

**Science fair Logbook**

**By Sobem Eresia-Eke**

09/07/2024

Today I started organizing all the files I’ll need for my science fair project. I created a Google document for my logbook as well as a slideshow for my research, I also made a Google Workspace folder so I’ll be able to store various files for my project.

09/08/2024

Today, thanks to some advice from my mum I started researching cancer statistics both in Canada and worldwide and I’ve started to make a plan for what my project will be about.

09/15/2024

Unfortunately, due to a very hectic first week back to school, I couldn’t work on my science fair project much this week. I was able to read an article today that delved into much detail about how cancer forms, how the immune system plays a vital role, and some of the terminology associated with cancer growth. I’m starting to develop a better understanding of what cancer is, how it works, and how it could be stopped, but additional research needs to be done.

09/16/2024

Today I researched the factors that play a role in tumor initiation and also read an article regarding the possibilities of nano scale robotics in drug delivery and chemotherapy.

10/13/2024

The first month back in school has been far more hectic than expected, with extra-curriculars, personal projects and school in general making it difficult for me to work on my science fair project. I’m going to start developing the routine of chipping away at my science fair project during the weekends to ensure that I am able to work on it every week.

My original project idea was to research the possibilities of nanotechnology in future cancer therapies. I am still a fan of this idea but I’m going to spend some time considering other project ideas in the technological/robotic fields. The 4 possible project ideas I came to are;

* The application of nanotechnology in cancer therapies
* The development of Chatgpt and the future of AI
* The year 2124, A futurist approach to climate change, space travel, AI and a glimpse into the world 100 years from now
* The applications of nanotech in spaceflight

10/19/2024

Today I began researching the project idea that truly interested me the most, Artificial intelligence. I recently stumbled upon an extensive 50-page deep dive into the topic by the German science channel, Kurzgesagt and I’ll start reading 5 pages of it every day for 10 days starting tomorrow. I also created Google form to store my summary of each of the 5 page sections over the next 10 days as well as track how much I’m enjoying the topic and whether or not I should continue with it.

10/20/2024

Today I began reading the first five pages of the Kurzegast sources document and recorded what it is I learned, the main topic/ideas, how enjoyable I found the topic, etc. I’m going to try and read each section first thing in the morning while having breakfast to ensure that I don’t forget to read it that day.

10/30/2024

Today I finished reading the final Kurzegesagt article section. In general I found this strategy of dividing up the very daunting reading into more manageable chunks to be very efficient and helpful and I’ll try to apply it more often to future article readings for my project.

11/11/2024

One interesting idea I had for my project would be to divide it into 3 main sections, which I very loosely based of the 3 ghosts in the Christmas tale *Scrooge*.

The past

How AI technology evolved, how we got to were we are today and how it compares to the evolution of human intelligence.

The present

How Chat GPT works, and the current AI arms race.

The future

What’s an AGI? How it could develop superintelligence? What would this mean for human society?

11/27/2024

Today after quite some time feeling stumped in my research and not knowing what my next steps should look like I used ChatGPT to get some helpful tips on how I should approach my research, what tools/resources are available and what sites I should and shouldn’t trust, it gave me these 10 very helpful tips that I’ll start integrating into my research;

1. Pinpoint your specific research focus
2. Build a foundational understanding of the thing you’re researching with books like Sapiens by Yuval Noah Harari and Artficial Intelligence: A guide to Intelligent Systems
3. Use trustworthy sources like; Nature, ScienceDirect, TED Talks, Stanford AI Labs, National Geographic
4. Interview Experts
5. Explore online research platforms, like Youtube, Khan Academy and Google Scholar
6. Analyze Parallels between AI and human evolution
7. Conduct a Hands-On Experiment
8. Incorporate creative elements
9. Collaborate with forums, peers, teachers, etc
10. Keep it fun

11/30/2024

Today I decided the main focus point of my science fair project would be Machine Learning compared to natural selection. I also used ChatGPT to provide me with a list of 10 books on machine learning available in my local library.

