Data Science with Autism: Embracing New Technologies to Accelerate Autism Research

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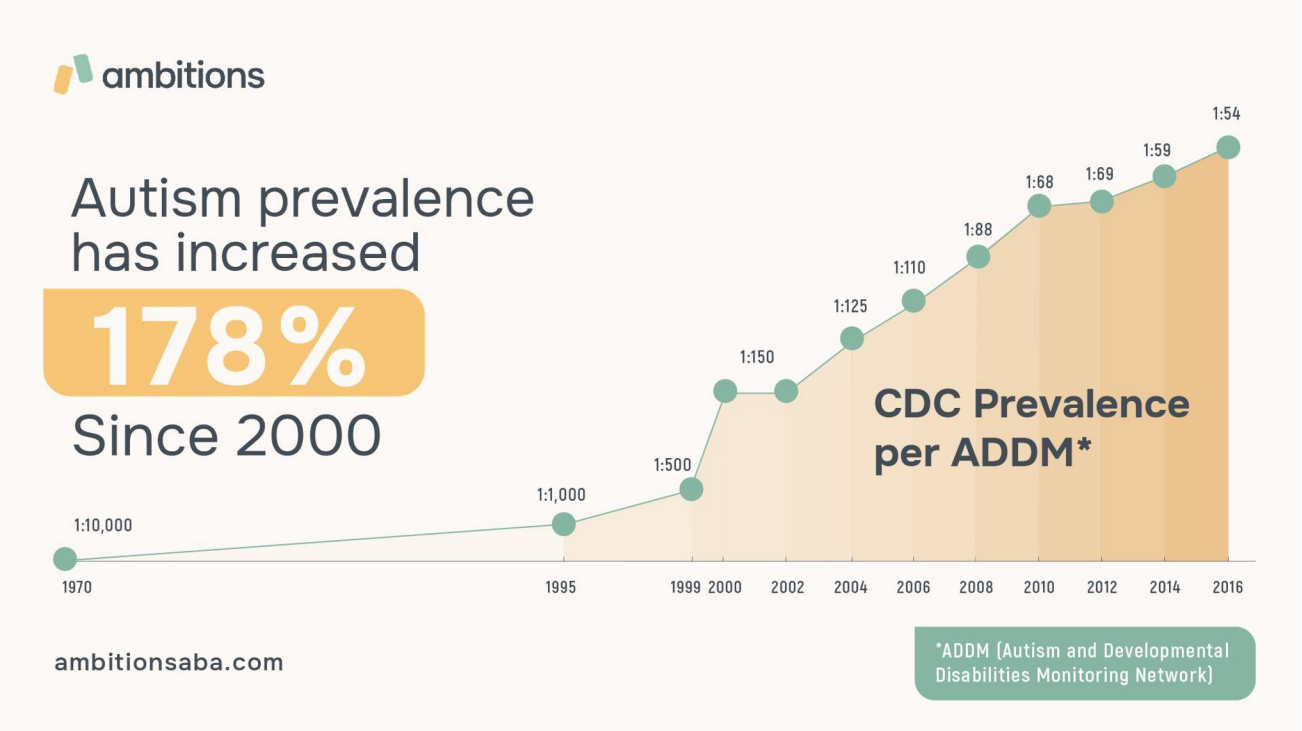
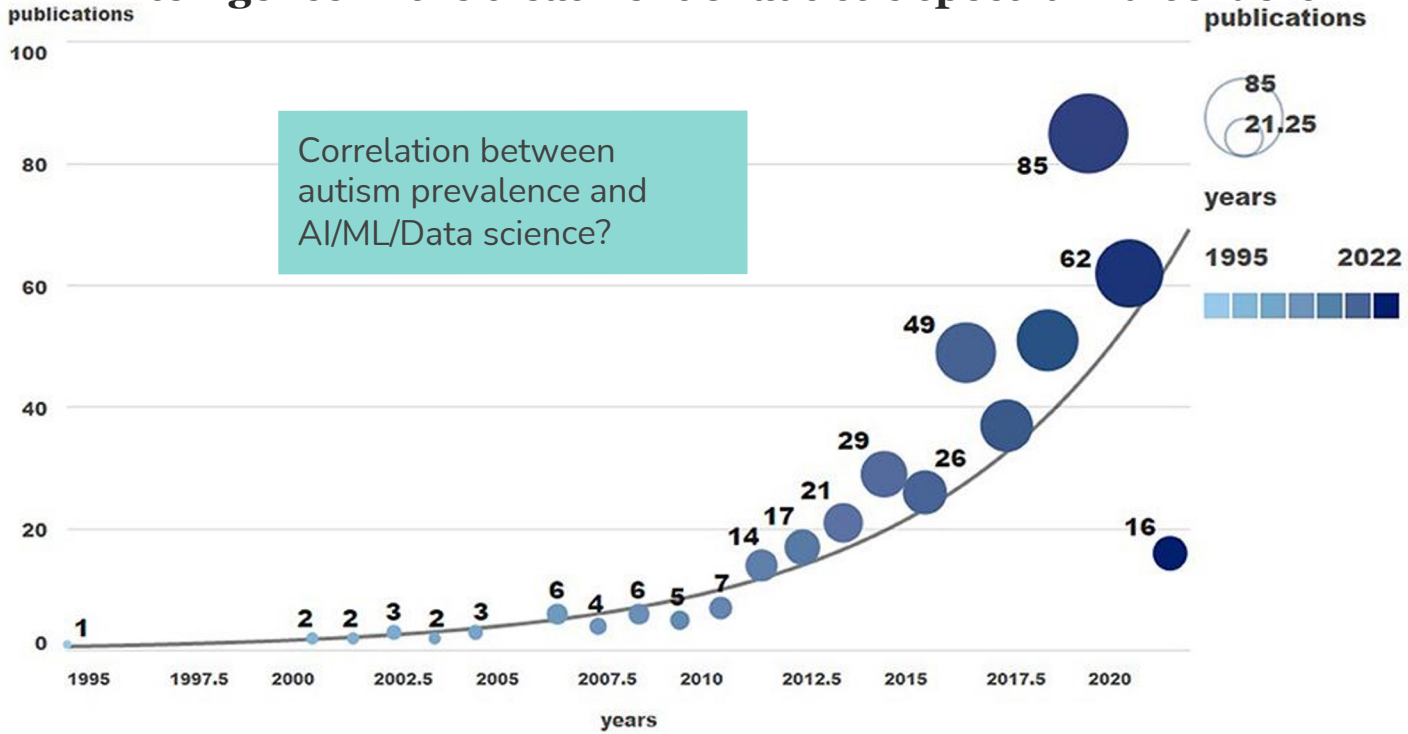
Autism prevalence is increasing



