code an artificial network. It played soccer, because I love soccer. But then, when I was in 10th grade, my cousin was diagnosed with breast cancer and I saw first-hand the impact this disease has on a woman and her family. I was really inspired to try to help make this process better. The way I approached that was by improving the diagnostics.

"...when I was in 10th grade, my cousin was diagnosed with breast cancer and I saw first-hand the impact this disease has on a woman and her family".

So, I believe you coded the neural network in Java. Is that the programming language you first taught yourself back when you were just 13 years old?

I actually taught myself C-sharp. I programmed in C-sharp from the time I was 13 until I was 15. Then,

in 10th grade, I took AP computer science - this is basically a college level class you can take at your high-school - and that course was taught in Java. Java and C-sharp are actually very similar, so after having formal training, I decided to code in Java.

Also, it seems the cloud has been very important in enabling your project. Perhaps you could tell us about the difference it made for you...

As the world becomes smaller, the cloud is something which can really connect it and make sure that hospitals around the world have access to the same technologies. Artificial neural networks learn based on their experiences and their mistakes, so I need to gain more experiences for my network. I had 681 samples at the time of the Google Science Fair and I'm now up to 691, so I am getting there. But, the thing about the cloud is that it doesn't just let me collect more data samples, it's also what's going to enable a million hospitals in the world to log onto my program at exactly the same time, not crash it, and use it to diagnose patients - if they want to do that, because of the cloud I've got the infrastructure to support that. Going forward, it's important that hospitals around the world can have access to the same technologies and the cloud is something that can facilitate that.

Do you

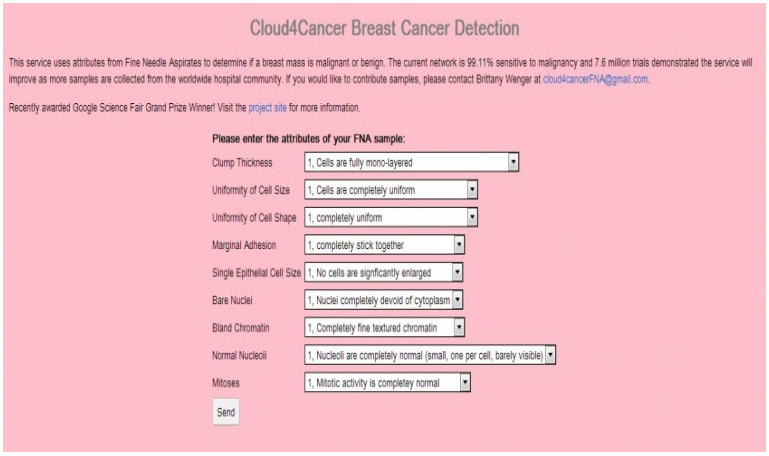
"Being able to say 'oh, that's where the worldwide web was developed' was just mind-blowing!"

have any advice for people thinking about entering the 2013 Google Science Fair?

I think the most important thing is to find something that you're really passionate about. I've spent over 700 hours to date on my science project and I've absolutely loved every minute of it, so, when you have that kind of passion, that's when science fair is really cool.

The other thing about it is to just enjoy the process: the Google Science Fair gives you this really amazing platform to meet scientists who really are the who's who of science, as well as coming to CERN of course, which is something you're average American teenager doesn't usually get to do. You get to see these cutting-edge breakthroughs and you also get to meet other kids who share your passions and who are going to be your future colleagues. It's just this incredible, once-in-a-lifetime journey that can really take your research to the next level. I think that Google Science Fair has given me the platform to get my research into hospitals - I've currently got two institutes beta-testing it.

Basically, my advice is just to enjoy it. Even before I won, or even made the top 15, I was able to use my project website to show to colleges, so it's been a really amazing platform for me.



This is a screenshot of the tool Wenger created. It can be accessed online here.

So, speaking of colleges then, what are your plans for the future?

I want to do a dual major in computer science and biology. I really think that inter-disciplinary research is the wave of the future and that that's where we're going to see more of the exciting advances coming from. Because I love computer science and biology already, I think it's a really great way to be able to get to the research frontier. I hope to eventually be able to do an MD-PhD, because I want to be a pediatric oncologist, but I still want to be involved in research.

Would you agree that, generally, we're now seeing the life sciences embrace computing in a big way then? And, is this a trend you're consciously trying to jump on?

I think we're seeing more and more computing come into the biology and life-science world. You have doctors using iPads now - my physician types all of her notes on her iPad while she's talking to me! Of course, I think little things like that are going to make a difference, but also, as we extend

to more technologies, we have more diagnostic and treatment power. I was talking to Steve Myers [Director for Accelerators and Technology] yesterday here at CERN. He was telling me about this incredible machine which has come out of what CERN has been studying in particle physics. Essentially, from what I understand, with such a machine you'd be able to fire a proton beam at cancer tumors. So, instead of having all this healthy tissue be damaged, you'd actually have very little damage. As we move forward, I believe that we really need to embrace these new technologies, because those are the things which are going to save lives.

How have you enjoyed visiting CERN over the last couple of days then?

It's been amazing. You read about all of these exciting breakthroughs that have been happening, like the Higgs boson for instance, but it's really hard to actually understand fully what's going on until you've seen it in person. It's been very neat to have that tangible experience.

Being in the CERN IT department in particular was amazing - they were so great at explaining everything to me. The grid is, in a way, the predecessor to cloud computing and I actually got to stand in the middle of CERN's grid, which was just incredible. These are the sort of things that we take for granted now that came out of CERN. Being able to say 'oh, that's where the worldwide web was developed' was just mind-blowing!

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