* "Grokking Machine Learning" by Luis Serrano
* "Hands-On Machine Learning with Scikit-Learn and TensorFlow" by Aurélien Géron
* "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
* "The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World" by Pedro Domingos
* "Artificial Intelligence: A New Synthesis" by Nils J. Nilsson
* "Machine Learning for Dummies" by John Paul Mueller and Luca Massaron
* "Python Machine Learning" by Sebastian Raschka
* **"How to Create a Mind: The Secret of Human Thought Revealed" by Ray Kurzweil**
* "Machine Learning: The New AI" by Ethem Alpaydin
* "Nature of Code" by Daniel Shiffman

12/01/2024

Today I began researching the main types of machine learning; supervised, unsupervised and reinforcement learning. I also briefly researched the different types of unsupervised learning like clustering and associating rules

12/02/2024

Today I began creating a timeline of Artificial Intelligence as well as the evolution of AI technology, starting with the Turing Test

12/08/2024

* Today I began exploring podcasts that related to my science fair project that I would be able to listen to during my commute to and from school.
  + In doing so I discovered the TED AI Show and listened to the episode “How AI robots learn just like babies - but a million times faster with NVIDIA’s Rev Lebaredian”
    - The episode went into detail about how an AI robot would learn how to walk for the first time with reinforcement learning
    - And how it could *learn* to navigate all possible scenarios in the real world with the laws of physics using a computer simulation software like NVIDIA

12/17/2024

* Today I decided to combine my AI research project with another area of science that I’m very curious about, space exploration. Specifically the use of Machine Learning AI systems in Martian rovers.
* Today I also discovered a new podcast called Google Deepmind: The Podcast that relates to my research topic on AI on an AI podcast app called Snipd that allows you to create AI generated notes for the podcasts you listen (during the creation of my project I never directly copied any of my research from the AI notes, I simply used them to help me better revisit and remember what the podcast covered)
  + And I also began listening to the “Let’s get physical” episode of the podcast that talked about combining AI and robotics

12/18/2024

* Today I finished listening to the “Let’s get physical” episode of the podcast and also listened to two other episodes relating to the use of AI in science; “AI for science” and “AI: Supercharging Scientific Exploration with Pushmeet Kohli”
  + “Let’s get physical”
    - The *sparse reward* problem with reinforcement learning arises because rewarding a robot only when it’s fully completed a certain task can lead to insanely long wait times
    - The Fukushima nuclear disaster highlighted the need for AI robots that can adapt to new conditions in hazardous environments
      * Unlike pre-programmed robots that are specifically programmed by humans to do a certain task with variability
    - Humanoid AI robots can *learn* how to walk through reinforcement learning (earning rewards for accomplishing the desired behaviour) similar to how toddlers learn how to first walk
  + “AI: Supercharging Scientific Exploration with Pushmeet Kohli”
    - AlphaFold is a new AI program that can predict protein structures and has revolutionized the work of biologists
      * What would had normally taking ten years can now be done in a few days or hours
  + “AI for Science”
    - Researchers in East Africa often use hidden cameras to monitor the population of specific species in an area
      * Which can turn into a daunting task as sorting through a year’s worth of data would take a person up to 7 or 8 years
    - Using AI and computer vision a machine learning program can be used to identify the type of number of each individual species across a year’s worth of photographs at an insane rate

12/19/2024

* Today I listened to the Google Deepmind episode “AI in the Classroom with Irina Jurenka” that talked about the possibility of a combined teacher and AI tutor classroom experience and what it would look like to integrate this new technology into the educational system in a way that benefitted everyone.
  + I learnt that for very complex challenges like GO or teaching a student math it becomes increasingly difficult for the AI because it’s now faced with many different potentially successful strategies and it has to sift through and decide which strategy is th bst for the giving task
* I also listened to “AI and Nueroscience: The virtuous cycle” which explained many of the parallels between AI and human neuroscience and how understanding the human mind can help us build better AI systems and vice versa
  + I learnt about Moravec’s paradox, one of the most contradictory parts of AI research were it’s very easy for AI systems grasp conceptual topics that many humans struggle with like advanced calculus or organic chemistry but find it very difficult to do the things we humans easily do on a daily basis with thinking like walking, comprehending our physical environment and prospecting about the future

12/20/2024

* Today I listened to two more Google Deepmind podcast episodes; “AI: Your New Creative Muse? With Douglas Eck”
  + Which discussed that unlike previous advances that furthered human’s expression of creativity like digital animation techniques, movie cameras, etc. The recent advances in Generative AI (Gen AI) could serve to either revolutionize human creativity or remove the human element entirely
    - One way Gen AI is revolutionizing creative works is through it’s recently acquired ability to create and render animations and movies reminiscent of the physical laws of physics
      * Which opens the door for training AI to operate in our real world using physical simulations
* I also listened to “The promise of AI with Demis Hassabis” were the th CEO of Deepmind, Demis Hassabis discusses the potential AI has to change our world for the better
  + By using AI to solve climate change and create free accessible energy by cracking the code for nuclear fusion, etc

12/22/2024

Today I listened to the Google Deepmind episode "Project Astra: Exploring a Universal AI Assistant". That covered a new universal AI assistant with the ability to aid users with proactive memory and computer vision all from the users phone.

