"Artificial Intelligence to Support Speech-Language Services"
Carol Miller, Pennsylvania State University
International Disability Rights Affirmation Conference 2024
November 15

[2024/11/15 12:31] Carolyn Carillon: Hello everyone.

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Transcriptionists will fill in any gaps and support the Question & Answer section at the end.

A little explanation about this service.

Voice-to-text transcriptionists provide a translation of the key ideas discussed, NOT a word for word transcription.

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Transcription is provided by Virtual Ability, Inc.

The transcriptionists are:

Shaerken Changeheart

Carolyn Carillon

The speakers will be identified by initials as they speak.

The following initials in the transcription record will identify the speakers:

 CM: Carol Miller

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[2024/11/15 12:28] Anna Adamant: Hello! I'd like to extend the warmest of greetings to everyone here!

I am delighted that you could all join us today.

My name in Second Life is Anna Adamant.

I am from The United States and a former educator in the public school system for 2 1/2 decades.

In real life, I was born with spina bifida and I deal with a tethered spinal cord.

SL has been a part of my life for the last 20 years.

I love building here, being a shop keeper, and running a sandbox to help people.

Today, it is my pleasure to introduce our next speaker to you.

She is from Penn State University.

The title of her lecture is "Artificial Intelligence to Support Speech-Language Services."

The National AI Institute for Exceptional Education develops solutions for artificial intelligence to assist speech-language pathologists in providing services for school-aged children.

AI can help simplify time-consuming and tedious tasks to free speech-language pathologists to spend their time directly serving children.

Here to tell you more about this awesome technology, please welcome our next speaker, Carol Miller!

You have our attention, Ms. Miller!.

[2024/11/15 12:31] Carolyn Carillon: CM: I am new to SL so I may make mistakes

hope everyone can see the slides

And hear me

[2024/11/15 12:33] Buffy Beale: yes and you are among friends here

[2024/11/15 12:33] VAIPresenter2 Resident: Thank you for inviting me to this conference! It's exciting to be using this innovative virtual platform to talk about how technology can help speech-language pathologists in schools serve children better.

I'll be talking about the National Artificial Intelligence Institute for Exceptional Education, or AI4ExceptionalEd.

In this talk I'll explain the goals of the institute and some of our early progress.

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The National Science Foundation funds 27 AI Institutes, along with partners.

We are proud to be the first institute that is co-funded by the Department of Education's Institute of Education Sciences

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AI4ExceptionalEd is headquartered at the University at Buffalo, but there are a total of 9 participating institutions. I represent Penn State!

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First I want to explain how I come to be telling you about this, and some basic concepts that are part of what we are doing.

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The goal of the AI4ExceptionalEd is to help speech-language pathologists help children with speech & language disabilities. That's how I got involved.

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[2024/11/15 12:38] Carolyn Carillon: CM: let's focus on machine learning

The AI for exceptional ed involves machine learning

Info is fed into a model

And the AI makes predictions

Adding a label or putting it into a category

[2024/11/15 12:39] VAIPresenter2 Resident: AI4ExceptionalEd consists of many projects. A lot of them involve some form of machine learning.

Information is fed into them, they manipulate the data, and make predictions. Giving a label to something, or putting it into a category, is a kind of prediction.

In this example, an image goes into the model, and it produces a prediction: this thing belongs to the category known as Barney.
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The machine learning model might learn from just one kind of information, like an image. But what if we gave it more information: sounds, and moving images, and written descriptions.
This is multimodal learning--it involves more than one modality. This makes the model more complex but can improve its accuracy.
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Multimodal learning is an important part of AI4ExceptionalEd. Think about a model that is learning to predict if a child has a language disability.
It can take audio and extract different kinds of information from the child's speech: like the speech sounds themselves, the hesitations and mispronunciations, the intonation.
[2024/11/15 12:41] Carolyn Carillon: CM: all this info is added together all the time
This is useful for speech language pathologists

[2024/11/15 12:41] VAIPresenter2 Resident: If we add video, the model can add information about gestures and facial expressions.
The model also learns about how all of these pieces of information are combined together over time. If we can make it work, this would be a very powerful tool for SLPs.
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The big news currently is about generative AI. Not the same as artificial general intelligence! These models are generative because they generate things.
ChatGPT and other large language models generate text, computer code, etc. Others, like Dall-E, generate images. Others generate music.
You may use apps that generate transcripts of speech (unlike the human transcribers at work during this conference!).
That's usually generative AI. Several AI4ExceptionalEd projects include Gen AI tools.
[2024/11/15 12:43] Carolyn Carillon: CM: One example is a tool that creates a summary of research to find evidence to support practice
[2024/11/15 12:43] Shaerken Changeheart (ChangeheartShaerken Resident): CM: That's an overview of AI as it relates to exceptional ed.
The link to this is in my handout

