# home**Right**

*a model built to increase efficiency of preventive action taken by state agencies towards children experiencing homlessness*

A week and a half ago, my summer research supervisor, Dr. Ghassemi, forwarded me a link regarding an event entitled "Hack for Inclusion". I was very intrigued by this event, as it was focused around utilizing technology for social impact, an area in which I am very passionate about. I have attended many hackathons in the past, and I will preface this article by saying this experience was by no means similar. The purpose of this article is to outline my experience at Hack for Inclusion as well as the project that our team created.
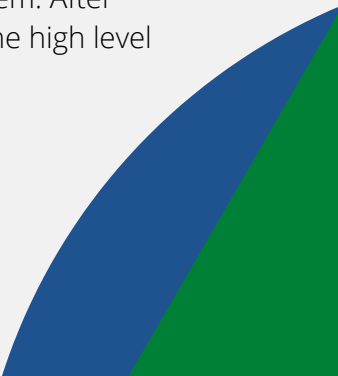


The morning of the event, I flew down to Boston from Toronto and headed right to the Microsoft New England Research Centre on MIT campus. As the elevator doors began to open and voicing "floor Microsoft", the excitement in my body for this event continued to grow. I met the organizing team for Hack Inclusion and started to network with a variety of different individuals from a variety of different backgrounds. After exploring some startups in the Microsoft "Garage" and meeting some different researchers in the AI department of the Microsoft New England Research Lab, I knew that I could one day see myself coming back to this space. After networking and lunch ended, the hackathon began.

**Image 1.** Day 1 at H4I

### *THE PROBLEM*

The project that I was tasked towards for this event was "creating a smart solution to homelessness". I was very honored to be selected to work on the Microsoft sponsored team, as well as work on a project that meant a lot to me. I have traveled to over 50 countries internationally, and have witnessed through experience a variety of different types of homelessness and I knew that I wanted to make valuable contribution to this problem. After doing a breadth of preliminary reading prior to attending the event, I understood the high level complexity of the problem that I was dealing with.

### THE TEAM

The team that I was working with at this event was absolutely amazing. On my team was Pablo (a Harvard MBA student), Liza (surgical resident at Harvard), Marie (PHD student at MIT), Saadie (Computer Engineer MIT alumna), Sarah (Wayfair Project Manager), Shubham (Masters of Computer Science student at Northeastern), Zhou and Haoyang (Masters of Computer Science students from Boston University).  From an outside perspective, it is clear that I was the least qualified individual on my team as a first year undergraduate engineer. However, at no point throughout this hackathon, did I feel as though I was less qualified. The inclusive environment that our team created enabled everyone to make valuable contributions to the project.



**Image 2.** Our team right before our pitch!

### OUR PROJECT

Over the course of the weekend, our team developed a prototype of a model that can be used by state agencies to optimize efficiency of preventative action to mitigate the number of children that experience homelessness.

Our team understood that the trauma that experiencing homelessness triggers in children creates a perpetual cycle of stigma and housing instability. 1 in 30 children in America experience homelessness. Once a child experiences homelessness, it is already too late. The potential for mental illness, anxiety, and overall not being provided the adequate resources for success, leads children who experience homelessness into a downward spiral that is very challenging to escape. Current attempts to address this problem lack integration of data, accuracy of data elements, and poor coordination between institutions. Historically, agencies have also attempted to solve this problem by being reactionary, but intervening before the problem even occurs is critical. As a result, the child as a member of the community remains forgotten.

What are the main features of our model?
- Our model is able to predict neighborhoods where children are most likely to experience homelessness.
- Our model maps pressing needs to current resources to ensure optimal allocation is executed.
- Our model is able to recommend specific actions a stage agency may take to respond.
- Our model is able to quantify the size of cost-savings.