A very insightful episode about the future of personal assistants with AI. Today I also realized that in order to develop the most nuanced understanding of the topic on AI I need to expose myself to multiple podcasts and perspectives, not just from Google Deepmind.

12/25/2024

Today I listened to the Google Deepmind episode "Gaming, Goats & General Intelligence". I learnt that video games offer ideal training environments for AI to learn about the physical world, how objects interact with one another, etc.

I also learnt that AI "agents" are autonomous systems that are able to perform an action in an environment whether that is digitally or physically.

12/28/2024

Today I listened to the Google Deepmind episode "Unreasonably effective AI" that discussed some of the current limitations with LLMs (Large Language Models) like ChatGPT like the fact that they are only passive Q&A systems and often "hallucinate" and provide inaccurate information.

In addition the episode also touched on the Grounding problem with AIs, essentially the disconnect between an AIs abstract understanding of something as opposed to the real world thing.

Today I also borrowed "The Martian" by Andy Weir from the library today, a realistic sci-fi novel about an astronaut stranded on Mars in order to further spark curiosity in my research of the Red Planet.

12/31/2024

Today I listened to the Google Deepmind episode, "AI Safety, Ok Doomer" and I learned that one of the main reasons we don't have standard-issue AI powered self-driving cars in the modern day (among plenty of others) is because of the AI alignment issue, that essentially it's very difficult for modern AI models to both predict what other humans would do and respond in a way that's safe for as most people as possible. A concept that's deeply important for driving safely and responsibly.

01/02/2025

Happy new year! Today I began to expand my podcast topics into the other half of my science fair project (about the Martian surface and especially what rovers have to endure) by listening to the episode "Mars" from the podcast "Settle the Stars: The Science of Space Exploration". My 2 main takeaways being that Martian dust is so dangerous to rover machinery because it's so fine it can slip into the internal workings as well as clog up cameras. My second insight being that Martian caves hold interesting possibilities for scientific discoveries (because they're shielded from the harsh surface radiation and may possess liquid water) but are unfortunately our of reach for normal solar powered rovers but may be possible for an AI rover (specifically designed to quickly adjust to changing circumstances) with an internal radioactive power source to navigate.

01/04/2025

Today I began to listening to the podcast "Houston We have a podcast!", specifically the episode "After a year on Mars". Which covered the CHAPEA mission which was essentially a trail run of how humans would adjust to life on Mars and the communication delays that come with it, as telecommunications can take somewhere from 3 min to 22 min to reach Mars from Earth's depending on how close they are to each other.

01/07/2025

Today I listened to the Google Deepmind episode: "AI, Robot" which discussed some of the many problems with how AI responds to a human request. For example the specification problem (not being specific enough) or Goodhart's law (when AI goes overboard on accomplishing it's objective that it has unintended consequences). A good example of this law in the real world is when British officers in India offered cash rewards in exchange for people killing cobras (in order to reduce the snake population) which ended up having the opposite effect as the people began to herd and breed the snakes in the hopes that more snakes and therefore more snakes to kill would result in a higher reward. Which resulted in India being overrun with the increased cobra population.

01/17/2024

Today after quite some spent away from my science fair project studying for my exams I decided to do some research into computer vision (specifically it’s application into robotics) using Google Scholar. I also decided to combine all my science fair google docs (my logbook, research notes, references and cool images) and combine all of them into a single document using the surprisingly helpful tab feature in google docs.

Tomorrow I’m going to work on my project again in the morning and get caught up on all my Machine Learning research notes which I have not finished yet. As well as research how deep learning works.

01/28/2025

Today (after having finally caught a breather from my final exams) I began to write down all my research on reinforcement learning over the months through Google:Deepmind podcasts and Brilliant’s Computer science courses.

01/31/2025

Over the last three days I listened to 4 more Google Deepmind podcasts (Better Together, Fair for all, Me, myself and AI and the Road to AGI). Throughout all 4 episodes some of my key takeaways were the differences between reinforcement, supervised and unsupervised learning (and how each one is useful), a new AI called waveform that can accurately mimic a person’s voice with only a few mins of hearing them speak, the importance of AI learning to collaborate with other AI models and most importantly (and concerning) how even the most impartial AI models can and do reflect and reinforce societal inequality.

