

# Can AI and ML Help With Detecting Child Leukemia?

## Kiyaara Grade 6 Logbook

*Problem:* The most popular cancer type for kids is leukemia. Almost 2,000-3,000 kids in Canada get diagnosed with leukemia. Since AI and ML has been very useful throughout the world, can it help with detecting leukemia found in children early on?

*October-November, 2023* | Research on my project.

*December 27th, 2023*

Research link: [Cancer Moonshot Current AI](#)

*December 31st, 2023* | Started filling out my basic project info.

The cancer moonshot is an ambitious initiative that the US government is taking the lead of, and the purpose is to reduce cancer related deaths to 50% in the year of 2047. It will take the most intelligent minds, and biggest hearts in healthcare, science, and technology. One of the greatest tools that can help this project is artificial intelligence. Initially, surgeries were the treatment for cancer, and in the late 1990's genetic testing was founded.

It has been a very slow process but everyone is very hopeful.

One of the ways AI can help cancer treatment is to help patients feel more confident about their decisions. Patients have to live with their decisions both mentally and physically. With the AI-enabled tests, the clinician and patient can review data to see which therapy suits them the most. A lack of understanding the circumstances causes a great impact on their survival rates.

*January 1st, 2024*

Filling out forms and conducting more research.

[How do cancer cells behave differently from healthy ones?](#)

Life starts off as a single cell. Then the cells divide and create more cells. Cells create organs and organs create us. When cells divide into more and more cells it is called growth. But sometimes, in an area of a hundred trillion cells, something can go wrong. An individual cell's DNA gets a typo, which is called a mutation. Mostly, the cell senses its mistakes and automatically shuts down, or the system detects a mutation and eliminates it. But sometimes, enough of the mutations can avoid the fail-safes causing it

to divide uncontrollably. That one cell will spread and then you might see the doctor about a lump on (anything). If the tumor is slow-growing and in one place, all you would need is surgery. If the tumor is fast-growing or near any tissues, your doctor would probably recommend radiation, or surgery followed by radiation. If the cancer has spread, (leukemia), then your doctor would recommend chemotherapy which has its side effects. Although, when you take a chemotherapeutic drug, it doesn't aim for just the cancerous cells. For example a healthy liver cell only divides when it is stressed, and a healthy hair cell divides frequently, and cancerous cells divide recklessly. When you take the drug, it hits all 3 of the cells causing it to eliminate all 3. That causes hair loss, nausea, vomiting, weight loss, and more symptoms.

### [The Cell Cycle \(and cancer\) \[Updated\] Prokaryotic vs. Eukaryotic Cells \(Updated\)](#)

Prokaryotes are cells that can be bacteria and archaea. They are unicellular (single-celled) organisms. Eukaryotes are cells that could be protists, plants, animals, or fungi.

### [What Causes Cancer?](#)

Mutations cause cancer. But, what causes mutations? Mutations are when a cell gets a 'typo', just like how when we type we often make typos. Science has it that  $\frac{2}{3}$  of cancer mutations are caused by DNA copying errors. The second possibility is environmental, some people add more mutations by their behavior, such as smoking. The third factor is genes. If your ancestors, or anyone blood related, had cancer, you are more likely to get cancer as well.

*January 3rd, 2024:* Filled out forms, did more research, and started to understand the different ways AI can help.

AI can assess and understand the 'multi-factor' data from patient assessments and provide information about their patients survival rate, disease, and disease progression predictions in order to predict the cancer.

### [UCLA Health](#)

Artificial Intelligence (AI) is the science of making machines that can, well, think like humans. AI can process tons of data that humans can't, so that's why AI is really beneficial towards the world.

“Machine learning is a field of study in artificial intelligence concerned with the development and study of statistical algorithms that can learn from data and generalize to unseen data, and thus perform tasks without explicit instructions.”

*-Research from Wikipedia*

Investigators from the UCLA Health Jonsson Comprehensive Cancer Center have built an Artificial Intelligence model based on epigenetic factors that is able to predict patients outcomes that are right, across multiple countries.

### [How can ML help with Cancer](#)

AI is used to predict and automate many cancers, which is a very new and promising way for our healthcare system to be more accurate of a patient's cancer and their possible outcomes.

