

# Data Science applications for Health Care

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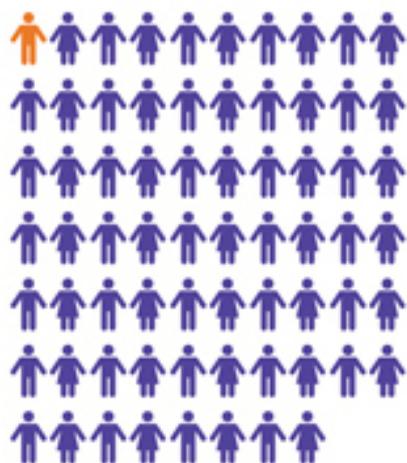
# About me

- *PhD in Chemical and Biomolecular Engineering*
- *Academic Research (5 years)*
- *Data Scientist (3 years)*
  - Data analysis, Algorithms, Modeling, Visualization, Insights
- *Worked with retail, financial and federal clients*
- *Lead team of analysts for multiple successful PoC and RFPs for Federal and Commercial clients.*
- *Python, R, MicroStrategy, Tableau, SQL, TensorFlow, Hadoop, Spark, AWS, MicroSoft Azure*

# Autism and ABA

2012

NUMBER OF CHILDREN  
IDENTIFIED WITH ASD



1 in 68      59

2014



U.S. Department of  
Health and Human Services  
Centers for Disease  
Control and Prevention

