

CUNY-IBM Watson Case Competition

2017 Finalists

TEAM 2: Watson Immigration Help Business Case Analysis

TEAM 4: Augmenting 311 System in NYC Leveraging Social Media and IBM Watson

TEAM 5: Business Case IBM Watson

TEAM 9: Dashboard Integration of IBM Watson and CUNY-Wide Platforms

TEAM 11: ACIT (Academic Cultural Integration Tool)

TEAM 12: Improving Public Services for Homelessness

TEAM 16: VR Language Learning Platform with Watson

TEAM 18: Team A.R.M Business Case Analysis

TEAM 19: Optimizing Resources – CUNY Comrade and the Future of Academic Counseling

TEAM 21: Cognitive Technology for Early Detection of Mental Illness (CTED-Mental)

TEAM 25: FOIL Request Analysis

CUNY-IBM Watson Case Competition

SPRING 2017

Group Name: *SagaCity*

Team Number: 4

Business Case Title: *Augmenting 311 System in NYC Leveraging Social Media and IBM Watson*

1-minute Video Link: <https://www.youtube.com/watch?v=BGqXt6xEgII>

Case Domain: *City Services*

One-liner: *Actionable Insights for City Services*

Augmenting 311 System in NYC Leveraging Social Media and IBM Watson

Team 4 – Michael Iannelli, Arun Adiththan, and Feng Hu

1. Summary

The existing NYC 311 system lacks the capacity of accurately and swiftly identifying the large volume of complaints' core issues due to the time-consuming and monotonous way of manually receiving telephone calls and incapability of accepting multimedia information such as text, images or videos. Therefore, in this work, we propose to augment the system utilizing social media and IBM Watson, allowing the public to report problems using multimedia (text/images/videos) concurrently and at a large scale, by leveraging the Watson's ability to understand unstructured data and its virtual agent. We believe our proposed approach can save a large amount of money, reduce the human labor required, and significantly increase the community engagement, resulting in efficient usage of time and resources of the public service agencies.

2. Background

The 311 system in New York City (NYC) offers a wide range of non-emergency services and government information around-the-clock. New Yorkers currently rely heavily on the traditional telephone platform to register an average of 60,000 non-emergency complaints daily -- from unshoveled sidewalks to noisy neighbors to broken street lights.

We have identified two key issues in the existing call center-based 311 system: i) complaint turnaround time, and ii) community engagement. The turnaround time in resolving a complaint is often impacted by challenges in problem diagnosis and appropriate agency identification. Typically, the person filing a complaint is asked a series of questions to first identify the type of service required. In some cases, the complainant spends around 20 minutes on the call but ends up with the complaint not assigned to an appropriate agency¹. Such arduous waiting time may have a deterrent effect on community engagement as the public would rather choose to move on with the assumption that the problem would somehow be taken care of eventually than spending time on 311 calls. A 2012 Pew Charitable Trusts study² found that the average cost of each 311 call is in the range of \$3-5 and a major chunk of the cost is attributed to employee compensation.

Another Study³ conducted by Pew Research found that younger American adults are much more likely to engage in social or political issues through social networking sites such as Twitter and Facebook. Therefore, we can leverage these modern digital communication spaces to boost community engagement in resolving issues that affect society. The digital space will also provide a platform for other forms of communication such as sharing multimedia content. This might be helpful in addressing the issues in problem diagnosis and improve the efficiency of time and resource usage of different agencies. Unfortunately, the NYC 311 system has been slow in keeping up with the advancements in the digital space such as engaging via social media. The non-

¹ NYT interview with the DoITT Commissioner <https://cityroom.blogs.nytimes.com/2008/09/11/answers-about-311-part-2>

² 311 Cost: <http://www.governing.com/topics/urban/gov-311-systems-cost.html>

³ Civic Engagement in the Digital Age: <http://www.pewinternet.org/2013/04/25/civic-engagement-in-the-digital-age/>

emergency services system currently accepts a very small category of service requests via social media and the complainants are often advised to call 311⁴. Moreover, the social media service requests are handled manually by call center representatives.

Another fundamental challenge with the existing 311 system is in the initial stages of complaint resolution, such as accurately diagnosing the problem and identifying resources to resolve it. This often leads not only to inefficient usage of time and resources but also prolongs the process of fixing the problem. For instance, it might be challenging for a layman to know the differences between a pothole and cave-in. Let's say someone calls to report a pothole but through some questionings about the details, it turns out to be a cave-in. Now what if 311 simply takes the complaint as a pothole instead, without asking questions, and a pothole crew is dispatched when the condition really is a cave-in -- which requires different personnel from a different agency?

3. Problem Statement

In this work, we propose augmenting the existing system with usage of social media platforms and IBM's Watson data analytics tool. The alternative medium to report a problem would allow people to post a text status message on Facebook or Twitter and/or share images or short videos along with geolocation information. On the other end, we can leverage IBM Watson Conversation tool to engage in conversations with the complainant to collect as much as information as possible. We can then employ the cognitive system's capability to sift through large volumes of unstructured text and multimedia data to accurately diagnose the problem, assess its validity (a false alarm or not) and generate insights on the resources required and priority level for appropriate agencies. Assuming 20% of service requests per day in NYC are received via social media, the average per day cost savings with a Watson-augmented system will be around \$40,000. Also, it will improve the accuracy of problem diagnosis and quicker complaint resolution.