Source:https://www.ambitionsaba.com/resources/autism-statistics

But with AI, research with autism is also increasing

A bibliometric analysis of research trends of artificial intelligence in the treatment of autistic spectrum disorders



Correlation between autism prevalence and AI/ML/Data science?

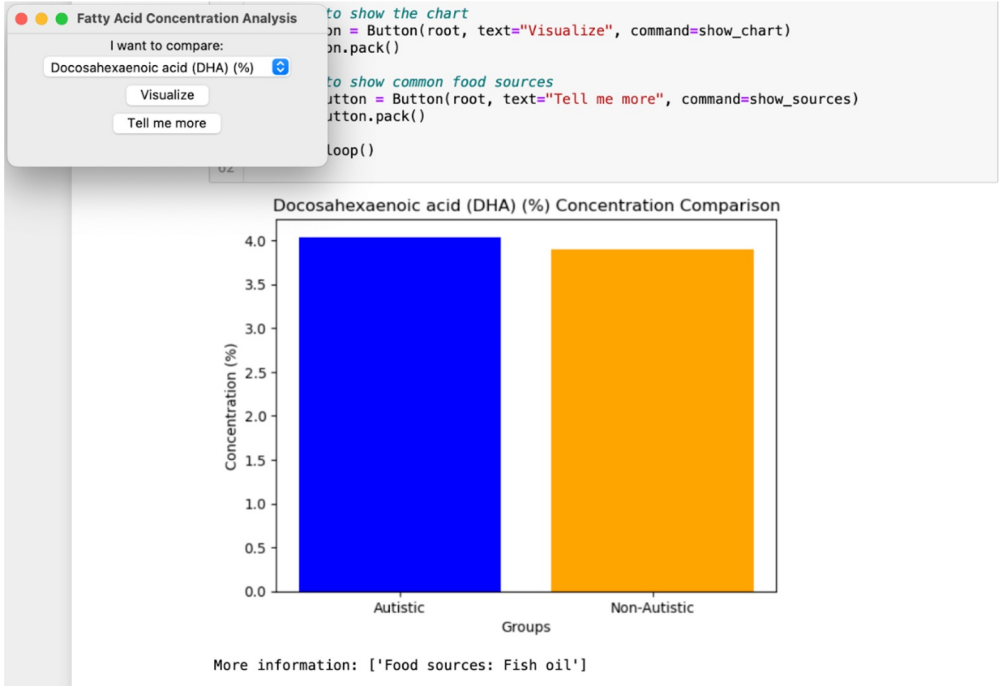
Source: https://www.frontiersin.org/articles/10.3389/fpsyt.2022.967074/full

Purpose of Our Project

- Inspire medical professionals to use emerging data science technologies as a new tool for autism research
- Using two data science techniques:
  - Information retrieval
    - Pulls information from a dataset or database
  - Machine learning
    - Predicts an outcome

Information Retrieval (IR) Task 1: Biochemical Compounds Data Visualizations

- Purpose: Quick information retrieval using easy to use graphical interface:
  - Compares autistic vs non autistic groups with average fatty acid concentrations
  - Plots a bar graph
  - Also retrieves a brief description of what the fatty acids mean



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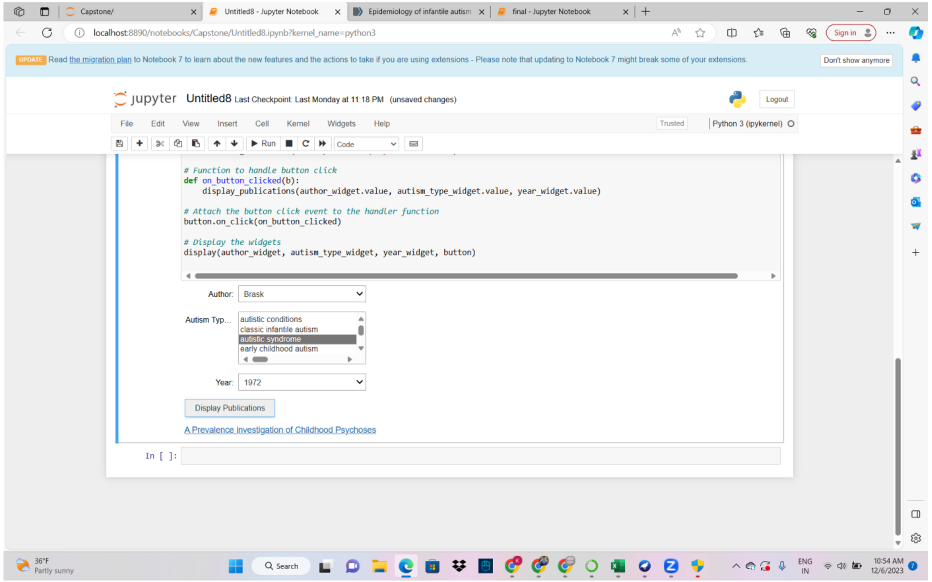
IR Task 2: Journal Article Query

- Purpose: easy to use graphical interface to find a journal article based off user input
  - Filter by:
    - Author
    - Autism Type
    - Year



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Machine Learning (ML) Task 1: Forecast % Likely Autistic From Questionnaire

National Institute for Health Research

AQ-10

Autism Spectrum Quotient (AQ)

A quick referral guide for adults with suspected autism who do not have a learning disability.

