Project Notes:

Project Title:
Name: Daiwik Pal

Note Well: There are NO SHORT-cuts to reading journal articles and taking notes from them. Comprehension is paramount. You will most likely need to read it several times so set aside enough time in your schedule.

Contents:

Knowledge Gaps:

This list provides a brief overview of the major knowledge gaps for this project, how they were resolved and where to find the information.

Knowledge Gap	Resolved By	Information is located	Date resolved
What are PEMs?	N/a (old idea)	n/a	n/a
How is NaBH4 produced?	n/a (old idea)	n/a	n/a
How do Viral Diseases Spread? (look for indicators)	yes	Article #8	Oct 6
How are Cameras used to detect cars in parking lots?	yes	Article #6, Article #9	Sep 22
How do chatbots work and what are some common uses?	yes	Article #7	Sep 22
How do NLP systems work?	yes	Article 10, 11	Oct 9
How do phone detection devices work?	Yes	Article #12	Oct 16
Previous Models that related to covid 19	Yes	Article #13	Nov 7

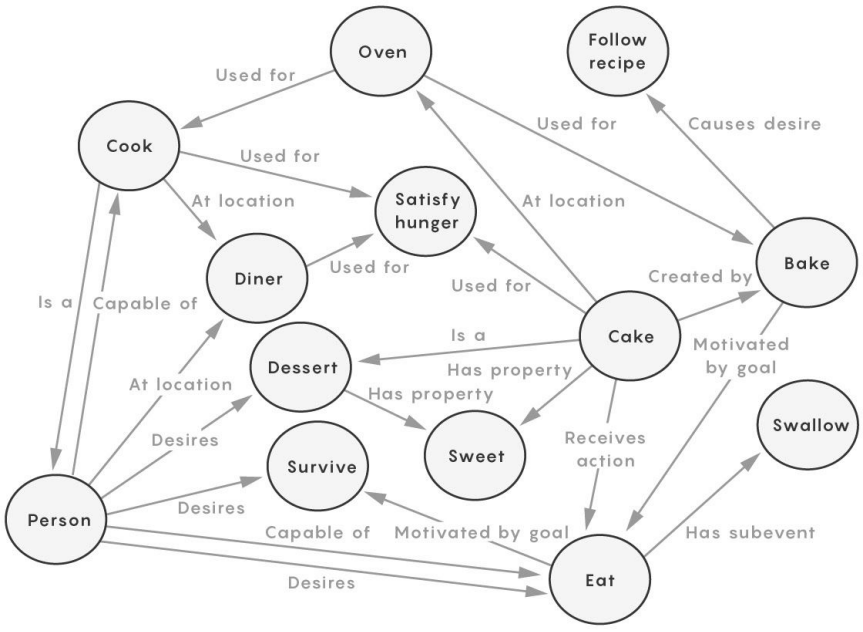
Literature Search Parameters:

These searches were performed between (Start Date of reading) and XX/XX/2019.
List of keywords and databases used during this project.

Database/search engine	Keywords	Summary of search
WPI Library	Cars AND Hydrogen AND Renewable	
Google Scholar	Cars AND Hydrogen AND Renewable	
Google Patents	Language: ENGLISH Parking AND vacancy AND system AND camera	
Google Patents	chat bot) language:ENGLISH type:PATENT	
Google Scholar	Viral AND Diseases AND Spread	First paper was what I was looking for, but there were papers that were about computer viruses that came up too. I should specify biological or computer related next time.
Gordon Library	Natural AND Language AND Processing	All papers were related to what I needed, and the NLP book resulted in the search was the best for my needs .

