

"How accurate and reliable is a browser-based AI system in audibly identifying medication containers to assist visually impaired individuals?"

Source	Question	Answer
https://www.geeksforgeeks.org/computer-vision/what-is-image-classification/#what-is-image-classification	What is image classification and how does it work?	Computer vision that deals with automatically understanding the content of an image. It involves assigning a label to an entire image.
https://afb.org/blindness-and-low-vision/using-technology/prescription-health-and-fitness/accessible-prescription	How do visually impaired individuals currently identify their medication?	Using Braille or large-print labels, tactile markers like rubber bands or stickers, and technology like smartphone apps or dedicated devices that read special labels.
https://afb.org/blindness-and-low-vision/using-technology/prescription-health-and-fitness/accessible-prescription	What technologies are currently available to help blind people distinguish between different medications?	A ScriptTalk Station uses special talking labels that have the prescription name, dosage instructions, and other label information encoded on (RFID) chips
https://dipankarmedh1.medium.com/real-time-object-detection-with-yolo-and-webcam-enhancing-your-computer-vision-skills-861b97c78993	How do webcams capture image data for machine learning models in real time?	A software library like OpenCV then captures these frames one by one, and they are sent to a machine learning model for processing, all within a fraction of a second.
https://www.ultralytics.com/glossary/confidence#:~:text=In%20machine%20learning%20C%20the%20confidence,output%20for%20a%20single%20instance.	What is confidence probability in AI predictions?	A numerical score, typically from 0 to 1 (or 0% to 100%), that quantifies an AI model's certainty about its output for a single prediction, with higher scores indicating greater confidence.
https://pubmed.ncbi.nlm.nih.gov/24513423/#:~:text=Abstract,impairment,%20Vision,%20Visual%20impairment.	What are the risks associated with medication misidentification for visually impaired individuals?	Serious health consequences, including overdose, underdosing, untreated or worsening health conditions, adverse drug events, organ damage, and even death.

https://www.ibm.com/think/topics/artificial-intelligence	What is artificial intelligence?	Artificial intelligence is the ability of a computer or machine to perform tasks that normally require human intelligence, such as learning, recognizing images, and making decisions.
https://www.geeksforgeeks.org/machine-learning/	What is machine learning?	Machine learning is a type of AI that allows computers to learn from data and improve their performance without being explicitly programmed.
https://teachablemachine.withgoogle.com/	What is Teachable Machine?	Teachable Machine is a web-based tool created by Google that allows users to train machine learning models using images, sounds, or poses without needing coding experience.
https://www.tensorflow.org/js	How does TensorFlow.js run AI models in a browser?	TensorFlow.js allows machine learning models to run directly in a web browser using JavaScript, without sending data to a server, which improves speed and privacy.
https://www.w3schools.com/howto/howto_js_speech_synthesis.asp	How does text-to-speech technology work in a web browser?	Text-to-speech technology converts written text into spoken audio using speech synthesis, allowing computers to read information aloud to users.
https://www.microsoft.com/en-us/ai/ai-for-accessibility	How can AI improve accessibility for visually impaired people?	AI can help visually impaired people by recognizing objects, reading text aloud, and providing audio feedback, increasing independence and safety.

Image classification is a branch of computer vision that focuses on automatically understanding the content of an image. It works by analyzing visual features such as shapes, colors, and patterns, and then assigning a label to the entire image. In this project, image classification is used to recognize different types of medication bottles and assign the correct name to each one.

Artificial intelligence (AI) is the ability of a computer or machine to perform tasks that normally require human intelligence, such as learning, recognizing images, and making decisions. A key subset of AI is machine learning, which allows computers to learn from data and improve their performance without being explicitly programmed. Instead of following fixed rules, machine learning models analyze examples and identify patterns on their own.

To build the model for this project, Teachable Machine was used. Teachable Machine is a web-based tool created by Google that allows users to train machine learning models using images, sounds, or poses without needing advanced coding knowledge. The trained model runs in the browser using TensorFlow.js, which enables machine learning models to operate directly in a web browser using JavaScript. Because the model runs locally, it does not need to send data to a server, which improves both speed and privacy.

Webcams play an important role in real-time image recognition. A webcam captures video by recording a sequence of image frames. A software library such as OpenCV (or similar browser-based tools) processes these frames one at a time and sends them to the machine learning model. The model analyzes each frame within a fraction of a second and outputs a prediction. Along with the prediction, the model provides a confidence probability, which is a numerical score between 0 and 1 (or 0% to 100%) indicating how certain the AI is about its classification. Higher confidence values mean the model is more certain about its prediction.

For visually impaired individuals, identifying medication can be challenging. Many currently rely on Braille or large-print labels, tactile markers such as rubber bands or stickers, or smartphone apps designed to read labels aloud. Specialized technologies such as the ScriptTalk Station use talking prescription labels with RFID chips that store information about the medication, including dosage instructions and warnings.

Medication misidentification can lead to serious health consequences. These risks include overdosing, underdosing, untreated or worsening medical conditions, adverse drug reactions, organ damage, and potentially life-threatening situations. Because of these risks, improving medication identification methods is extremely important.

Artificial intelligence has the potential to significantly improve accessibility for visually impaired individuals. AI-powered systems can recognize objects, read text aloud, and provide real-time audio feedback. By combining image classification with text-to-speech technology in a web browser, systems like the one developed in this project can increase independence, safety, and confidence when managing medications.