Nationwide rate of autism  
1993 - 2003

657%

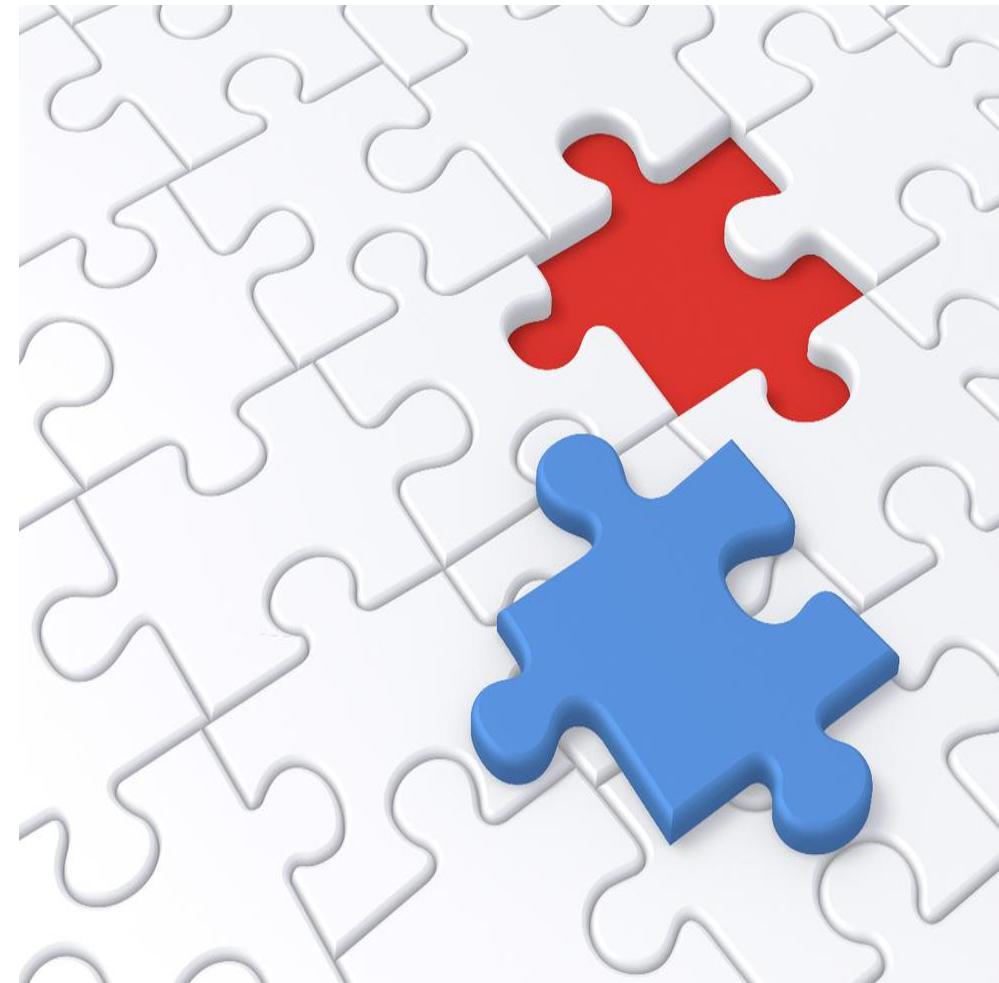


“Applied Behavior Analysis (ABA) uses methods derived from scientifically established principles of behavior and incorporates all of the factors identified by the US National Research Council as characteristic of effective interventions in educational and treatment programs for children who have autism.”

[Foxx, Richard M. “Applied Behavior Analysis Treatment of Autism: The State of the Art”, Child and Adolescent Psychiatric Clinics , Volume 17 , Issue 4 , 821 - 834](#)

# Challenging Behaviors

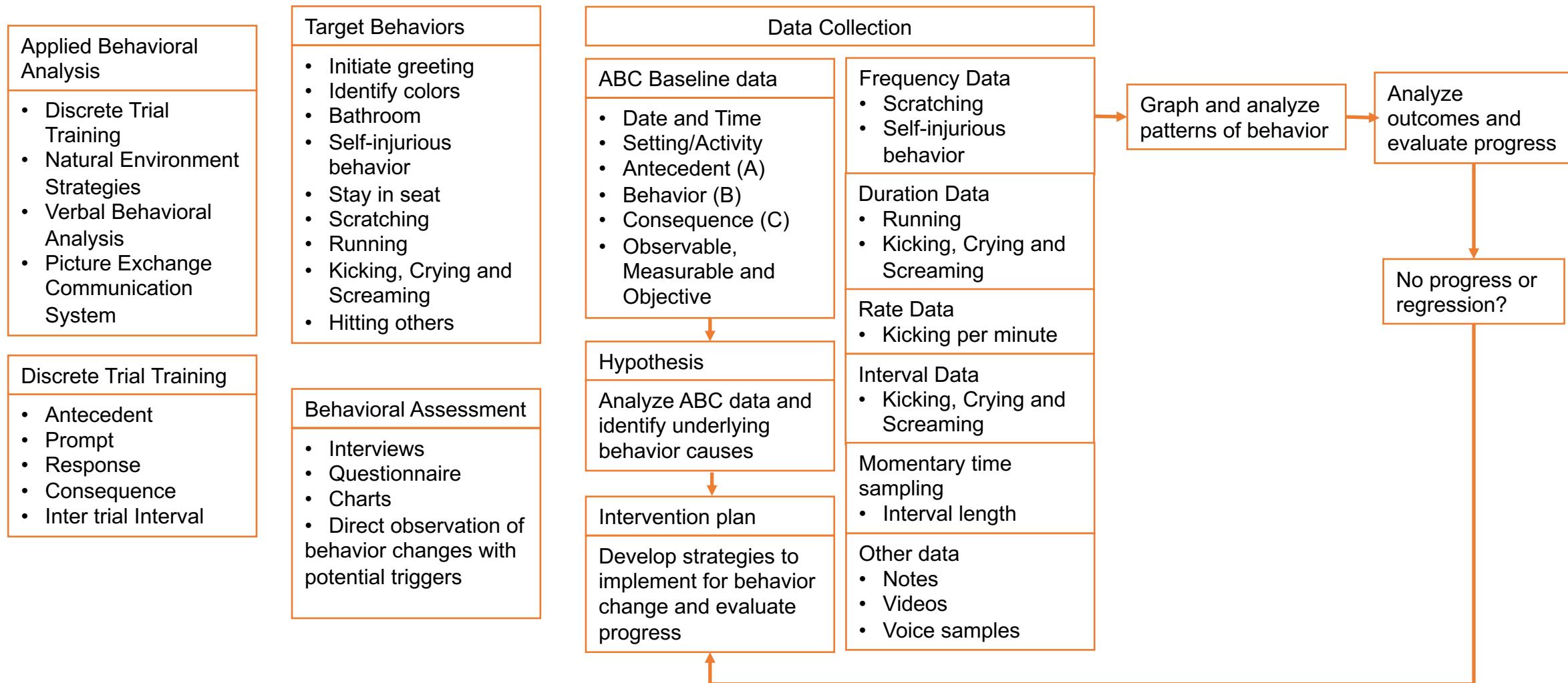
- Aggression and self-injury
- Social communication and social interaction problems
- Repetitive behaviors and restricted interests
- Cognitive problems
- Mental health problems
- Sensory problems
- Motor skills