Every year the HUD Exchange releases raw data sets that contain Point in Time (PIT) estimates of homelessness by Community of Care (CoC). This information is updated once a year. Specifically, we can analyze information like the number of beds being occupied by children in both temporary/emergency and permanent housing options. After consulting with Courtney from the city of Boston, we were able to see that the data that is provided is only accurate up until 2012. We started to develop, but did not finish implementing a softmax/linear regression algorithm to be able to predict the number of beds that a specific CoC may need in the coming year.
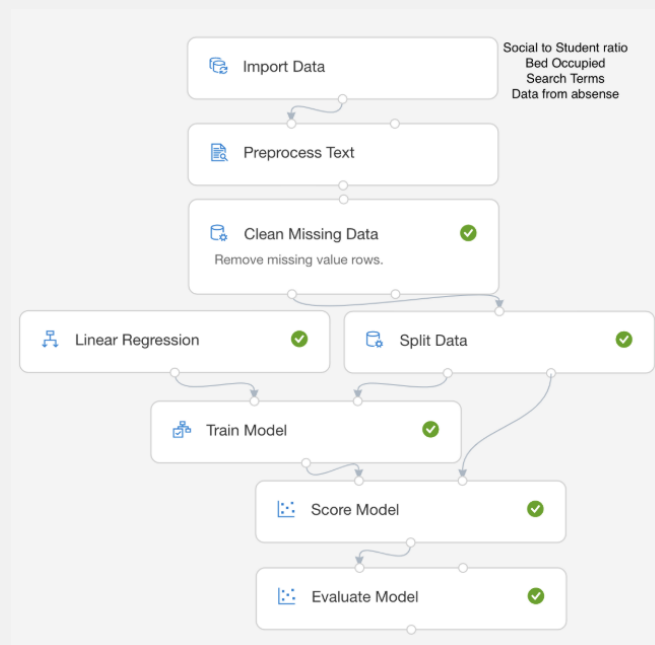


**Image 3.** A screenshot of our pipeline.

This could then enable our team to be able to predict where optimal allocation of resources may need to be distributed at the beginning of every year. We were also planning on implementing a K-Nearest Neighbors algorithm to predict where a new shelter may need to be built.

We understood that if we were truly going to provide a "smart" solution to preventing children from becoming homeless, we needed more dynamic data that we could use to build a model that would be able to learn and train on a much faster basis than a year. Thus, we decided to meet children where they currently are and collect data on a daily/weekly basis at schools. We interviewed a teacher, Nicole, who taught in South Dakota where she voiced the different processes in which she takes when she recognizes that a child might be at risk of something serious such as homelessness. After doing some research, we realized that schools in America are currently not incentivized to report child homelessness as it means that they are required to provide transport and other resources for those children.

In order to tackle these problems, we decided to take advantage of data that is constantly being updated: children's social media, search history, and school assignments.

By leveraging modern sentiment analysis algorithms we are able to process triggers based off the language, types of searches (we found that it is common for children experiencing homelessness to have search points in the domain of temporary housing), to notify the appropriate individuals to intervene with the child before it is too late.

We are also able to look at absentee, truancy, social worker to student ratio, as other metrics that are constantly being updated. With the formulation of modern partnership between housing departments and schools (as seen in the city of Boston and Boston public schools), the transparency between data is only increasing. Finally, the other dynamic data that we believed would be helpful to consider is mapping where there is reduced housing costs as well average housing costs.

This information can be sent to the state agencies regarding a population of children that may be at risk of homelessness in a school (not by the individual but by the school for privacy reasons). This in turn incentivises schools to report homelessness as the adequate resources will be provided to these schools to prevent a case of homelessness occurring.One of the largest problems that the housing market faces is the ability to share data regarding homelessness. After speaking with Sue, the director of Family Promise (a homeless shelter in Boston), our team understood the privacy at the individual level is a primary focus. Thus, gathering specific data, despite being useful, would be out of the picture (individual income, substances being used, parental marriage status, etc.). All the data points that we have considered would be completely anonymous or aggregated in order to ensure the utmost privacy for the children who are potentially at risk.

Not only did our team develop a framework for tackling this problem, but we prototyped an interactive dashboard that can be used by state agencies. Courtney from the City of Boston was very impressed with our prototype and expressed her interest in potentially engaging individuals to leverage the opportunity for this model.