Article #1 Notes: Common Sense Comes Closer to Computers

Source Title	Common Sense Comes Closer to Computer
Source citation (APA Format)	Pavlus, J., & Quanta Magazine (2020, April 30). Common Sense Comes to Computers. Retrieved July 11, 2020, from
Original URL	https://www.quantamagazine.org/common-sense-comes-to-computers-20200430/
Source type	Article
Keywords	N/a
Summary of key points (include methodology)	The central question is how and why has Common Sense Reasoning (CSR) gotten complex and smarter over the past few decades? This question is important beca analogous of the whole computer industry. CSR uses new technologies from the computer science field like Natural Language Processing, Neural Networks, and i databases to make sensible predictions. If researchers look at this one field, they understanding of how the whole tech industry has evolved from the 1980s. The required to answer this question are what the difference in predictions from the systems because that will give a fairly definitive sense of improvement. Second, need to see how these system work behind the scenes because that is where the uses new advancements in tech and looking at that will give a clear reason for th improvement. The methods used to get those data are through firsthand testing giving the algorithm an input and examining the output on their own computers be looking through archives of CSR researchers from decades ago to see how the worked. Finally, they could directly interview researchers from the present to se CSR systems operate. After getting this information, they have to analyze the inf which component contributed the most towards the growth of CSR systems. For it the addition of a larger set of general information that helped? Or was it the a faster computers that made these systems better? The data was obtained was that the 1980s CYC CSR system (old) was much slowe less precise in its predictions, also they found out that the computer researchers code every single association between ideas, making it very tedious to make. Co slow computers, the old CSR systems took a great amount of time to operate an predictions. On the other hand, the COMET CSR system (new) is much more adva make complex predictions about random events that are described using a single example, the researchers inputted this: What happens when you stack kindling and logs in a fireplace and then drop some matches is that you typically ... and COMET responded with this: wanted to start a fire.

	They inputted many more sentences like that to see how precise COMET's predictions were. They also found out that COMET uses new machine l systems like Natural Language Processing, Neural Networks, and a large databas connections for COMET to use. The results of the analysis were that the new COMET system can make accurate predictions 77% of the time. Also, the main reason for improvement was becaus neural network system. This system allowed the computer to make its own conn instead of having a human make the connections for it. The versatility allowed it solve through ambiguates in the sentence much better than the old version. Afte they realized that this was not the end of CSR system they still have to test on m things such as trying to identify objects and listening to sounds. Right now, they primitive. This answered the central questions because the analysis shows what the exact for improvement was and how exactly these improvements were made. This tell information about the broader field. The CSR system is analogous to the whole t because it advanced just like the tech industry does: minor advancement each ye overtime the advancements add up to create something much better. It also sho industry is always changing for the better and researchers are always looking at implement new technologies.
Research Question/Problem/ Need	How has common sense reasoning evolved over 4 decades and what were the causes?
Important Figures	
Notes	• Gary Marcus was testing about a deep learning network called GPT-2. • Machine learning network that is capable of creating plausible sounding news articles from only simple prompt

- Marcus tested GPT-2 by typing in “What happens when you stack kindling and logs in a fireplace and then drop some matches is that you typically start a ...”
    - It responds with something completely off: "irc channel full of people."
- Common sense reasoning is very hard task
    - AI researchers have been trying to figure it out for decades
    - He realized that neural networks are good at mimicking linguistics, but they lacked basic common sense
- Yejin Choi developed a system called COMET(Commonsense Transformers)
    - It was supposed to perform common sense reasoning using an older version of GPT2
    - She puts in that same prompt as Gary into the common sense reasoning
    - COMET generates 10 inferences on why the person drops matches on some kindling logs
        - Not all of the inferences made sense, but 2 did:
        - "wanted to start a fire
        - "to make a fire