Please tick one option per question only:		**Definitely Agree**	**Slightly Agree**	**Slightly Disagree**	**Definitely Disagree**
1	I often notice small sounds when others do not				
2	I usually concentrate more on the whole picture, rather than the small details				
3	I find it easy to do more than one thing at once				
4	If there is an interruption, I can switch back to what I was doing very quickly				
5	I find it easy to 'read between the lines' when someone is talking to me				
6	I know how to tell if someone listening to me is getting bored				
7	When I'm reading a story I find it difficult to work out the characters' intentions				
8	I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant etc)				
9	I find it easy to work out what someone is thinking or feeling just by looking at their face				
10	I find it difficult to work out people's intentions				

SCORING: Only 1 point can be scored for each question. *Score 1 point for Definitely or Slightly Agree on each of items 1, 7, 8, and 10. Score 1 point for Definitely or Slightly Disagree on each of items 2, 3, 4, 5, 6, and 9.* If the individual scores **6 or above**, consider referring them for a specialist diagnostic assessment.

This test is recommended in 'Autism: recognition, referral, diagnosis and management of adults on the autism spectrum' (NICE clinical guideline CG142). www.nice.org.uk/CG142

Key reference: Allison C, Auyeung B, and Baron-Cohen S, (2012) *Journal of the American Academy of Child and Adolescent Psychiatry* 51(2):202-12.