[2024/11/15 12:43] VAIPresenter2 Resident: There is a national AI strategic plan, and the National Science Foundation contributes to it by funding the National AI Institutes.
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27 National AI Institutes have been funded as of this fall, with many areas of focus. There are 5 institutes focused on education.
We are one of them, and the only one co-funded by the Dept of Education.
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The ethical issues related to AI are many and varied.
[2024/11/15 12:45] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Ethical and Responsible AI -- may be repeats of some things that have been said today

[2024/11/15 12:45] VAIPresenter2 Resident: As noted on the previous slide, one of the National AI Institutes is devoted to this topic, but all of them have to include ethical considerations in their mission.
Here are a few areas of particular concern for our Institute. On the following slides, I'll say a little more about each one.

[2024/11/15 12:46] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Our guiding principle is "help people, don't replace people"
Rose Hill said, AI can't replay the ethical alliance.
AI can do some things faster and more accurately than speech pathologists
We want to leverage that so the pathologists can do their jobs better
We don't want to expose children to bad data/bad actors

Voice and images are data that need to be perfected
As well as assessments and interventions
Diverse, equitable and inclusive -- part of the ethics
Unbiased data is important to train AI models
Linguistic and cultural diversity of students needs to be considered
Increase diversity of research and share knowledge of AI with divers audiences.
Like I'm doing with you today
Projects include "Broader Impacts"

The 4th point under ethics is: the black box.
Ethical AI should be explainable
People will trust AI more if they understand how it works
Or at least believe that somebody knows how it works.

[2024/11/15 12:50] VAIPresenter2 Resident: AI4ExceptionalEd exists because there is a great need for school age children to receive speech-language services.
[2024/11/15 12:50] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Our institute -- the problem we address and what we try to get AI to help with is next.
Speech language pathologists (SLP's) are stretched to the limit and beyond
The majority of children served under the DEA had a disability with language -- written or spoken
3.4 million children

[2024/11/15 12:51] VAIPresenter2 Resident: There is a gap between the services that are needed and the capacity of the SLP workforce to provide them.
[2024/11/15 12:52] Shaerken Changeheart (ChangeheartShaerken Resident): CM: In 2021 the Bureau of Labor Statistics estimated there were fewer than 61 thousand SLPs to serve those children
So children are not receiving the amount or type of services they need
The references are in the handout

[2024/11/15 12:52] VAIPresenter2 Resident: Currently, in most U.S. schools, the system for identifying children in need of speech-language services works something like this.

[2024/11/15 12:53] Carolyn Carillon: CM: Not sure how well you can see this graphic
I'll talk you through it
This starts with parents or teachers having a concern
The child is referred and evaluated
If the child is eligible, the child gets a plan, an IPP, that lays out the services they'll receive
But there are shortages of SLP
So kids get limited time
Many SLPs indicate that they're frustrated that they can't give the services they want

[2024/11/15 12:54] VAIPresenter2 Resident: Our institute proposes 2 solutions.
One is an AI-assisted screening tool to identify children at risk for speech-language disabilities. It may allow for all children to be screened, not just those who have been noticed by parents or teachers.
[2024/11/15 12:55] Carolyn Carillon: CM: some disabilities are hard to discern
[2024/11/15 12:55] VAIPresenter2 Resident: The second solution is really a package of AI-assisted tools, called the AI Orchestrator, that will help SLPs manage their caseloads and provide personalized interventions.
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When I started to review the projects that AI4ExceptionalEd faculty and graduate students are doing, I realized there are so many cool things, it would take far too long to describe them all.
[2024/11/15 12:55] Carolyn Carillon: CM: there are a lot of parts that go into making these parts a reality
I'll talk about that now
Here are a few examples of work in progress

[2024/11/15 12:56] VAIPresenter2 Resident: I will talk about a few of them: first the work that I am directly involved with, and a couple others that I think are especially interesting.
[2024/11/15 12:56] Carolyn Carillon: CM: I am involved with the AI Screener
We're developing the AutoASR
It's built on an existing instrument
[2024/11/15 12:56] VAIPresenter2 Resident: ASR is everywhere, like in Alexa and Google Home, on the phone when you call your bank or insurance company. A lot of the time it works well.
[2024/11/15 12:57] Carolyn Carillon: CM: in this test, children listen to sentences and repeat them
They're scored based on the differences between what they say and the target sentence
Words may be added or omitted or changed
We focus on speech disruptions
Let's talk about how the AutoASR scores the test
It uses automatic speech recognition or ASR
[2024/11/15 12:58] VAIPresenter2 Resident: And if we are disfluent, or we pronounce something wrong, the ASR model makes its best guess at what we are trying to say. Sometimes it doesn't work well. We all know how frustrating it can be when the machine fails to recognize what we're saying.