<u>Two paths to Common Sense:</u>

- Common sense is both essential and frustratingly difficult
    - Common sense contains a very broad range of implicit information
    - Rules of thumb that human automatically make sense of
    - People do not realize when they use common sense to read between the lines because it is so natural, but it hard to mimic in computers
- Progress since the 1980s in commons sense AI has been very slow
    - First, AI researches tried to write down all the unwritten rules of human common sense, and the computer could reason with the info like they already do with arithmetic
    - It was a little successful but not very feasible in the long run
    - Turned out to be extremely overwhelming
- 2nd alternative was Deep Learning networks:
    - Mimic interconnected layers of neurons
        - They car learn patterns without the need of programmers coding it in like the previous method
    - They are much smarter but can have silly lapses in judgment
    - This is how the COMET works, it extends on the old style but uses the latest advancements
    - COMET works by reimagining common-sense reasoning as a process of generating plausible responses instead of

making concrete deductions

Endless Unwritten Rules

- Implicit nature of common sense knowledge makes it hard to represent explicitly.
- First, they tried to write down all the facts of the world, but it is much harder than it sounds.
    - This started in 1884 with a project called Cyc,
        - They wanted to encode about 400 encyclopedias worth of info for it to work
        - They never stopped feeding it info, but in 2015 they said Cyc never really had an impact on AI research
    - It do not work out because there are always exceptions to every case
        - Exception = hard to anticipate
        - "purely symbolic based knowledge is doomed"
    - Sharply defined relations within a knowledge base enables powerful reliable reasoning
    - Symbolic systems, no matter how much info they have, will always have shortcomings
        - They fail to capture ambiguities that are normal in common sense reasoning

Going Neural:

- Group of researchers build of symbolic systems with neural networks
    - These system do not have defined databases with rules for associating things
    - "statistically smear their representation of language across billions of parameters"
        - Hard to interpret but are more robust than symbolic
        - Can generate predictions based on ambiguous input without breaking
    - Choi trained the neural network with their ATOMIC database, similar to how they trained the GPT-2 (system that makes fake new articles)
    - This was the creation of COMET (ATOMIC DATABASE + Neural Networks)
    - COMET is surprisingly good; 77.5% were considered plausible by human evaluators
        - This is because it used its neural network to make predictions, not a preexisting knowledge base
    - To show how robust COMET is they prompted the phrase from a researcher ' s 5 y/o: "Daddy goed to work.."

<table>
<tr><td></td><td>

COMET's response was very good:

"daddy wants to earn money"
"daddy wants to make people proud"
"daddy is hardworking, motivated, dutiful, etc."

Choi says CYC would not have been able to understand that, unless someone manually coded in that "goed" means "went"

<u>Ladders and Rockets</u>

There is always a catch,
Neural network can only go so far
They are good at mimicking understanding, but they never truly 'know" that dropping matchstick with cause a fire
Choi agrees, COMET relies on surface patterns, not understanding

That is good apparently, they just need more informative surface patterns
Researchers argue that the next step forward is introduction info outside language

Like images,
perception,
emotion

Those more direct 1st person interaction can help much more in common sense reasoning, language will act as a supplementary second layer
They are trying advance AI system's common sense by interacting them with VR

COMET is missing the reference part

The word 'apple' is not an apple, the meaning of an apple has to exist in some form of matter

This is pretty epic
Other researchers are working on systems that use common sense reasoning to predict physics based things

Tipping a cup of water with cause the water to spill out type things
Language processing is only a fraction of the real world

Choi thinks COMET is a flawed but important

It is not the best, but is better all the other things researchers have tried

</td></tr>
<tr><td>Cited references to follow up on</td><td></td></tr>
<tr><td>Follow up Questions</td><td></td></tr>
</table>