**Image 4.** Screenshot of our prototype.

The link to the code for this can be found at https://github.com/zhou-1/HackForInclusion and you can experience this live demo at https://pupiltong.github.io/HackForInclusion/.

Our team also started to work on implementing some of the machine learning algorithms by first working on cleaning the datasets. The link to our google colab can be found https://colab.research.google.com/drive/1aK_kZrawIAn9qKMGKK76ts009gKRsa32



**Image 5.** Screenshot of the beginning of the data cleaning process.

### *FUTURE QUESTIONS AND NEXT STEPS*

Some of the potential challenges that our team recognizes that we could potentially face include:

1) Data Use Agreement (DUA): We understand that accessing children's social media and search history from an outside view may not bee seen as ethical, however, through outlining the very specific anonymized and aggregated data that would be used for a very specific purpose would be appropriate (as validated by a Roman Lutz a ethical AI director at Microsoft New England Research Centre). Additionally, the partnership between Boston Public Schools and the City of Boston (a partnership which highlights upon DUA), can serve as a pilot model for other states and countries to adopt in the future.

2) Gap data availability in summer months: The amount of data that would be available to gather during summer months would be significantly less, however, accessing data on reports from summer counsellors, libraries, summer school teachers provide a temporary solution.

The future of this project has a lot of applications. Our team understands that although we may have not actually implemented the models to create a finished prototype, we believe that we have laid a very strong foundation to pave a road for individuals to build off of. We did not come into the event expecting to solve homelessness, but we did in fact provide unique insights into a method of mitigating homelessness for children by taking preventative action prior to it occuring. After developing our model, it would be key for our team to pilot homeRight on the city of Boston where there is an ongoing relationship and data integration process between the city and public schools. We can then educate state agency workers and teachers (who are closest to aiding the students who are directly impacted), to understand how to leverage the recommendations from our model.
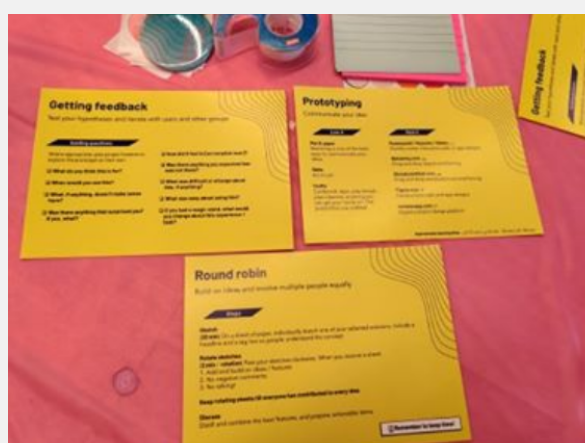


**Image 6.** This is an image of the recommended steps to follow for the prototyping phase as directed by MIT Sloan.

Despite not being implemented into our project, some of the other ideas that our team diverged upon that are very interesting for future work in this space that I found particularly interesting include:

- Creating job opportunities for children at their local schools
- Extending the hours of community facilities (ex. Athletic centres/libraries which are already being occupied by the general population)
- Re-branding the word "homeless" as it can be seen as too aggressive.
- Enabling private donors/sponsors to be able to help fund families/children that are experiencing homelessness. This could extend further into schools where bake sales and other fundraising events go towards supporting families in their community.
- Developing a mentorship program whereby children who are experiencing homelessness can be paired with adults (18+) who previously had experience with homelessness.



**Image 7.** This is an image of our divergence process of ideating different prototype options.

All of the ideas expressed above stemmed from the diverging process that occurred during our teams brainstorming phase that still have the potential for a lot of impact in this domain.