People who don't speak some kind of ideal American dialect of English—which nobody really does—run into a lot of problems with ASR. That's a whole other talk!

[2024/11/15 13:00] Carolyn Carillon: CM: At least one team is working on better recognition of children's speech

[2024/11/15 12:59] Gentle Heron: Ebonics!

[2024/11/15 13:00] VAIPresenter2 Resident: My point now is that these models are based on adult speech and most of them don't do as well with children's speech.
An important aspect of our institute's work is that we DON'T want the ASR to "fix" errors.

[2024/11/15 13:01] Carolyn Carillon: CM: here's an example
Imagine a child who says "the pictures was coloured by his big sister"
We need to know that the child omitted, changed a couple of words
And eventually succeeded in saying sister

[2024/11/15 13:01] VAIPresenter2 Resident: If we are going to accurately assess a child to see if they have a speech-language disability, we need to know exactly what they said and how they said it!
Here is a made-up example from the ASR.
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AutoASR mimics the behavior of a human SLP by a three step process.
It first transcribes what the child is saying to English, then second step, it aligns the transcription with the intended sentence.
Lastly, it finds any mistakes the child makes and produces a score.
Whisper and BertAlign are pre-existing AI models. They are being modified to increase accuracy of scoring, which is already over 90% accurate compared to humans.
The details of the transcription are not as good, and that is my next topic.
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We hypothesize that STALLS will be characteristic of children at risk for DLD.

[2024/11/15 13:03] Carolyn Carillon: CM: On the slides, we see "stalls"
Like word and phrase repetition
Pauses like "um" and "uh"
Silent pauses

[2024/11/15 13:05] VAIPresenter2 Resident: Previous research has suggested that children with DLD demonstrate a larger number of sentence disruptions when compared to typical peers, even when their utterances were largely grammatical.
We hypothesize that stalls will be most apparent between groups of children at risk for DLD, because a weaker underlying language system will result in more effortful productions.
In contrast, revisions in young children have been associated with stronger developing grammars.
Revisions require a listener to monitor their speech output at the same time that they are formulating their utterance.
Therefore, revisions are a distinct set of sentence disruptions, which is why we want to separate them out.

[2024/11/15 13:05] Carolyn Carillon: CM: here's the tough part

[2024/11/15 13:06] VAIPresenter2 Resident: Transcribing children's speech including all the stalls and revisions is hard work! SLPs working in schools don't have time to do that.

We hope to create an AI-assisted tool that can accurately transcribe the disruptions and use them to help SLPs make more accurate diagnoses.
[2024/11/15 13:06] Carolyn Carillon: CM: that's where my expertise comes in

[2024/11/15 13:06] VAIPresenter2 Resident: Now here is a project that I am not directly involved in, but I wanted to share it because it shows how multimodal data can be used.
[2024/11/15 13:06] Carolyn Carillon: CM: Now I'll tell you about some other projects
Thinking of multimodal data, we can compare it to Pi
The idea is that emotions are important for learning
If we could have some help with emotions, we can create better learning opportunities for children

[2024/11/15 13:08] VAIPresenter2 Resident: There are existing machine learning models that can recognize emotions in the faces of adults. But just like for speech, those models don't work as well for children.
[2024/11/15 13:08] Carolyn Carillon: CM: SLPs spend a lot of time on paperwork and they don't like it
We're looking at a tool that creates progress notes, whether in text, audio or video
It takes that info and summarizes it into progress notes
Or, handwriting analysis
There are AI tools that do this
They work with adult handwriting but not children's
[2024/11/15 13:10] VAIPresenter2 Resident: We have a team working on improving emotion recognition through 3D representations of faces.
Another group is reviewing the literature to learn the best ways to use multimodal data to represent children's emotional and cognitive states.
[2024/11/15 13:10] Carolyn Carillon: CM: this would help us diagnose dyslexia and dysgraphia

[2024/11/15 13:10] VAIPresenter2 Resident: I joined AI4ExceptionalEd with very little idea of what it would be like.
I have learned that creating applied AI tools that will really help children is harder than I imagined, and so is collaborating across disciplinary lines. But it is within reach!
And the potential to expand and improve services for children is also greater than I imagined.
AI is already making a positive impact on the field of speech-language pathology, so it is vital that it is done responsibly.
[2024/11/15 13:11] Carolyn Carillon: CM: my references are in the handout
Questions?
[2024/11/15 13:11] Shaerken Changeheart (ChangeheartShaerken Resident): Please put QUESTION (in all caps) in front of your questions, so our team can read them aloud to Carol with ease and backtrack them if necessary.