4. Mock 311 Complaint Conversations

Here we provide a couple of examples demonstrating how complaints can be reported and handled using Twitter and IBM Watson. Based on the privacy preferences of the complainant, he/she may choose to engage with the 311 system with a public status message or send a private message about an issue.

In Example 1, the phrase "broken signal" doesn't indicate the signal isn't working. The actual issue is that the signal pole is broken. Watson's machine learning capabilities will be helpful in distinguishing this difference, determine appropriate resources required, and help resolve the issue promptly.

In Example 2, again what a layman calls a pothole is in fact a cave-in situation in an important location. While the Watson Conversation assures a fix to the problem, the machine learning capability of Watson can be leveraged behind-the-scenes for accurate diagnosis of the problem and generate actionable information to an appropriate agency to resolve it.

⁴ <http://newyork.cbslocal.com/2017/03/15/311-social-media/>



Example 1: A mock complaint via private conversation (through Direct Message)



Example 2: A mock complaint via public twitter post

5. Privacy Concerns

The usage of this modern communication platform to improve the services offered by public service agencies naturally raises privacy risk concerns. For example, what sort of metadata is collected and whether the movements of the complainant can be tracked based on his/her interactions with the 311 system? There is a substantial amount of research being conducted in this space and we think a strong regulatory framework is required to prevent the collection and use of metadata with malintent. For instance, we can mask the personal metadata of complainants and simply use the voluntarily provided geolocation information -- which is essential to resolving complaints in the 311 system. The regulation can also ensure that the privacy preferences of the users are complied with while engaging in a conversation with them during the problem diagnosis phase.

CUNY-IBM Watson Case Competition

SPRING 2017

Group Name: Disease Predictive Analysis Team

Team Number: 5

Business Case Title: Business Case IBM Watson

1-minute Video Link: <https://www.youtube.com/watch?v=IpbcrDxaGUI>

Case Domain: City Services

One-liner: Automatic classification of disease reports to better track and prevent outbreaks



BUSINESS CASE
IBM WATSON
APRIL 2017

Table of Contents:

1. Executive Summary
 - 1.1. Issue
 - 1.2. Anticipated Outcomes
 - 1.3. Recommendation
2. Problem Definition
 - 2.1. Organizational Impact
 - 2.2. Technology Migration
3. Cost Benefit Analysis

1. EXECUTIVE SUMMARY

New York City's Department of Health and Mental Hygiene (NYC DOHMH) receives thousands of electronic disease reports daily. These reports are sent through a disease classification system where they will be used for disease surveillance and prevention. Data continuously converges around standards. On the other hand, reports will always differ in quality and format given numerous diseases, tests, providers, and laboratories. The current system employs a series of sophisticated business rules which help interpret these reports and classify diseases. However, the system is not perfect and many diseases are left unclassified, requiring a high involvement of human review. It would be painstaking for employees to spend countless hours reading these reports. Implementing IBM Watson Disease Classification Software (Watson DCS) will allow the classification system to be interoperable, flexible, and capable of classifying any incoming disease report. This enables epidemiologists and research scientists to accomplish more in less time and to handle an increased workload. These factors increase the productivity and efficiency of the DOHMH. Furthermore, it would accrue savings of at least \$300,000 annually.

1.1. Issue

New York City is one of the most populous cities in the world. In addition, New York City functions as the capital of the global economy and as a center for tourism. Epidemiologists and research scientists at the DOHMH need to be capable of quickly tracking all diseases within the city to conduct research, detect and control outbreaks, investigate cases, and conduct partner outreach (in the case of STDs) in order to protect the welfare of the community.

1.2. Anticipated Outcomes

By centralizing and uniformly classifying data, epidemiologists at the NYC Department of Mental Health and Hygiene can address and resolve outbreaks earlier. With Watson DCS, the system would continuously make neural connections, link diseases to each other and discover the origin of such outbreaks. The response rate, containment and the source of origin of diseases/outbreaks will be determined significantly faster. As a result, employees can extract data faster than they would otherwise be able to. Consequently, employees are able to attend more high-priority work including developing statistical models, improving current systems, or conducting other research activities. These developments could be appropriated to other health departments and city health agencies which experience similar challenges.

1.3. Recommendation

Watson DCS's machine learning capabilities will allow all incoming electronic health reports to be classified in real-time. These reports will train Watson DCS to classify reports faster and enable more accurate classification as time goes on. Unique and anomalous reports that have already been classified can be fed into our system in order to identify these rare reports when they appear again. Watson DCS will also assist researchers who aim to link cases together, discover relationships and previously overlooked common factors.

2. PROBLEM DEFINITION

Software limitations have hindered DOHMH's ability to automatically classify electronic health reports. Failure to automatically classify these health reports makes it harder for epidemiologists and research scientists to track and prevent disease outbreaks. Informatics specialists have to manually check these unclassified documents. Their time could be better spent on auditing laboratories and facilitating the informational retrieval processes. Disease outbreaks are a major risk in metropolitan cities like New York. Any delay in preventing these outbreaks only exacerbates their risk. These inefficiencies put the welfare of New Yorkers at risk in the event of an epidemic.