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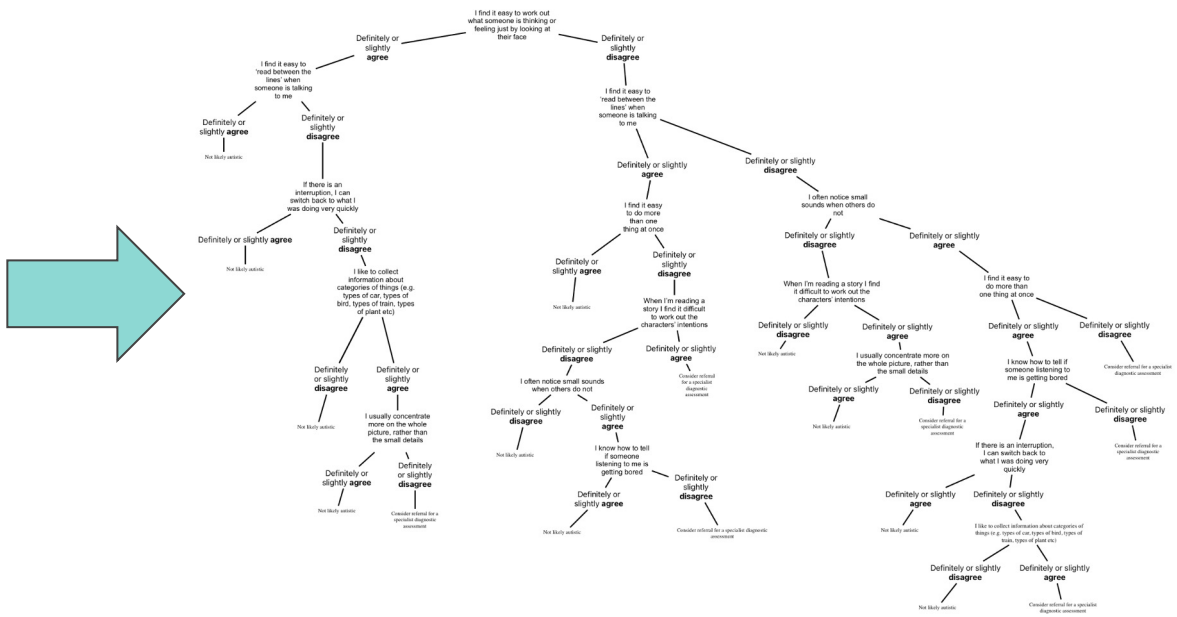
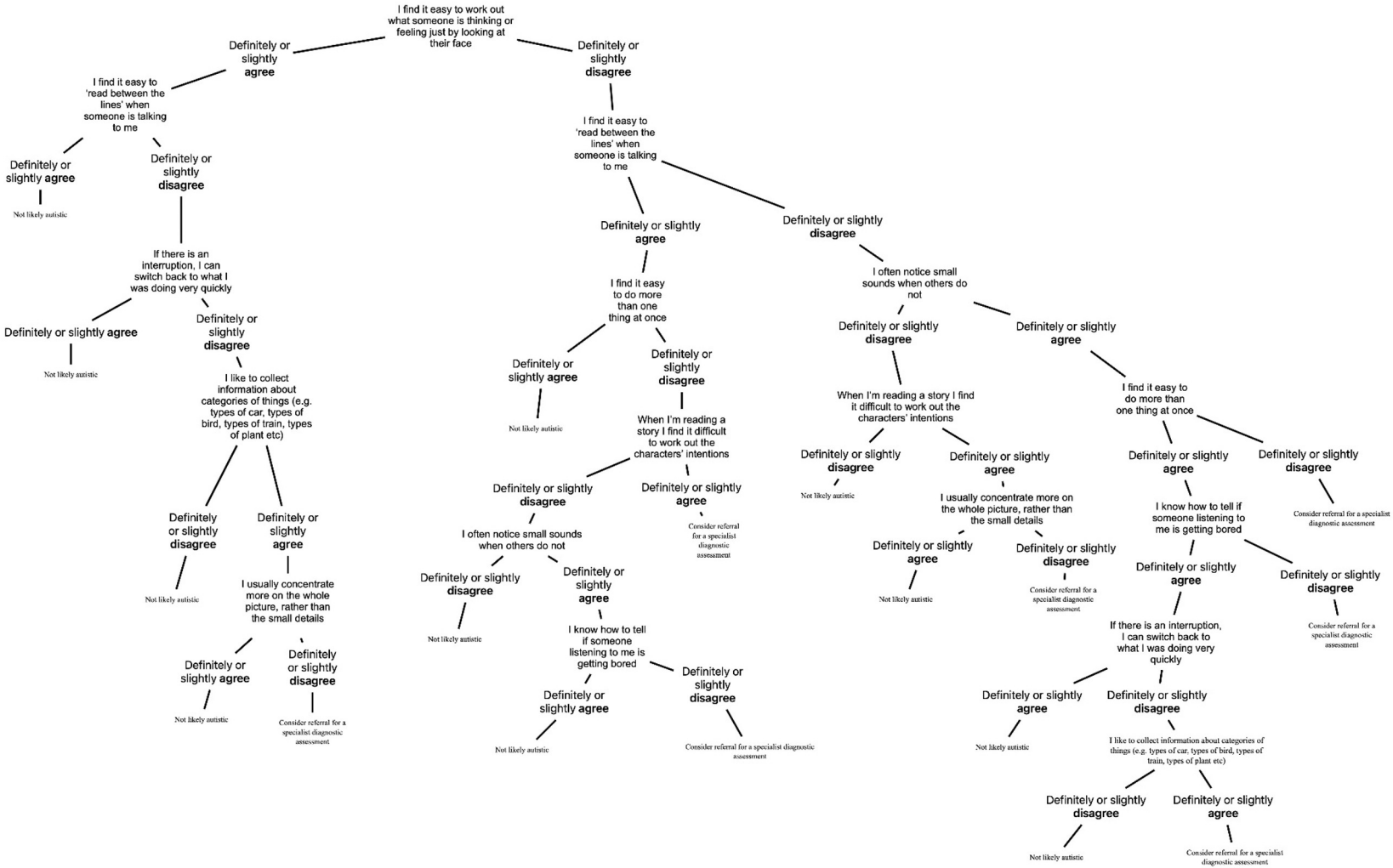
autism research centre arc



Original "rules":
Score ≥ 6: Consider referral
Else: Not likely autistic
(Doesn't give insight to what questions are more important)

Decision Tree
(Gives more insights)