An unfortunate example of this last point at play is how a computer vision AI system could consistently identify a picture of a person snowboarding as male (because it assumed it was a more male thing to do) and would also identify a picture of someone in a kitchen as female. Scarier examples involve how a health insurance AI was more likely to withhold healthcare from black individuals and an AI designed to help in legal cases would be more likely to identify a black defendant as a criminal

02/06/2025

Today I listened to the Google Deepmind episode “Life is like a game” and some of my key takeaways were how video games provide a useful training environment for AI models to learn and I also learnt about genetic algorithms which is essentially the AI version of natural selection where the models with the most desirable traits move on and pass their skills/knowledge on to their copies (or offspring)

02/08/2025

Today I made a huge first step towards completing my science fair research by creating the first draft of my project’s introduction/problem. Rather than my typical approach of kind of forcing myself to sit in front of a computer, figuring out to research more or less on the fly and stressing about how it will come across. Instead I began experimenting with doing the research on my phone during my free time (and most importantly having a single guiding question for my research), and one huge benefit I felt was that it was much easier and fun to do the research this way because it was a first draft I didn’t have to obsess about it being perfect and I could maybe do a writing block every Saturday were I take all the first draft research I’ve taken and refine/edit as needed.

02/11/2025

Today using the method I developed on Saturday I researched what artificial neural networks (ANN) are. Among other things, I learned that ANNs are based on the human brain, and are extremely good at finding connections between data points, but this also makes them prone to either finding flawed connections between datapoints or find connections that aren’t there

02/14/2025

Today using the same method I began researching the 4 different types of machine learning, starting with supervised learning and deep learning.

02/15/2025

Today I edited the 1st draft for my project’s introduction that I had wrote up last week and I copied it into the CYSF site (an inspiring first step towards finishing my research). I also added my Canva-designed science fair poster into the site

03/01/2025

Today I had a CYSF Writing Day, which is what I’m calling the days when edit the first draft of research I did throughout the week, and I was able to get a fair amount of work done and after putting the date my CYSF Project is due on my calender which is in about 2-ish weeks I realize that I need to spend more time outside of weekends and scheduled CYSF Writing Days in order to get the online portion of my project done

03/07/2025

Today was a really productive day in terms of working on my science fair project, I was able to finish editing the 4 types of Machine Learning section and I’ve started working on the real-life case studies where I’ll probably just include MENACE and ALPHA-FOLD, with the MENACE section already being done and completed and my throughout this week I’ve been researching ALPHA-FOLD and would hopefully be able to finish today. Another really important thing I need to do before the end of march is to pre-order a trifold for the actual science fair day and if that’s not possible then maybe reuse last year’s trifold?

03/10/2025

Today I finished my research for the Alpha Fold case study and hopefully tomorrow I’ll be able to start the editing process for that part. Now that I’ve finished the case studies all that’s left to do is to do research on computer vision and research AlphaGo as well as examples of self-driving car and weather prediction algorithms which I should be be able to finish by Friday

03/19/2025

Today I finished my research for Weather prediction AI models and I finished my research on Autonomous Vehicles on Sunday (On MArch 16th), I’m currently on track to have my project fully edited, proof-read and ready to be finalized tomorrow. All that’s really left for me to do is to write up a conclusion and do any final touch ups necessary and then paste my research onto the CYSF site, and maybe get my parents to take a look at my project too

03/20/2025

Hi! Today I’ve officially finished the editing/proofreading process for my project and have also finished the conclusion. Write now my all my research takes up nearly 45 pages with a font size 18 which is without a doubt a lot, I always thought that my project suffered from too little research but it turns out that I have **too** much research. It should all still be able to fit into my trifold but I’ll definitely have to reduce the size to 11 or something smaller like that for it to work. Anyway my project is at least on paper finalized, I was only able to make two passes through my project so far which has helped me find an embarrassing amount of errors but it’s still likely that there may be a few grammatical errors still in my project. I’ll do my best to go over it one last time today and hopefully if I’m still able to access it tomorrow morning I could do a collective proofreading with my parents then. But if I’m not able to access it tomorrow morning then this would be my last Logbook entry for this project, I had a really fun time doing the research and learning about all these very cool things for my project and I just want to say thank you to however may be reading this for helping to support the CYSF program which is just amazing!