2.1. Organizational Impact

Various departments, including Informatics and Epidemiology, will see an immediate growth in productivity. Informatics specialists can focus their time and resources on doing something tangible with incoming reports since information retrieval will now be fully automated. The automation of Watson DCS will promote seamless communication between informatics teams and research teams. This would increase the level of teamwork as well as the quality of service. Excess time will no longer have to be spent on monotonous work and the true value of these departments can be utilized to better keep New Yorkers safe.

Personnel roles are not expected to significantly change but human capital should be able to accomplish more in less time.

3. COST BENEFIT ANALYSIS

The following table captures the cost and savings actions associated with the IBM Watson Project, descriptions of these actions, and the costs or savings associated with them through the first year. At the bottom of the chart is the net savings for the first year of the project along with estimated ongoing savings.

Action	Action Type	Description	Potential First year costs (- indicates anticipated savings)
Purchase of IBM Watson	Cost	IBM Watson at \$1000/month	\$12,000

Software installation and training	Cost	Cost for IT group to install new software and for the training group to train all employees	\$75,000
Hardware Upgrades	Cost	New server and additional storage	\$10,000
Employee Efficiency	Savings	Employees currently average 8 hours per project. It is anticipated that this number will be reduced to no more than 5 hours per project. At an average \$24.00 per hour (using a \$50,000 annual salary and 4,000 employees) this results in almost a 40% reduction in time used	-\$288,000
External Support	Savings	Less frequent use of IT resources working on non-value added tasks results in approximately \$42,000 savings per year.	-\$42,000
Future Training Costs Decrease	Savings	The simpler system requires less training.	-\$75,000
Net First Year Savings		This includes the initial costs and is the anticipated savings for the first year.	\$308,000
Ongoing Savings		This does not include the initial costs and represents anticipated ongoing savings.	\$393,000

Based on the cost benefit analysis above we see that by authorizing the IBM Watson Project, the NYC DOHMH will save \$308,000 in the first year alone. This will increase by approximately 27.5% in the following years as well as having an ongoing positive impact on efficiency and productivity. This number is based on the conservative estimate of 4,000 relevant employees, however top level employees that are not directly affected by this almost certainly number less than 1,000 employees. This has a significant impact because the majority of savings is directly related to the number of employees which number over 6,000.

CUNY-IBM Watson Case Competition

SPRING 2017

Group Name: PiedPiper

Team Number: 12

Business Case Title: Improving Public Services for Homelessness

1-minute Video Link: <https://www.youtube.com/watch?v=vYRAjArCaNI>

Case Domain: CityServices

One-liner: DAISY, your friendly digital assistant; when you needit, where you need it.

Case Statement:

HelpUSA is the leading client-oriented organization providing housing and homeless services to homeless military veterans. Help USA's core activity is placing homeless veterans in transitional, temporary, or permanent housing. For example, Hollis Gardens in Hollis (Queens, NY) is the latest housing unit with 80 veteran residents and 40 senior citizens of the local community. In addition to housing, HelpUSA provides ancillary services such as homelessness prevention, client case management, legal assistance, employment service referrals and workshops, and assistance in securing entitlements and benefits among other services. To receive these services, homeless veterans are given vouchers to select which HelpUSA location he/she would like to be housed in. HelpUSA performs a background check on the veteran (up to 7 years prior, although in some cases, it would be preferable that up to 10 to 15 years' worth of data is available) to accurately assess a veteran's condition. Once a veteran becomes a client of HelpUSA, a social worker creates a Housing Stability Plan and assesses any compulsory subsidies based on the veteran's needs and current financial position. The Housing Stability Plan outlines the placement of the client and the mandatory steps to secure stable housing and build a self-reliant lifestyle. The plan includes Mental Health and Wellness services to supplement compulsory services.

HelpUSA faces several challenges to their mission of providing housing and other support services to help the homeless. First, a lack of access to extensive background information about their clients. Second, efficiently delivering Mental Health and Wellness services and effectively providing support for its clients. HelpUSA's services are separated into two main categories: compulsory and optional services. Most clients would only attend services that are compulsory, ignoring those that are optional yet could prove beneficial for the client (e.g., anxiety relief or body and mental wellness programs). Third, evaluating how well each service performs. Currently, a Mental Health and Wellness service such as yoga or acupuncture is evaluated based on attendance. Since Mental Health and Wellness services are optional, and advertised either through bulletin-board postings or word-of-mouth, HelpUSA has regularly experienced low turnout rates. Attendance is not an ideal measurement to determine how a specific Mental Health and Wellness service contributes to a client's progress. Therefore, HelpUSA needs to find a way to determine and track a client's progress as each client completes the Housing Stability Plan and Mental Health and Wellness services. Finally, clients have a wide-range of personalities that makes it difficult to apply a standardized process to track progress and personalize plans. The aim of our project is to resolve these challenges by leveraging on state-of-the-art augmented intelligence, particularly, cognitive computing. We chose IBM Watson and Bluemix technologies because of the simple integration and vast array of APIs. In addition, it is a scalable platform that can be used by both clients and social workers with minimal training.