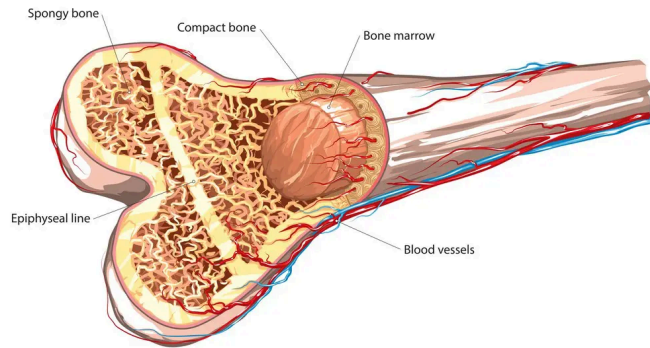
Machine learning(ML), a subset of AI that enables computers to learn from training data, has been highly beneficial for predicting varieties of cancer, such as breast, liver, brain, lung, and prostate cancer. Actually, AI and ML are proven to detect cancer better than most clinicians. And because of all these reasons, it is super important to improve current modern AI + ML to find even better programs that can entirely change the outcome of cancer patients, and not just cancer-related patients, but for other illnesses as well.

*January 7th, 2023-* Started researching leukemia found in children.

About 1,000 children get cancer every year. Children with cancer may be at a greater risk of covid-19. Covid may cause an abnormal immune response in the body that can cause mutations leading to cancer.

[Childhood leukemia statistics | Canadian Cancer Society](#)

Leukemia is the cancer of the white blood cells, and in leukemia, the bone marrow makes tons of white blood cells that are abnormal. The bone marrow is the spongy material inside the bones.



### [Bone Marrow - What is it? Structure, Function, Diseases.](#)

Incidence is the total number of new cancer cases. Mortality is the number of deaths caused by cancer.

*January 10th, 2024-* Started researching cases of leukemia.

Leukemia occurs most to people older than 55, and is the most common type of cancer to kids less than the age of 15.

The cancer statistics for kids 0-14 years of age for 2016-2020 are:

- 138 Canadian children died from leukemia.
- 59 Canadian children died from acute lymphoblastic leukemia.
- 51 Canadian children died from acute myelogenous leukemia.

Cancer Statics are used to inform people of how many people died due to cancer.

### [Childhood Cancer: Statistics](#)

*January 11th-* Researched on ML algorithms and variables.

A Machine Learning algorithm for diagnosis of leukemia is SVM.

### **Risk Factors that can affect Leukemia**

- ★ Exposure to certain chemicals. ...
- ★ Chemotherapy in the past. ...
- ★ Radiation exposure. ...
- ★ Rare congenital diseases. ...
- ★ Certain blood disorders. ...
- ★ Family history. ...

- ★ Age.
- ★ Smoking |people who smoke are at a risk of acute myeloid leukemia (AML) more than people who don't smoke|

A machine learning model is a program that can find patterns or make decisions from datasets.

The ML model used for image recognition in convolutional neural networks (CNNs). Neural Networks are like a human brain trying to learn something. Inside a computer, it has things like neurons, and those have connections to our brains. So basically, we train a computer to find out, for example, what makes a car a car. With this technology, the computer can learn and get smarter over time. To train a computer, people can send huge amounts of data. The computer can then sort through the data and learn from it very quickly.

### How to Make an ML Model Using Python

- Loading the dataset.
- Understanding the dataset.
- Data preprocessing.
- Data visualization.
- Building a regression model.
- Model evaluation.
- Model prediction.

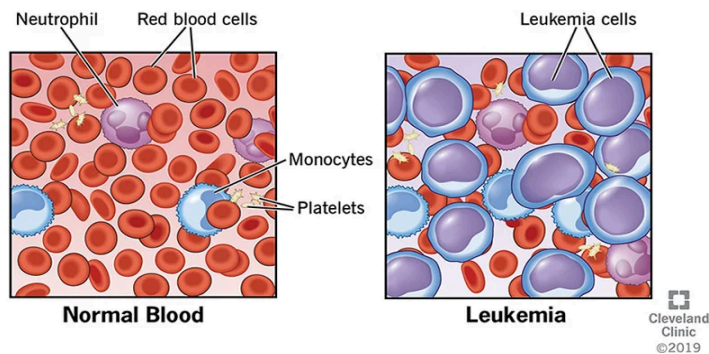
Reinforcement learning (RL) is a machine learning (ML) technique that trains software to make decisions to achieve the most optimal results. It mimics the trial-and-error learning process that humans use to achieve their goals. Reinforcement learning is by the process of trial and error, just like the human brain. In this case, we would train the computer by giving it data, and when it does something wrong, it learns from its mistakes.

Linear regression is a data analysis technique that predicts the value of unknown data by using another related and known data value. It mathematically models the unknown or dependent variable and the known or independent variable as a linear equation.