# Background

- Lovaas' (1987) – Children diagnosed with autism can learn most effectively using ABA technique, particularly with Discrete Trial's Methodology.
- Francis (2005) – Children who received ABA treatment made larger improvements in most skill areas than children who participated in other interventions
- Barbera (2003), Hernandez (2008) – Discrete Trial Training is typically recommended for 40 hours per week.

# Methodology



# Case Study

- Objective:
  - Applied Behavior Analysis (ABA) effectiveness to elicit a spontaneous greeting in various setting by an adolescent male diagnosed with autism.
- Research Design: Single-case experiment design
- Training method: Discrete Trials Training (DTT)
- Training period: 10 week intervention program (20 hours per week)
- Success metrics: Behavior checklist for assessing skill improvement

# Procedure

- Skill taught to make initial greeting ‘hello’ while making eye contact with other person
- Score measured behaviors as ‘2’ (without prompt) or ‘0’ (with prompt):
  - Make eye contact
  - Acknowledge other person without prompting
  - Offer verbal response
  - Reciprocally acknowledge with wave or smile
- Data Collection:
  - Four raters perform scoring independently at multiple locations (school, public places etc.)
  - Daily scores over a 10–week period. Weekly scores range between 0 and 10.
  - Record evaluations in a checklist - Frequency, percentage, latency etc.
  - Weekly scores were converted into percentages from 0% to 100% to represent the frequency of occurrence
  - Weekly frequencies of occurrence of behaviors were plotted on bar graphs for the ten week training program period
  - Weekly scores for each of 4 behaviors are plotted.