Technology:

We propose a Digital Assistant and Integration System (DAISY), an integrated communications tool and digital platform available as a desktop application for social workers and as a personalized mobile application for clients to use, which syncs wirelessly to the external Smart voice-enabled device. DAISY uses IBM Watson and Bluemix cognitive technologies to improve HelpUSA's processes of delivering, evaluating, and managing housing and homeless services.

As a digital platform, DAISY is optimized to deliver a personalized selection of upcoming Mental Health and Wellness services that align with a client's Housing Stability Plan. Each selection is carefully assessed by DAISY's recommendation algorithm, which, for example, utilizes Document Conversion and Watson Discovery to read and convert a client's Housing Stability Plan and make recommendations that are approved by the client's social worker. The algorithm may accept parameters such as need, income, location, and personal characteristics outlined in the Housing Stability Plan along with key information provided by the social worker.

The recommendation algorithm is augmented by the assistance of the Smart voice-enabled device to enable veterans to interact with technology with minimal technical knowledge required. The device uses Watson Conversation to create natural conversations with a client in the comfort of their home in Hollis Gardens. With the device, a client may ask questions like "*DAISY, is there a service that can help heal my back pain?*" or "*What does my schedule look like today DAISY?*" or "*DAISY, can you RSVP and remind me of the next Resume workshop?*" or "*Can I pay my rent online DAISY?*" DAISY's automated responses are generated based on personal management tools, available features that are integrated into the system such as an online payment option, and on the expert knowledge of social workers who manage homeless cases. However, if a response is insufficient or can't be provided, DAISY reports to the social worker to learn of new solutions. These responses are uniquely delivered through the voice-enabled device and through an internal alert system that notifies a client about upcoming services, meetings, friend's activities, or due dates. These notifications can be sent through voice, email, text, or a desktop notification. DAISY may record and highlight key elements of a client's conversation and assess which Mental Health and Wellness service a client should attend, keep track of the client's Housing Stability Plan, and the client's overall progression. A client can rate services offered by HelpUSA and DAISY shares the information with the client's designated social worker. Together, DAISY works with the social worker to create knowledge about the client that can be implemented into the Housing Stability Plan and offer meaningful Mental Health and Wellness services to further personalize the client's development.

Impact & Closing:

DAISY provides a forum where clients can anonymously or openly review a service. This allows HelpUSA to evaluate the efficiency and effectiveness of current Mental Health and Wellness programs and other optional services, such as yoga, acupuncture, employment-readiness workshops, or legal assistance. DAISY analyzes the tone and processes the natural language of a review to discover whether services are performing above average, average, or below average. HelpUSA has been strongly interested in helping clients feel included in a community. The inclusion of senior citizens in Hollis Gardens is meant to reform the negative perception that is associated with shelters or housing units that provides housing for the homeless, and the forum is an extension of HelpUSA's initiatives to promote a positive image. By using DAISY, clients may virtually chat with other members of the community on the forum, promoting a greater sense of community among military veterans and senior citizens housed in Hollis Gardens.

By leveraging on gamification techniques, we will implement a rewards system in DAISY to significantly improve client engagement and organizational productivity (e.g., badges and milestones). Each client and social worker is given a profile on the platform. The client-facing

home screen creatively displays an aggregate view of their activities, schedule progress, job opportunities, milestones achieved, friends made in the community, and rewards earned from committing to their Housing Stability Plan and actively participating in Mental Health and Wellness services. The aim is to constantly remind clients of how far they have come after joining HelpUSA.

HelpUSA can effectively evaluate and efficiently deliver compulsory and optional services, empowering social workers in managing their caseload by adopting DAISY's capabilities. DAISY as a digital assistant is not just a creative use of technology, it is also an economically feasible one. DAISY is built on OpenWhisk, a pay-for-use serverless computer platform that executes logic based on event triggers, allowing for scalability. OpenWhisk communicates with the pay-for-use Cloudant NoSQL database to store client and company data. DAISY's use of IBM cognitive technologies, excluding Speech to Text, and including Watson's Personality Insights and Tone Analyzer, in total would cost HelpUSA approximately \$58.14 per month, or less than \$0.50 per client per month. The total cost signals affordability and scalability for HelpUSA and other non-profit organizations that plan on leveraging Artificial Intelligence to increase the efficiency of their practice.

In the future, DAISY would be able to detect the tone of the individual and assess his/her mood. For example, if a client sounds unhappy, anxious, or depressed, DAISY can quickly create recommendations based on available services (e.g., counseling, yoga, referrals to medical clinics). On top of creating the recommendation, DAISY would request that the services be approved by the client's social worker on the reasoning that the recommended service has a strong percent possibility of benefitting the client. Another future endeavor, would be to expand the platform to operate on wearable devices. The implementation of OpenWhisk's scalable server directly impacts accessibility because OpenWhisk can help DAISY live practically anywhere.