I find it easy to work out what someone is thinking or feeling just by looking at their face
Definitely or slightly agree
Definitely or slightly disagree
I find it easy to 'read between the lines' when someone is talking to me
Definitely or slightly agree
Not likely autistic
Definitely or slightly disagree
If there is an interruption, I can switch back to what I was doing very quickly
Definitely or slightly agree
Not likely autistic
Definitely or slightly disagree
I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant etc)
Definitely or slightly disagree
Not likely autistic
Definitely or slightly agree
I usually concentrate more on the whole picture, rather than the small details
Definitely or slightly agree
Not likely autistic
Definitely or slightly disagree
Consider referral for a specialist diagnostic assessment
I find it easy to 'read between the lines' when someone is talking to me
Definitely or slightly agree
I find it easy to do more than one thing at once
Definitely or slightly agree
Not likely autistic
Definitely or slightly disagree
When I'm reading a story I find it difficult to work out the characters' intentions
Definitely or slightly disagree
I often notice small sounds when others do not
Definitely or slightly disagree
Not likely autistic
Definitely or slightly agree
I know how to tell if someone listening to me is getting bored
Definitely or slightly agree
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Consider referral for a specialist diagnostic assessment
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Definitely or slightly disagree
Consider referral for a specialist diagnostic assessment

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ML Task 2: Forecast % Likely Autistic From an Image

- Purpose: To develop a machine learning model for early detection of autism in children using image analysis, aiming to augment traditional diagnostic methods despite current challenges in achieving high accuracy.

- This machine learning model employs convolutional neural networks (CNNs) to analyze images for autism diagnosis in children. It utilizes data augmentation, binary classification, and rigorous testing to enhance accuracy despite current limitations.

- Utilizes a convolutional neural network with sigmoid
activation for binary classification, predicting autism in children from images. The model outputs a probability score, with a threshold at 0.5 to distinguish between 'autistic' and 'non-autistic' classifications based on learned image features.