## [How to Make an ML Model Using Python](#)

*January 13th, 2024-* Researched on leukemia cells under microscopes.

### [Leukemia Cells](#)



### [Using ML to detect Cancer](#)

The doctor may start by asking you about personal and family medical history. You get diagnosed with cancer by taking lab tests or other procedures. But you can also use image detection. The proposed intelligent deep learning algorithm uses the microscopic images of blood smears as the input data. The tissue slides that pathologists use to diagnose cancer contains a vast amount of information. Every cell needs to be examined. Sometimes, cancer is hard to find. Using the tissue slides, they put it underneath the microscope, and it has a camera, so the computer is seeing everything that the humans see. It's feeding information into the computer which then does billions of calculations and then telling the pathologists whether it is a tumor or not. The computer detects cancer from early on and is more accurate than real human beings. The pathologists then train the computer with showing different cancer cells. If pathologists have access to this, then it can make a big difference to people with leukemia. A pathologist is a medical healthcare provider who examines bodies and body tissues.

*January 14th, 2024-* Researching on the advantages of machine learning image detection.

If Cancer is detected early on, it may mean less treatment and less time recovering. The earlier cancer is detected, the better your chance of survival.

The most popular leukemia found in children is Acute lymphoblastic leukemia (ALL). The second most popular type of leukemia found in children is Acute myeloid leukemia (AML) which is very common in teens.

Childhood acute lymphoblastic leukemia (ALL) is a type of cancer in which the bone marrow makes too many immature lymphocytes (a type of white blood cell). Childhood acute lymphoblastic leukemia (also called ALL or acute lymphocytic leukemia) is a cancer of the blood and bone marrow.

### [Cancer Staging](#)

*January 15th, 2024-* Started working on staging.

Child Leukemia has no standard staging system, although they can be described as phases. The time when the phases occur are different for every child. The phases include:

*Untreated-* The leukemia is newly diagnosed and hasn't been treated yet.

- There may be low numbers of normal blood cells.
- For Acute Lymphoblastic leukemia (ALL), usually more than 25% of the cells in the bone marrow are blasts (immature white blood cells)
- For acute myelogenous leukemia (AML), usually more than 20% of the cells in the bone marrow are blasts.

*Remission-* After the leukemia is treated, the leukemia can still be in remission.

#### **Complete Remission is when:**

- The number of blood cells is normal or close to normal.
- Less than 5% of bone marrow are blasts.
- There are no general signs of childhood leukemia.
- There are no signs or symptoms of childhood leukemia anywhere in the body.

**Partial remission** means that less than 25% of the cells in the bone marrow are blasts.

*Minimal residual disease (MRD)*- After the treatment there still may be blasts in the bone marrow. Standard tests may not find these. But, disease that can only be found using more sensitive tests is called minimal residual disease (MRD).

*Active disease*- more than 5% of the cells in the bone marrow are blasts. This term may be used during and/or after the treatment.

*Recurrent Disease*- Leukemia has come back after it was in remission following treatment. A child will have recurrent leukemia if more than 5% of the cells are blasts in the bone marrow.

*Refractory Disease*- The cancer is resistant to the treatment or the treatment is not working.

*Central Nervous System (CNS disease)*- Leukemia has spread to the brain or spinal cord.

CNS disease means one of the following:

- CNS 1 – no blasts in the CSF (cerebrospinal fluid)
- CNS 2 – White blood cells count is less than 5/mL with blasts in the CSF
- CNS 3 – White blood cells count is 5/mL or greater with blasts in the CSF or there are signs that leukemia has spread to the CNS

*January 26th, 2024*- Putting my research together and pulling out a conclusion.

AI can help with detecting cancer by risk assessment, early diagnosis, patient prognosis estimation, and treatment selection based on deep knowledge.

*January 29th, 2024*- Finishing little details and getting closer to finish. Also starting to work on a conclusion.

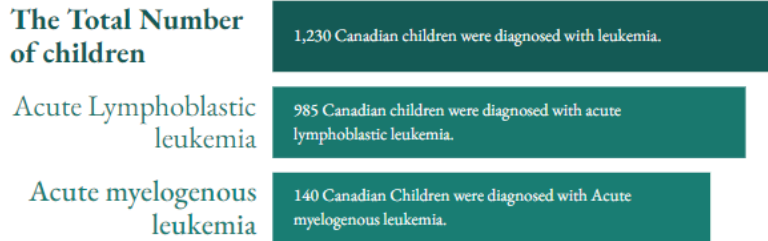
Leukemia is detected using the help of image detection which AI and ML contribute to. ML models can find ways to improve classification of imaging findings related to cancer.