CUNY-IBM Watson Case Competition

SPRING 2017

Group Name: WILSON – Watson Immersive Language Simulating Ontological
Nexuses

Team Number: 16

Business Case Title: VR language learning platform with Watson

1-minute Video Link: <https://youtu.be/BbZ4SD6KII0>

Case Domain: Higher Education

One-liner: The overseas language learning experience from the comfort of your
own home.

Case Criteria: There are over 1 million foreign students enrolled in U.S. universities and many more students all over the world looking to learn or improve their English language skills. An example of where there are high enrollments of foreign students are in the big cities of the U.S. such as the CUNY schools in New York City. With the many foreign students we have surveyed from the CUNY system, we found that there were commonalities in the struggles they experience when transitioning into schools in another country. Struggles would include: feeling they are not adequately prepared enough to handle their school work and a lack of confidence in their abilities causing them to not ask questions in class which could result in lower grades and not communicating with their peers that would hinder them from not getting out of their comfort zone. This would be detrimental to the growth process for students and schools having students with lackluster performance and higher enrollments into remedial courses.

Internationally, we also found out that families and students spend a lot on courses and tutors to learn a second language and to prepare for college entrance exams such as the TOEFL. A common issue that arises is that many students do enough to just pass the exam but there is not much applicability when dealing with everyday conversations. Many families and students also struggle to attain the resources to learn another language and would have to find less effective alternatives to learn.

Higher education is a sector that needs to be transformed to meet the demands of today's fast-changing world. With today's emerging technologies, learning outcomes can be improved at an exponential rate and better prepare students for the real world. One of the most sought out skills to learn in the world is the English language. There is a need for language learners from all over the world to practice what they are learning and may lack access to tutors, someone to practice with or a more realistic experience that is needed for learning a language that mobile apps and other software may not provide. The obstacles language learners may experience can now be overcome with WILSON - a product aimed at the Higher Learning market to transform the way students from the United States to all over the world learn English as a second language.

In order to offer a more realistic learning experience and to improve students' performance, virtual reality technology will be the medium to deliver this learning experience. The technology to be teleported to a virtual simulated world is already available in our pockets. With an Android smartphone or iPhone and an inexpensive mobile VR headset, students can begin practicing their language skills in real-world scenarios such as ordering food at a restaurant, asking for directions and completing mini challenges. Users will have an AI agent powered by Watson that will work as a study buddy to practice communicating with and will recognize users' pronunciation of words using Natural Language Processing (NLP).

With today's limited interaction in learning programs, a VR experience that is supported by Watson can bring new possibilities to language learning. Stress, anxiety and depression that new language learners may experience can now be mitigated. Informal scenarios, job interviews, public speaking can now be practiced with this application. The possibilities are endless.

Integration of IBM Watson Technology:

Technology Stack -

Software	Use
Unity3D	VR Software Engine
C#	Programming Language
Unity Asset Store	3d models
Blender	3d modeling software
Watson SDK for Unity	NLP
Bluemix	Backend
Speech to text API	Translate speech to text
InstaVR	Heatmap to understand what users spend time looking at
Google Cardboard SDK	SDK needed to run VR applications in Unity
Language translator API	Translate text
Visual recognition API	Comprehend drawn images and convert to real life equivalent
Watson Analytics	Understand amount time users spent on exercises, DAU, and what they are getting wrong
IBM Watson Machine Learning	To deliver a more personalized learning experience to users

By using Watson's cognitive technology and Bluemix as the backend, it will bring an inexpensive way to language learning for students all over the world. Watson will come to life as an agent in this application and will mimic human conversations in a realistic manner. Watson's strength in dialoguing with individuals and recognizing speech will provide a superb user experience than current learning tools that ask to recite words with limited feedback. Watson is also great at finding regularities and will be able to report on the mistakes users make and will provide the analytics of the user's progress over time.

The goal for WILSON will be to expand into all major VR headsets such as the Carboard, GearVR, Oculus, and HTC VIVE. In order to reach a broader market WILSON will initially be built for the Cardboard. It will be available for download in the App Store and Play Store in which users will be able to view their analytics through a dashboard and their profile settings while in portrait mode. When they want to commence their learning sessions they will tap a button to enter VR mode and will tilt their phone into landscape mode followed by inserting the phone into a plastic VR headset.

How IBM's technology will work - Watson's SDK for Unity will be integrated into Unity in which its Natural Language Processing abilities will be utilized to comprehend how well users are pronouncing words and to either mark the exercise challenge as right or wrong. While sessions are going on Watson Analytics will be working in the background to analyze the user's time spent in sessions and what they are getting wrong. This data will be fed to IBM Watson's Machine Learning capabilities to understand the areas the users is struggling in and to frequently make users practices certain exercises.

Performance assessment -

Step 1 - Survey for better sampling

User needs to complete a questionnaire during the registration process that will give them a profile. Users will answer several questions including: gender, age, how many languages his or her family used before turning 4 years-old, how many languages the user speaks and often uses, if the user is a visual learner or a sequential learner, what the first language was, and have they ever lived or studied abroad and how long. We request this to provide a better measure of learning by sampling the learners who have similar natures, skills, and backgrounds.