[2024/11/15 13:12] Mook Wheeler: COMMENT: There's a new Oct 2024 pre-print study by 6 Apple researchers which says current LLMs "are not capable of genuine logical

reasoning; instead, they attempt to replicate the reasoning steps observed in their training data." https://arxiv.org/pdf/2410.05229 So, currently, the training data selected/designed by humans is built in as a front-end weakness of the AI. At the same time, at the other end, a 'human-in-the-loop' is also necessary to safeguard against AI hallucinations. That means a supposedly objective process deemed 'logical reasoning' is actually steered by human fallibility/biases at both ends. Yet taking the human out of the loop completely may be even more frightening.

[2024/11/15 13:13] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Yes. I would say I agree with that.

In the AI Institute for Exception Ed we are very attentive to that

The AI solutions are not necessarily going to be the most cutting edge

We want to make solutions that work for the particular purpose

We want to help SLPs in schools

That's more important than being cutting edge

Human safeguards are important in what we are doing

[2024/11/15 13:14] Gentle Heron: Thank you Carol. QUESTION- What barriers do you expect in getting education professionals in various fields to use AI in ways that are appropriate and efficient, like you are creating?

[2024/11/15 13:15] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Yes, that's a great question.

We include people whose expertise is in human computer interaction and human centered design

They are doing focus groups and survey

With parents, SLPS and teachers

To find out what they want

And what barriers might be for them.

The use of AI in speech language pathology and education -- they have fears and worries as they should

The biggest thing is educating and explaining what is it we are doing and how its going to help them

And getting their feedback

We want the tools to be what they will really use

It's a co-design process

[2024/11/15 13:17] Carolyn Carillon: [13:13] Stepin (stepinwolf.darkstone): QUESTION Is there any effort to help those adults that still have speech and language issues.

[2024/11/15 13:17] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Answer to Stepin -- ty for asking that.

Those adults are close to my heart

This institute is focused on school age children

That's its mandate

Tools being developed by us and others can be used by adults who have persistent speech and language problems

Last fall at our annual convention of our professional org there was a day-long session on AI in our field

Journal of Speech Language and Hearing Research published them
https://pubs.asha.org/journal/jslhr
Difficulty in expressing speech (cerebral palsy for example) may be able to use an AI tool to reproduce what they are trying to say
There's lots of stuff going on
We don't work with adults but they are close to my heart
Any more questions or comments?

[2024/11/15 13:20] Gentle Heron: QUESTION- are there similar efforts in other languages?
[2024/11/15 13:20] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Good question and I don't think I know the answer to it
I feel certain there are
I don't know much about it
We are funded by US funders -- so the focus is on US schools
they may speak various dialects
Yeah, I think that it's not falling squarely within the mandate
I see that as where we need to go next
[2024/11/15 13:21] Gentle Heron: Yes, that is what I was thinking ESOL
[2024/11/15 13:21] Particle Physicist Bejiita (Bejiita Imako): seems promising in any case
If it can help children with language difficulties it's great
Good use of AI

[2024/11/15 13:21] Lyr Lobo: Thank you for the great session!
[2024/11/15 13:22] Gentle Heron: Thank you Carol. Lots of good information.
[2024/11/15 13:22] Luna Twilight: Thank you!
[2024/11/15 13:22] Anna Adamant: Thank you so much for such a great talk!
[2024/11/15 13:22] Buffy Beale: Really great information, great session thank you!

[2024/11/15 13:21] Shaerken Changeheart (ChangeheartShaerken Resident): CM: Thank you!
Thank you all. I've enjoyed all the talks I was able to listen to
I put my e-mail in the chat
cam47@psu.edu
People are welcome to contact me.
[2024/11/15 13:22] Carol Ann Miller (VAIPresenter2 Resident):
https://www.buffalo.edu/ai4exceptionaled.html
[2024/11/15 13:23] Shaerken Changeheart (ChangeheartShaerken Resident): CM: that's the website for the institute
Good info, links to a podcast or two

[2024/11/15 13:24] Elektra Panthar: ♫♪♫♪ Applauds ♪♫♪♫
024/11/15 13:24] Mook Wheeler: ♫•:*¨♥¨*:•♫ APPLAUSE ♫•:*¨♥¨*:•♫
[2024/11/15 13:24] Particle Physicist Bejiita (Bejiita Imako): /me ♪♥♪APPLAUDS!!!♪♥♪

[2024/11/15 13:24] Carolyn Carillon: <>