**CONCLUSION #1**- Leukemia is found in the bone marrow and it is usually detected using image detection. AI and ML models can contribute a lot to that. If Cancer is detected early on, it may mean less treatment and less time recovering. The earlier cancer is detected, the better your chance of survival. So, AI and ML can contribute by detecting leukemia early on.

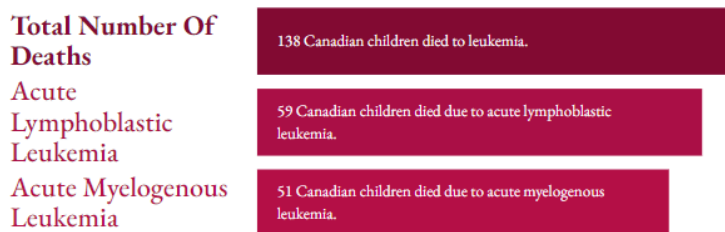
*January 30th, 2024*-Working on finding my data.



## Recent Incidence Statistics for Leukemia in Children From Ages 0-14|| 20014-2018 Are:



## Mortality Statistics For Leukemia Found in Children From Ages 0-14|| 2016-2020 Are:



*January 31st*, - Organizing my research for easy accessibility.

*February 3rd*- Finishing research on last questions.

A tumor is an abnormal mass of tissue that forms when cells grow and divide more than they should or do not die when they should.

*February 4th*- Finishing research and drawing diagrams.

*February 5th*- Worked on my method.

### ***METHOD:***

***- First, I tried to find a topic that I was interested in. Cancer is a global Issue, and AI/ML have been finding solutions to global issues, so I wondered if I could put those together.***

***- Second, I started research on both topics. I researched about Cancer and AI/ML, plus started by logbook.***

- *Then, with such a broad topic, I decided to narrow it down to AI/ML and child leukemia.*
- *After that, I asked myself a question. How can AI/ML help detect childhood leukemia?*
- *I filled out a variety of forms.*
- *I conducted research for my question.*
- *I found a conclusion to the question.*
- *Finally, I prepared a speech and worked on my tri fold and my online presentation.*

*February 6th, 2024-Worked on my final conclusion.*

## **CONCLUSION-**

Leukemia is found in the bone marrow. AI/ML can contribute to image detection, which is helpful for doctors to find out what cells are a tumor and which are not. ML models are proven to detect cancer better than most clinicians. If cancer is detected early on, it may mean less treatment and less time recovering. The earlier cancer is detected, the better chance of survival. AI and ML help us think outside the box, and we are no longer limited to the tool sets we had in the past. Diagnosing cancer normally with a doctor, without any help from AI and ML, it may take weeks or months. With the help of AI and ML, it only takes approximately 3 minutes.

*February 15th, 2024- Did some work on starting my video presentation.*

*February 16th, 2024- Continuing work on video presentation.*

*February 18th, 2024- Started getting ready to start my tri-fold.*

[ML Model for image recognition](#)

*February 19th, 2024- Researching on ML datasets.*

## Cancer Diagnosis

### ***WAYS A DOCTOR DIAGNOSES CANCER***

**X-RAY-** An x-ray is a quick, painless test that captures images of the structures inside the body; particularly bones. X-ray beams are passed through the body and are absorbed in different amounts.

**CT SCAN-** CT scans can diagnose possibly life-threatening dangers, like cancer. A CT scan takes no longer than 10-15 minutes, although when you are lying down on the bed, the actual scan takes around 20 seconds.

**MRI(Magnetic resonance imaging)-** A medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body. MRI scanners use strong magnetic fields, magnetic gradients, and radio waves to generate images of the organs in the body.

**PET SCAN(Positron emission tomography)-**PET scan shows how the patient's cells react to a radiotracer, which may indicate cancerous areas.

**BIOPSY-** “A biopsy is a medical test commonly performed by a surgeon, an interventional radiologist, or an interventional cardiologist. The process involves the extraction of sample cells or tissues for examination to determine the presence or extent of a disease.” - Wikipedia

Diagnosing cancer normally with a doctor, without any help of AI and ML, it may take weeks, or months to diagnose cancer. Although with the help of AI and ML, it only takes approximately 3 minutes.

*February 20th-30th, 2024- Organizing and printing out content for tri-fold.*

*March 1st+2nd, 2024- Finishing up tri-fold and video presentation. Also preparing my speech.*

*March 3rd, 2024-* All done my tri-fold and video presentation! Last thing to do is prepare a speech!

*March 4th-5th, 2024-* Practicing my final speech.