Step 2 - Grading and Benchmarking

Users with similar skills will be categorized together. In the group, each user's performance will be scored based on how they answer questions during sessions. The score range for each question is -2, -1, 0, 1, 2. It is the fact that people with different backgrounds tend to make different mistakes. For example, when a Chinese users using our product to learn English, common mistakes tend to be missing important nouns or objects in sentences. This is because compared to English which is noun-based, Chinese is a verb-based language. So if a Chinese user makes a mistake of missing a key noun when phrasing a sentence, he will be marked -2 by Watson as it knows that this mistake is common to Chinese users. Also, basing on the history of the user's personal performance, Watson can diagnose regularities of mistakes on questions and then provide similar questions later as a specific training. If the users make a mistake on a type of question in which he or she is constantly getting wrong, then Watson will give the user -2. If a less-than-regular mistake is made, a -1 will be earned. When users make a new mistake a 0 will be received. When it is a correct answer a 1 will be earned. When an answer to a question that was constantly failed is correct, 2 points will be rewarded.

Step 3 - Benchmarking and Comparison

After we collect scores from each user in the same group, we start to benchmark so that we can know the mean, the median, the sampling distribution, population distribution and standard deviations. This will help us to compare one user's performance to others in the same group and then give feedback to the user in where they currently stand in the language learning process.

Plausibility:

The future of language learning will continue to be expanded in our platform. We believe Watson can help with providing better language learning scenarios as time goes by. Watson will become

smarter and we will have relevant data to improve our agent's conversations to eventually deliver personalized learning experiences.

WILSON will initially only offer English language learning in order to fulfill the demand for the most sought out language to learn in which we will have crucial data to help refine the experience for other languages. The offering of more languages to learn, soft skill training, job training and new exercises to will allow us to satisfy the demands of users from multiple spectrums.

Convergence of VR and AI is starting to occur and WILSON will be in the forefront of leading this paradigm shift in education and technology. There is slow adoption in the market right now for VR due to high hardware costs and lack of compelling content but institutions will be key in exposing people to the wonders of this technology. WILSON will be created in a manner that follows imperative VR design principles to offer comfortable and engaging experiences and most importantly, finds real applicability in the lives of its users.

Impact:

WILSON will have the most profound effects in the Higher Learning market in which we have decided for the early days that it would be reasonable to form a licensing partnership with an educational publisher. The publisher would have a large distribution network and could hold the inventory for the VR headsets which would save us a lot in marketing and HR costs. The publisher would then sell to Higher Learning institutions and individuals.

- a. Universities - There is a significant number of foreign students enrolled in U.S. Universities and many of them may not be proficient enough in the English language. The universities can have this available in their writing and reading centers which would allow their students to practice at any time. In addition, schools can purchase a license that would extend the subscription to all their students so they can practice away from school. Universities could also request customized experiences tailored to a course's curriculum in which students would be able to purchase an access code kit and complete assignments through WILSON. These could be selling points for universities to show progressiveness and new offerings for students.
- b. Individuals - Students looking to enter universities all over the world can begin to practice real life scenarios through WILSON at a more affordable price point. WILSON will be able to reduce the time spent with tutors, be available 24/7, have a more personalized learning experience rather than a crowded classroom in which instructors would have to divide the time of students and provide a more interactive and entertaining experience than mobile apps and software. WILSON will have immense effects on students' confidence, academic and professional careers.

CUNY-IBM Watson Case Competition

SPRING 2017

Group Name: *HunterHawks*

Team Number: *21*

Business Case Title: *Cognitive Technology for Early Detection of Mental Illness (CTED - Mental)*

1-minute Video Link: *<https://www.youtube.com/watch?v=e3KwqZnkL8Y>*

Case Domain: *CityServices*

One-liner:

Cognitive Technology for Early Detection of Mental Illness (CTED-Mental)

CUNY IBM Watson Competition Business Analysis--Hunter Hawks Team

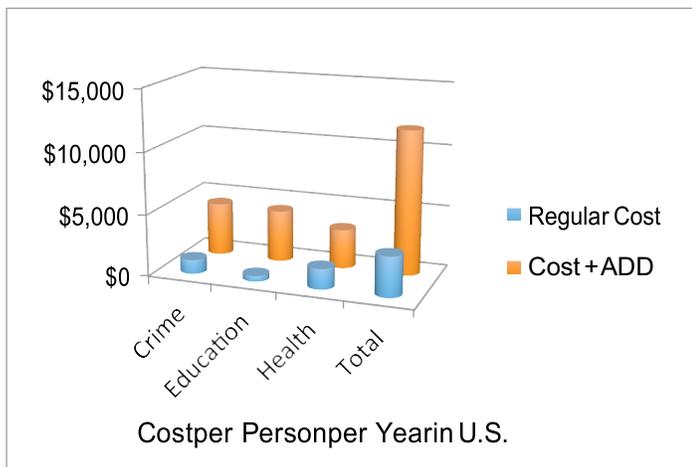
Team Leader: Thomas Ward, (M.S., Mental Health, Rehabilitation Counseling, MBA, B.A.); Julissa Lorenzo Vásquez (M.S. School Counseling, B.A.); Kevin Sánchez (B.A., Computer Science); Uman Shazad (B.A., Computer Science). **Mentor:** Professor Felisa Vázquez-Abad (Executive Director, CUNY Institute CoSSMO)

SUMMARY: Attention Deficit Disorder (ADD) is a particularly cruel mental illness, as it affects the youth as well as adults. It is well recognized today that children afflicted with it have much higher propensity to crime and delinquency, depression and, in general, a lesser quality of life. It is identified as a health crisis in NYC. To fight it, we have created Cognitive Technology for Early Detection of Mental Illness. CTED-Mental is a world where ADD will be diagnosed early. Adequate steps will prevent its tragic consequences for the patient and for society. New York will become a model city, saving millions of dollars and nurturing more productive and healthy youth.