Article #2 Notes: How Gödel's Proof Works

Source Title	How Gödel's Proof Works
Source citation (APA Format)	
Original URL	https://www.quantamagazine.org/how-godels-incompleteness-theorems-work-20200714/
Source type	Article
Keywords	Abstractions Blog Continuum Hypothesis Foundations Of Mathematics Mathematics Proofs Set Theory
Summary of key points (include methodology)	Gödel's proof proved that there can be no mathematical theory of everything. The theorem works by mapping mathematical statements into a unique Gödel number. This is done by assigning mathematical symbols and ideas into numbers; for example, "=" is assigned the number "5" and "⊃" is assigned 3, etc. Then to convert the mathematical expression into a unique Gödel number a certain algorithm is applied. Take the expression 0 = 0, for example. The corresponding numbers for each symbol are 6, 5, and 6, respectively. To turn those numbers into a unique Gödel's number you take the first three primes, 2, 3, and 5 (because there are three symbols in the equation) and raise them to the power of 6, 5, and 6 accordingly. Finally, the equation "0 = 0" becomes , or 243,000,000. The ability to "arithmetic" expressions is what allows Gödel to prove that all true statements cannot be proved. By converting expressions to numbers, he is able to substitute certain expressions into others. Gödel first creates a true expression, which relates a number "x" to a number "y." Using the algorithm above, this true expression is them converted into a Gödel number, "m." Then, a new expression is created, which is the exact same as the last expression but now relates the number "m" to a number "y." Gödel uses this substitution method some more times and ends up with a new true expression, which somehow says something along the lines of "the

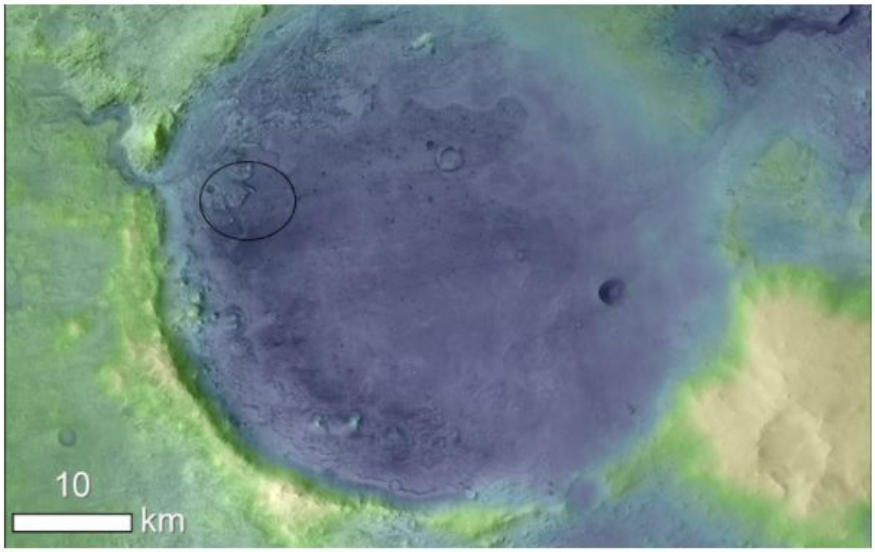
<table>
<tr><td></td><td>formula with Gödel number ‘m’ cannot be proved.” Since the Gödel number of the new expression is still m and still true, the new expression is referring to itself. It is saying that “this very own expression cannot be proved,” which is a huge paradox! If it gets proved then the statement is disproved, but if it is unable to be proved it gets proved. Basically, Gödel proved that the statement is impossible to prove. His proof destroyed the hopes of many mathematicians who sought for a consistent and complete mathematical system.</td></tr>
<tr><td>Research Question/Problem/ Need</td><td>How does Godel's Proof Work?</td></tr>
<tr><td>Important Figures</td><td>
<table>
<tr><th>Constant sign</th><th>Gödel number</th><th>Usual Meaning</th></tr>
<tr><td>~</td><td>1</td><td>not</td></tr>
<tr><td>∨</td><td>2</td><td>or</td></tr>
<tr><td>⊃</td><td>3</td><td>if...then...</td></tr>
<tr><td>∃</td><td>4</td><td>there is an...</td></tr>
<tr><td>=</td><td>5</td><td>equals</td></tr>
<tr><td>0</td><td>6</td><td>zero</td></tr>
<tr><td>S</td><td>7</td><td>the successor of</td></tr>
<tr><td>(</td><td>8</td><td>punctuation mark</td></tr>
<tr><td>)</td><td>9</td><td>punctuation mark</td></tr>
<tr><td>,</td><td>10</td><td>punctuation mark</td></tr>
<tr><td>+</td><td>11</td><td>plus</td></tr>
<tr><td>×</td><td>12</td><td>times</td></tr>
</table>
</td></tr>
<tr><td>Notes</td><td>"his incompleteness theorems destroyed the search for a mathematical theory of everything. Nearly a centaury later, we're still coming to grips with the consequences."