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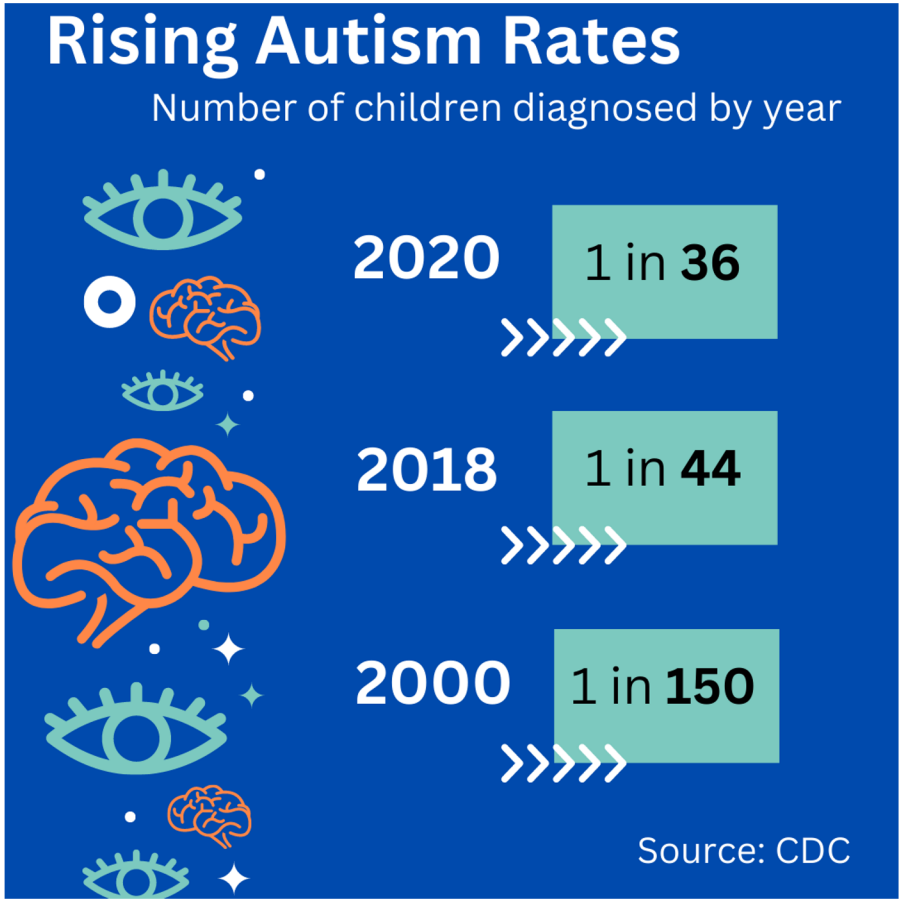
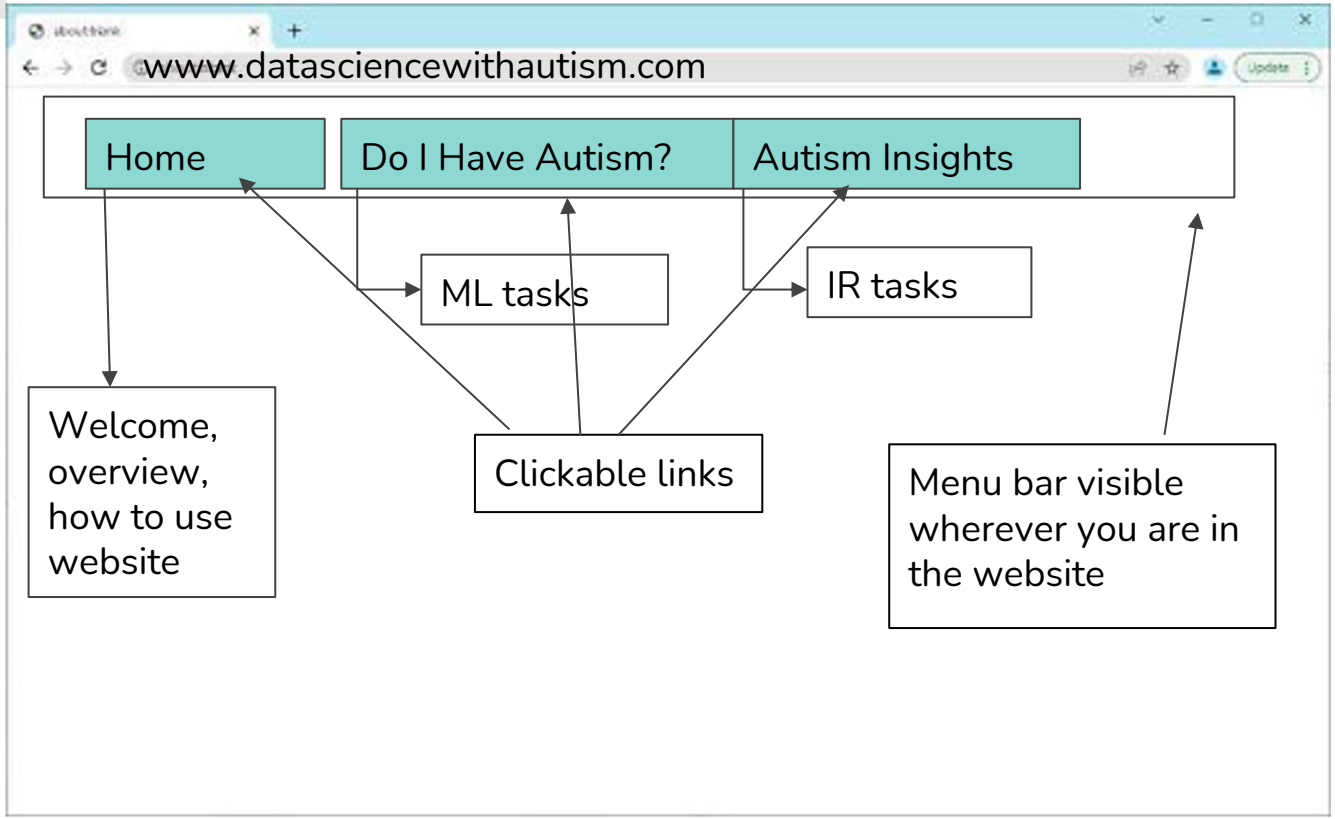
Conclusion

- Rising autism rates could be correlated with advancements in AI/ML
- These four tasks show what's possible with emerging technologies and data science as a whole with autism research
- Data science should be embraced as a new tool to accelerate autism research



Future Plans



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