1. THE MARKET: NYC Mental Health and Attention Deficit Disorder (ADD)

ThriveNYC is a new mental health care initiative pioneered by Mayor de Blasio. One in five New Yorkers (about 2 million people) suffer from all mental illnesses and the financial cost to treat them is conservatively estimated to be \$35 billion annually¹. The emotional and financial costs to the victims, their families, the NYC Criminal Justice System, the NYC Education Department, the NYC Department of Health and Mental Hygiene, employers and, in some way, all citizens of NYC--are staggering. We have created a business concept that will use IBM Watson’s cognitive technology for early diagnosis of mental illness that could significantly help address this situation.

For this competition, addressing all mental illnesses in NYC would be too broad a mandate for our team, so we will develop a proof of concept, focusing on data related only to ADD in youths (21 and under) in NYC. There are about 240,000 NYC youth now being treated for ADD resulting in more than \$4.2 billion in conservatively estimated annual costs. According to the Center for Disease Control (CDC) and the American Psychiatric Association (APA), 5-13% of boys and 4-7% of girls are diagnosed with ADD². Furthermore, 33% of children with ADD never finish high school (3 times the national average), so they end up in jobs that don’t pay well³. A Harvard study says that 52% of people with untreated ADD abuse drugs or alcohol⁴. ADD is often associated with higher incidences of academic problems, low self-esteem, depression, job failure, incarceration, obesity, divorce, Alzheimer’s disease, and other severe mental illnesses in adulthood such as bipolar disorder and schizophrenia. It is a health crisis in NYC that continues to grow.

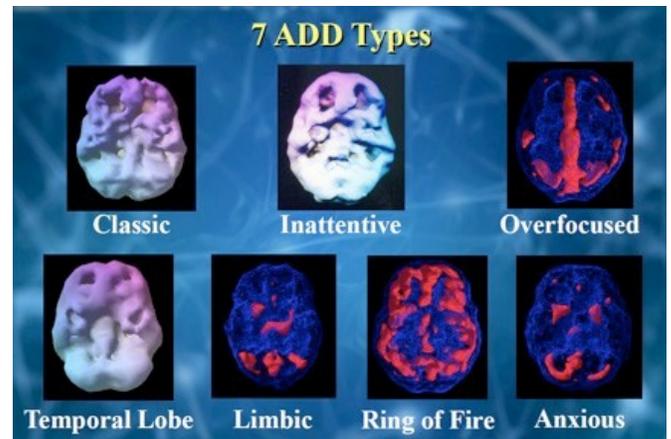


The table below provides the estimates of the “social cost” of ADD in the U.S. Detailed estimates of annual costs for crime and delinquency; education, and health and mental health care were obtained using data from 2005⁵. We adjusted for 2017-dollar amounts, as well as current demographic NYC figures⁶. The figures are plotted in the chart (left).

	Regular Cost	Cost w/ ADD
Crime	\$1,150	\$4,311
Education	\$460	\$4,206
Health	\$1,671	\$3,198
Total	\$3,281	\$11,715

2. CTED-MENTAL: SPECT Technology Combined with IBM Watson

Single-photon emission computed technology (SPECT) brain imaging is a validated methodology for identifying different types of ADD⁷. It measures the blood flow to the brain and allows doctors to see how the brain is functioning under stress and when relaxed. Dr. Daniel Amen and Dr. Cyrus Raji and their colleagues at Amen Clinics in California have identified seven types of ADD using these images (shown at right), providing more differentiated diagnoses than just one or two types (as is common practice). According to their studies, this can lead to materially better and more accurately tailored treatment solutions⁷. The Amen Clinics, with one located in NYC, has provided our team access to their data, containing more than 40,000 ADD SPECT brain images to use in a pilot study.



Our vision for the future focuses on early humane intervention to prevent the tragic consequences of ADD, rather than just treatment of illness after it has already become a serious impairment to a young person. Before this can even be plausible, there are two important obstacles to address in the brain imagery field:

- (1) Not many experts are trained to analyze the SPECT images in order to produce their diagnoses, and the process is time consuming, and
- (2) These experts can recognize the various mental illnesses from the images when the conditions of the illness are already severe.

Thus, we currently do not have the manpower or skill set required to address early detection of serious mental problems for all the children in NYC. Here, Watson's cognitive technology can help.