● Mathematicians of his era created axioms,
○ Axioms: mathematical facts
● Gödel's incompleteness theorems crushed the idea of having axioms
○ Proved that there will always be something incomplete</td></tr>
</table>

	○ No candidate set of axioms can ever prove its own consistency ● There cannot be a mathematical theory of everything ● What mathematicians can prove depends on their starting assumptions, not on any fundamental ground truth from which all answers spring ● The theorems affect not only math but aspects of reality Gödel Numbering: ● Map statements *about* a system of axioms onto statements *within* a system ○ Mapping lets axioms to talk cogently about itself ○ Cogent: clear, logical, convincing ● 1st step: map possible mathematical statements into Gödel numbers ○ 12 symbols get assigned the Gödel numbers 1 through 12
Cited references to follow up on	N/A
Follow up Questions	Where can this proof be utilized?

Article #3 Notes: NASA has launched the most ambitious Mars rover ever built

Source Title	NASA has launched the most ambitious Mars rover ever built: here's what happens next
Source citation (APA Format)	
Original URL	https://www.nature.com/articles/d41586-020-02257-w#:~:text=The%20rover%20will%20be%20the,sounds%20for%20the%20first%20time.
Source type	Article
Keywords	
Summary of key points (include methodology)	Nasa recently launched its Perseverance Rover on July 30, 2020. Nasa has learned a lot from its past rover mission and made

	subsequent improvement to the new rover and its 2 yearlong mission. This mission will explore a crater that scientists believe used to be a lake in which a river flowed into. On Earth scientists have found fossilized evidence of life in ancient Carbonate Rocks, which are found in similar areas like the Mars crater. The new rover is basically a geologist, whose main goal is to find any signs of ancient life on mars. It has a robotic arm that can get very close to samples and store them in test tubes. NASA hopes to have a mission in the future to retrieve the collected samples. The new rover also has microphones, so we will be able to hear Mars for the first time ever! These microphones also have a practical purpose, which is to hear any engineering problems in the wheels. It even has a 1.8KG helicopter, named Ingenuity, which will conduct the first powered flight on another planet. Lastly, the Rover also experimented with producing Oxygen from Mars's Carbon Dioxide rich atmosphere. This will directly help future colonization efforts because Oxygen is necessary for humans to live and is a key ingredient in rocket fuel.
Research Question/Problem/ Need	What are the new features of NASA's rover and how will it help find life on Mars?
Important Figures	 Mars's Jezero Crater will be the landing site for Perseverance. Credit: NASA/JPL-Caltech/MSSS/JHU-APL/ESA
Notes	● Biggest Rover sent to mars ● Will be the first to collect rock samples on Mars ○ Also its main goal is to search for signs of life ● It will launch a helicopter for the first time ● Many other mars missions took of at this time