# Data Collection

## Behavior Data

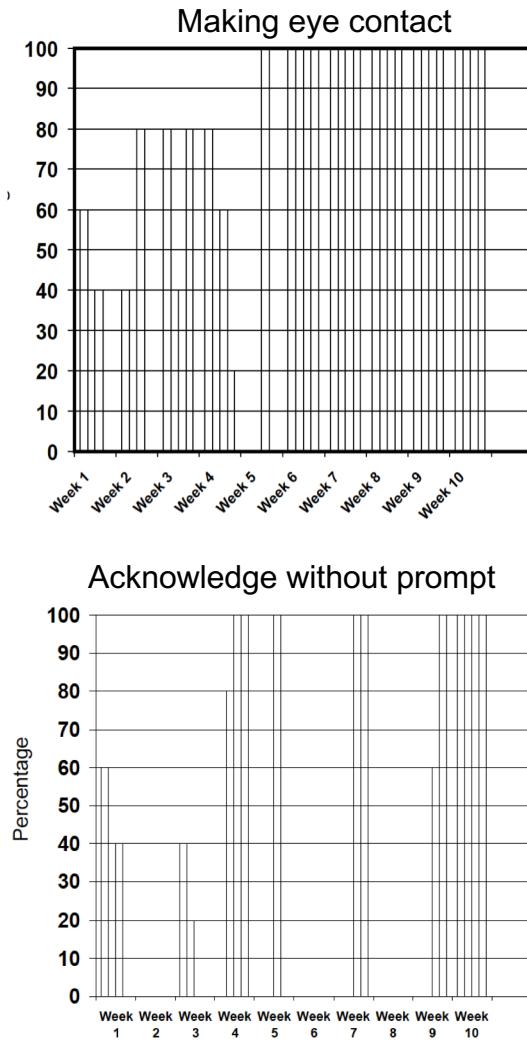
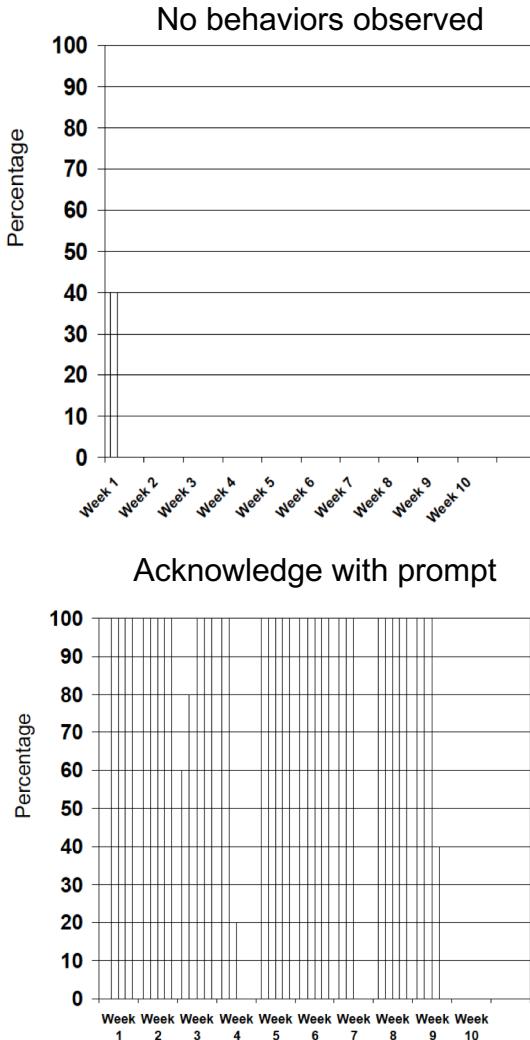
- Antecedence Behavior Consequence (ABC) Data
- Frequency/Event & Rate Recording
- Duration Recording
- Interval Recording
- Latency Recording
- Time Sampling Recording

## Use data to

- Establish a baseline
- Graph and analyze
- Determine patterns
- Compare pre- and post- intervention behavior
- Determine effectiveness of interventions
- Document and Report



# Behavioral Analytics



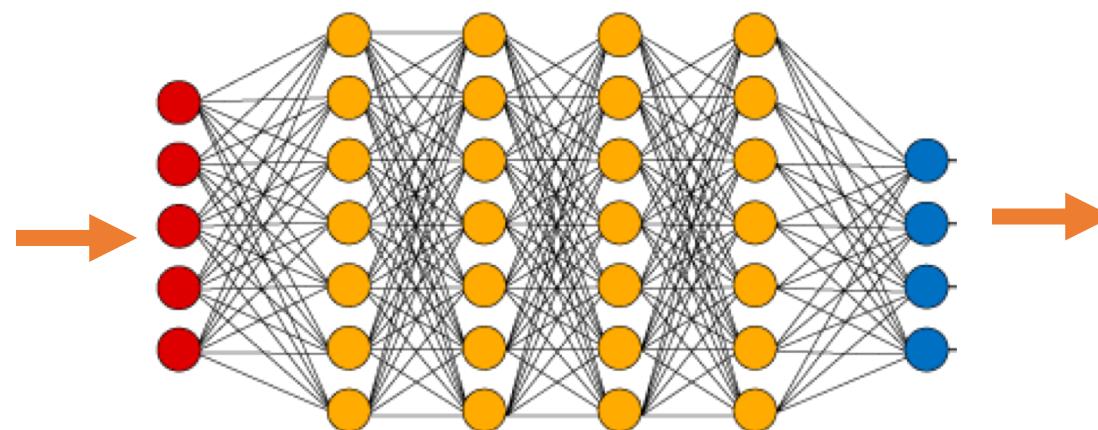
- Track multiple types of data including frequency, duration, and interval recording
- Generate reports for time
  - Cumulative Reports
  - Daily Reports
  - Date Range Reports
  - Monthly Reports
  - Session Reports
  - Weekly Reports
- Analyze patterns of behavior from the graphical data
- Develop dashboard tools and user-friendly interfaces for users and practitioners
- Communicate results with family