Watson's Visual Recognition cognitive technology can be used to predict the odds for future onset of the disease from a SPECT image. We will do this by training the machine with data from longitudinal studies in order to predict future onset of ADD and not just identify the type of ADD from an image of a brain that is already ill. Computers can evaluate these odds extremely fast, so they can deal with thousands of SPECT images at once, solving both problems mentioned above. Through the CTED-Mental website, these results will be communicated to the health care practitioners so that possible preventive measures can be done collaborating with the parents of the children tested and with the school counselors. Thanks to this technology, in the near future, parents will be better educated to deal with possible onset of ADD and mental illness, and many children will be spared much of the suffering. Our project is transformative--a beneficial and humane tool for the DOHMH.

3. THE FINANCIALS—5-Year and ROI Projections Per Clinic, Overall Cost Savings

We estimate that once CTED-Mental is fully integrated into the NYC mental health care system, our long-term plan could reduce social costs annually by 20%—or approximately \$840 million— with earlier and more accurate detection of ADD and better monitoring of the disease using SPECT brain images. As a pilot test, we initially propose to imbed a program for one year in an existing NYC mental health facility such as a child study care clinic in a public hospital at a cost of no more than \$3.5 million. Another possibility is to carry out a pilot program with local schools and collaborate with a private entity like Amen Clinics in NYC that already uses SPECT brain scans.

However, full implementation will require significant investment in infrastructure. The chart below is an income statement estimate for one clinic. Our business study indicates that in spite of the initial costs, the long-term operation is financially viable. Each clinic could do at least 2,200 scans per year. To do more than 10,000 scans per year and build out to scale, it is estimated that five clinics would ultimately be needed costing a total of about \$18 million to \$20 million to operate annually.

CTED-Mental Projections For One Clinic

(Figures in 000's; Assumes 3-year ramp to capacity)

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Revenues					
Initial Evaluation	\$2,500	3,000	4,398	4,618	4,849
Additional Patient Visits	700	840	882	926	972
Supplements	800	960	1,320	1,386	1,455
Net Operating Revenues	4,000	4,800	6,600	6,930	7,276
Expenses					
Salaries, Wages, Benefits	2,000	2,100	2,205	2,315	2,431
Other Expenses	1,500	1,577	1,656	1,744	1,834
Property, Plant, Equipment	50	50	50	50	50
Total Operating Expenses	3,550	3,727	3,911	4,109	4,316
Total +/-	450	1,073	2,687	2,821	2,961
Operating ROI	+/- 14%				

While it is difficult to quantify for purposes of our competition all of the sources of collateral and direct costs savings, we have estimated based on professional opinions and data on the NYC education, health care and crime costs that overall costs could be reduced by 20% or about \$840 million annually given a long-term plan. CTED-Mental will help to achieve:

- | Less Personal and Financial Strain on the Patients
- | Less Personal and Financial Strain on NYC Families
- | Savings from Prevention and Early Detection
- | Savings from Better, More Accurate Diagnoses and Treatments
- | Savings for NYC Social Services
- | Savings for NYC Criminal Justice System
- | Savings for NYC Education Department
- | Savings for NYC Department of Health and Mental Hygiene
- | Savings From Better Future Employees
- | More Income From More Paying Taxpayers (i.e. Productive and Healthy Patients)
- | Lower Costs From Better Measuring and Monitoring a Patients' Progress
- | Lower Costs From Latest and Best Treatments Suggested by Watson and Constantly Updated
- | Lower Costs by Watson Helping Practitioners be Significantly More Efficient

References

- 1 New York City Department of Health and Mental Health, "ThriveNYC: A Mental Roadmap for All." <http://www.nyc.gov/Thrivenyc>, #Thrive NYC, p.16 (2015)
- 2 Holland, Kimberly and Riley, Elsbeth, Medically Reviewed by Krucik, George T., *ADHD by the Numbers: Facts, Statistics and You*. <http://www.healthline.com> (September 4, 2014)
- 3 Cassels, Caroline. *High School Incompletion Rates Highest in Teens With ADHD*, Medscape.com (July 29, 2010)
- 4 Biederman, J.; Wilens T.E.; Mick, E.; Faraone, S.; Curtis, S.; Thornell, A.; Pfister, K.; Jetton, J.; and Soriano, J.; *Is ADHD a risk for psychoactive substance use disorder? Findings from a four year follow-up study*. *Journal of the American Academy of Child and Adolescent Psychiatry* 36:21-29, (1997).
- 5 Pelham, William E.; Foster, Michael; Robb, Jessica A.; *The Economic Impact of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents*, *Journal of Pediatric Psychology*, vol. 32 no. A.;6 ADHD Special Issue, reprinted by permission from *Ambulatory Pediatrics*, Vol. 7, Number 2 (Supplement), Jan./Feb. 2007, p.719
- 6 Pelham, William E.; Foster, Michael; Robb, Jessica A.; *The Economic Impact of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents*. *Journal of Pediatric Psychology*, vol. 32 no. 6 ADHD Special Issue, reprinted by permission from *Ambulatory Pediatrics*, Vol. 7, Number 2 (Supplement), Jan./Feb. 2007, p.719
- 7 *Seven Types of ADD*, Retrieved April 8, 2017, from <http://www.amenclinics.com>

