SLP.ai

Appendix

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FORMAL PROBLEM STATEMENT

The problem:
Children with autism do not get enough speech therapy due to the the need for huge coverage, lack of SLP staffing, and high patient costs.

Opportunities that arise:

1. Reduce qualitative assessments in guiding interventions with a data-driven approach
2. Reduce the burden on speech language pathologists (SLPs) who are severely outnumbered by the patients they care for
3. Increase independent learning of autistic children with automated progress tracking and improvement suggestions

TARGET STATISTICS

- **There are 1.2M children with autism in North America.**
  - 1 in 66 children in Canada have autism (National Autism Spectrum Disorder Surveillance System, 2018)
  - 5.6M children in Canada (Stats Can, 2010)
- **85% of children with autism are treated with speech therapy, making it the most commonly cited treatment for children with autism** (Carlon, Stephenson, Carter (2014))
- **Speech disabilities are among the top three most prevalent disabilities in children, and this number is increasing for school-age children in Canada.** (Stats Can, 2008)
- **Speech language pathologists are low in numbers, and is not a well-treated profession.** SLPs have the following concerns (ASHA, 2018):
  - High caseloads/workloads (70.6%)
  - Low salaries (38%)
  - Medicaid billing (36%)
  - Out-of-pocket professional expenses (35%)
  - Lack of parental involvement and support (29%)
  - Inadequate work space and facilities (28%)
  - Personnel shortage (21%)
- **The need for SLPs will grow by 27% by 2024** (Bureau of Labor Statistics) https://www.bls.gov/ooh/healthcare/speech-language-pathologists.htm
- 1h sessions for SLPs https://autismcanada.org/living-with-autism/treatments/non-medical/communication/speech-language/
- 1h per week session frequency: https://pubs.asha.org/doi/10.1044/2019_AJSLP-18-0248
- 1 in 66 canadian children have autism https://www.autismontario.com/what-autism/prevalence-rates

BUSINESS MODEL CANVAS

Infrastructure	Key Activities	Designing, improving, and innovating the app; engaging with SLPs and caregivers of children with autism to ensure we are understanding their needs
	Key Resources	Partnership with SLPs; Autism focus groups; Microsoft Azure
	Key Partners	Microsoft; Autism Speaks; Canadian Government; CACUP-ASLP
Offering	Value Propositions	SLP / Caregiver: quantification of progress towards understanding emotive speech. Child: a fun form of therapy that doesn't feel like an appointment. Canadian Government: decrease the cost of SLP therapy for children with autism.
	Customer Relationship	Automated services: children are able to interact with SLP.ai, which personalizes their experience and progression. Dedicated personal assistance: after we scale, we'll have sales representatives that actively seek out SLPs and develop relationships with them / train them on how to integrate our app into their practice.
Customers	Channels	Website, mobile app stores, government/hospital affiliation
	Customer Segments	Niche market, servicing families with autistic children
Finances	Cost Structure	Value-driven: providing a solution recognized by our key partners Fixed costs: cost of hosting application, marketing
	Revenue Streams	Asset sale: one-time purchase of app Subscription fees: additional data analysis of day-to-day use of app Advertising: revenue generated from targeted ads

SOLUTION ARCHITECTURE

Data Collected:

- Waveforms speech input from kid through mic from mobile device

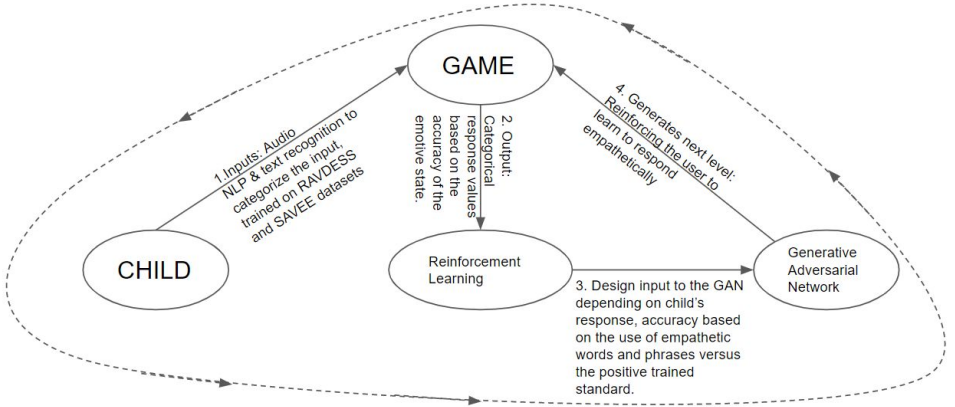
Datasets:

- RAVDESS (The Ryerson Audio-Visual Database of Emotional Speech and Song)
- SAVEE (Surrey Audio-Visual Expressed Emotion)
- Action-emotion pair dataset

Tools and Technology:

Microsoft Azure will be used for the following:

- Speech Emotion Recognition using Machine Learning [reference: https://www.isca-speech.org/archive/archive_papers/interspeech_2014/i14_0223.pdf]
- Reinforcement learning to figure out if the kids are saying the appropriate thing given the context
- Generative Adversarial Networks (GANs) for creating stories based on kid's progress
- GANs to visualize the environment for the game



INTERVIEW WITH PROFESSIONAL

Interviewee - James Im, MD, U of T Neurology resident

What is the biggest challenge in teaching kids with autism social interaction practices?

- This is a highly heterogeneous disorder and with that there are widely differing levels of functioning, different strengths and weaknesses, and very different goals for each of these patients. This would be the most challenging aspect as it often involves a different and individualized approach each time. Conversely however it makes it quite interesting and rewarding each time.

What is the most common training technique for improving social interactions?

- The most common technique we use is Social Skills Training where we practice social games, greetings, conversations or introduce social stories. In this we introduce implicit social rules that we often take for granted. The goal of this therapy is to introduce these ideas (without making them explicit) and as early as possible.
- We also generate a multidisciplinary approach involving teachers, family and friends.
- Other programs may include sensory integration therapy and early intervention programs such as the Frankfurt Early intervention Programme.

Neurological findings in autisms and social interaction?

- Up to 33% of diagnosed patients have comorbid seizure disorders.
- There are also reports of increased rate of macrocephaly, ventricular enlargement, and a number of other described syndromic commonalities.
- fMRI and other imaging modalities has shown promise in showing some patterns but we have yet to pinpoint any uniformly accepted patterns to my knowledge.

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