# Conclusion

- Evaluate clinical results through the compilation of daily and weekly data and analyze periodic graph patterns
- Success verified with raters, family and staff
- ABA was effective in increasing spontaneous greetings in this student with autism and has improved his socialization
- 10 week intervention program to teach a skill that leads to a lifetime of independent activity

# Artificial Intelligence (AI) for Autism

## Health Assessment Technology for Autism



Deep Learning Classifier

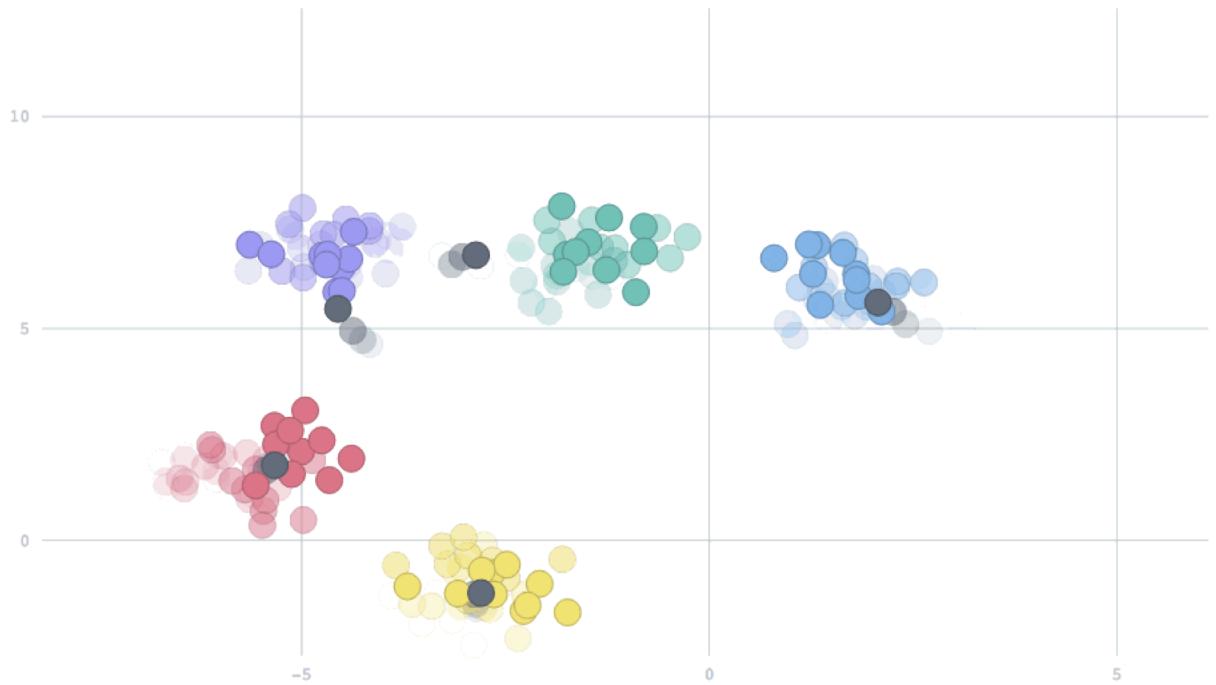
'Typical' behavior  
'Atypical' behavior

# Artificial Intelligence (AI) model

- An annual total of ~450,000 children need behavioral therapy
- Need for immediate assessments with diagnostic efficiency to facilitate treatment quickly
- Drastically reduce time to diagnose autism using machine learning
- Involve clinical experts to annotate videos with ‘atypical’ behavior
- Artificial Intelligent model learns to identify ‘typical behavior’ or ‘atypical behavior’ from a video recording sample