### THE PROCESS

This hackathon was an amazing experience that gave me the opportunity to not only work on a project that aligns closely with my values, but also work in a space with like minded individuals. I have always dreamt of one day pursuing some level of education at MIT and working on MIT campus in one of North America's cutting-edge research labs only heightened my motivation for me to pursue future education there. As I am still in training for triathlon, I had to ensure that I got my reduced workout sessions in. On the final day of the event, I did a 12km run around Boston and got to run through Harvard and MIT campus which was an amazing experience as well.



**Image 8.** This is an image of me at the Microsoft New England Research Centre on MIT Campus

I must say the streets of Boston are much more enjoyable to run compared to the streets of Toronto!



**Image 9.** This is an image of me on my morning run at the MIT great dome.

I  have led a variety of different hackathons and have taken part in many different hackathons over the past couple of years. This hackathon from a participant point of view was executed to perfection. The food, the speakers, the facilities, the mentors were amazing. Often, technical hackathons are very unstructured and give a lot of freedom for the groups. At Hack for Inclusion, we were being taught the engineering design process from MIT engineers/business students who were able to teach this process in a more dynamic way, compared to the traditional classroom setting. This may have increased the intensity of our project but enabled me to educate myself with regards to team norms, prototyping, research, brainstorming and other parts of the design process.

 It was also an amazing experience to go through this design process with a highly qualified team whereby I was able to learn so much from them. We were really able to focus on the problem that we were addressing and develop a really strong framework, versus wasting brainpower on nitty programming issues that traditional hackathons may experience.

I learned the value of social skills in this event as well. After 36 hours of hacking, it came down to a 2-minute pitch that would depict who won a prize. Regardless of the prize, I was very happy with the result of our project, however, I do now realize the value of storytelling and communication skills. I learned from some MIT engineers who went on to pursue business degrees, that at the end of the day, the solutions to a lot of problems are very similar, it is the communication of the solution that differentiates different teams. Winning was by no means the focus of the event, but this is an important skill to consider moving forward with pitching to different individuals.



**Image 10.** This is an image of our team after our final pitch.

After attending the event, I now understand why Dr.Ghassemi recommended for me to attend this event. Prior to confirming my attendance at the event, I was nervous as I knew that I had two major exams the week following, a training camp over reading week (causing me to be potentially tired prior to the event), and that the travel to Boston would consume a lot of time. Thus, I was initially in a mindset whereby this event might be too taxing to attend. I was right that this event would be challenging, but I was very much so wrong in prioritizing other action items over this.

I truly do not understand why I was ever stressed about my two mid term exams. In the macro, these exams do not define or make anything of who I am, but rather the value of the experiences that I am taking part in are going to make a more valuable impact on my future. After starting to attend fourth year computer science classes at UofT and starting to indulge in topics that are interesting to me, I am developing the right skills that I need to make a valuable impact in the space that I want to be invested into in the future. I am very excited for future work and potentially coming out to more of these events, but even more excited to get started on my summer research project where I can work on helping more people in the domain of technology.

Throughout the event I was able to learn a lot about housing in America. Not only did I develop a rigorous understanding for the homelessness community, but also the different types of homelessness and appropriate language to use when referring to an *individual experiencing* homelessness over a *homeless individual*. Over the course of the weekend, not only did I get to get to know individuals from my team very well, but I was also able to connect with many other individuals from a variety of different backgrounds. This hackathon had people from all age demographics, races and genders. It was inspiring to hear some of the different stories from these amazing people. There were a lot of amazing takeaways and only heightened my motivation to continue working in the technology space for social impact.

**From a more personal reflection on this event, I am now beginning to find where I want to place my efforts in the domain of technology. I am privileged to be born healthy in a loving family where I do not have to stress about my financial situation, health issues, substance abuse issues, or mental health issues. Often, it is easy to take things for granted, until you are exposed to what is worse (not through reading, YouTube, or watching, but through experience). After travelling the world, meeting so many different people from a variety of different backgrounds, I believe that I have developed a very strong sense of awareness. I am thankful for the situation that I have been raised in, but as I develop my technical and social skills over the coming years, I plan to focus my efforts to utilizing technology to making a valuable social impact towards others in the world.**

## REFERENCES

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