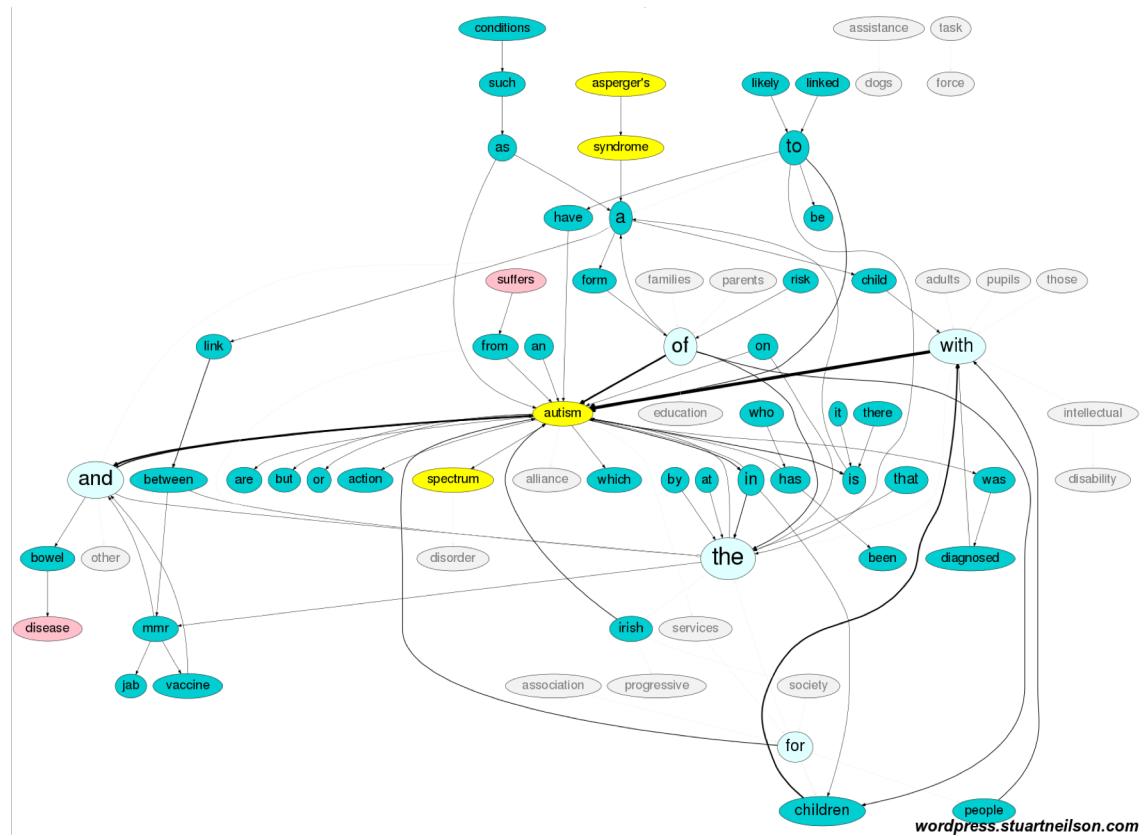
# Cluster Analysis

- Streaming data to group learners based on their behavior patterns and recommend treatment plans
- Identify factors leading to transitioning of learner from one cluster to another as recommended by the algorithm
- Track progress in behavior change and associate indicators with individual and collective response to identify effective treatment methods



# Natural Language Processing

Analyze session notes to identify underlying patterns and hidden context for behavior



# Journals

1. [Behavioral Interventions](#)
2. [Journal of Applied Behavior Analysis](#)
3. [Journal of Autism and Developmental Disorders](#)
4. [Journal of Intellectual Disability Research](#)
5. [Research in Developmental Disabilities](#)
6. [Research in Autism Spectrum Disorders](#)
7. [Behavior Analysis in Practice](#)
8. [Perspectives on Behavior Science](#)
9. [The Psychological Record](#)
10. [Behavior and Social Issues](#)
11. [Brazilian Journal of Behavior Analysis](#)
12. [EAHB Bulletin](#)
13. [European Journal of Behavior Analysis](#)
14. [Japanese Journal of Behavior Analysis](#)
15. [Journal of Behavioral Education](#)
16. [The Journal of Early and Intensive Behavior Intervention](#)
17. [Journal of the Experimental Analysis of Behavior](#)
18. [Journal of Organizational Behavior Management](#)
19. [Mexican Journal of Behavior Analysis](#)
20. [Monitor on Psychology](#)
21. [Psychonomic Society Publications](#)
22. [Speech and Language Pathology and Applied Behavior Analysis](#)





# Q & A