	○ They took advantage of a favorable alignment between the two planets ○ More fuel - efficient ● Will spend 2 earth years exploring a crater that most likely would have been a lake ● They want to find signs of fossilized life ● Fill in tubes of rock for a next gen space craft Next-gen explorer ● The machine is a beefed up version of the Curiosity Rover ● Will land similar to the Curiosity Rover ● A river flowed into the crater and it was a lake ● On Earth ancient carbonate rocks hold old fossilized evidences of life ● They have never explored an area like this ○ Evidence can be fossils or chemical signatures of organism that lived in the rocks Tools of the Trade ● The rover is more a geologist ● It also have two microphones, so we can hear mars for the first time ○ Will also help to hear engineering problems with the wheels ● 1.8 KG helicopter called ingenuity, it will be a the first craft to make a controlled flight on another planet ● Robotic arm that can get up close to the rocks are get samples ○ 30-35 good samples There and back again ● Returning samples will the first time we will have a round trip from mars ○ Will help in colonization because we want the astronauts back too ○ Rover will also produce oxygen from Mar's Carbon Dioxide atmosphere ○ This will colonization efforts and allows for the creation of rocket fuel
Cited references to follow up on	n/a
Follow up Questions	n/a

Article #4 Notes: A safe, portable, hydrogen gas generator using aqueous borohydride solution and Ru catalyst

Source Title	A safe, portable, hydrogen gas generator using aqueous borohydride solution and Ru catalyst
Source citation (APA Format)	Amendola, Steven C., et al. "A Safe, Portable, Hydrogen Gas Generator Using Aqueous Borohydride Solution and Ru Catalyst." International Journal of Hydrogen Energy, vol. 25, no. 10, Oct. 2000, pp. 969–75. ScienceDirect, doi:10.1016/S0360-3199(00)00021-5.
Original URL	https://reader.elsevier.com/reader/sd/pii/S0360319900000215?token=CF271AAE25CF514E10C0CFBD3B4CAA6FED8E9A50E07DEDB669EB390A118BDD6604D0C0942F6FDC9A51FBD35CF0DAB0BD
Source type	Journal
Keywords	Cars AND Hydrogen AND Renewable
Summary of key points (include methodology)	Hydrogen Fuel cells are seen as a clear step towards the future of zero emission vehicles (ZEV). These fuel cells convert the electric potential energy stored in hydrogen into electricity and water vapor; there is zero carbon emission in the reaction. The only problem that ZEVs face is how to generate hydrogen in a safe and efficient manner on board the vehicle. Luckily, a group of chemical researchers in New Jersey have been experimenting how to generate hydrogen gas. They created a safe and simple process that produces very pure hydrogen gas from a stable, aqueous solution of sodium borohydride, $NaBH_{4,}$ and by using a catalyst ruthenium, Ru. This exact chemical reaction can be replicated onboard hydrogen cars because it is extremely safe and efficient. The advantage of using this reaction in ZEVs is that it is a rapid but controlled generation of H_2 at normal atmospheric temperature, unlike conventional ways of producing H_2, which need a lot of heat. Also, it is much safer than gasoline cars since $NaBH_4$ is not flammable at all. The main advantage that this reaction has is that the hydrogen

	produced is already pure enough to use in the hydrogen fuel cell, which increases efficiency. Unfortunately, the only problem with this system is that $NaBH_4$ itself has a very high cost of $80/kg per gram, limiting it to only small and medium scale hydrogen generation. Researchers are working on solutions to effectively recycle $NaBH_4$ solutions to reduce cost.
Research Question/Problem/ Need	How can hydrogen generation be made more rapid and controlled?
Important Figures	$$NaBH_4 + 2H_2O \xrightarrow{catalyst} 4H_2 + NaBO_2 + HEAT \quad (300\,kJ)$$ Calculating how much time self hydrolysis will happen for: $$\log t_{1/2} = \text{pH} - (.034T - 1.92)$$ T = Temp in Kelvins pH = pH t1/2 = half life in minutes
Notes	· Hydrogen is seen as a clear step to the future in zero emission cars · They produce no carbon by product, which helps the environment · This paper studies how to store hydrogen in a safer manner. o When $NaBH_4$ is mixed with water it is turned into a aqueous solution o This solution releases H2 on its own, but at a very slow rate o The catalyst Ru is used to speed up the process o This delivers safe and dependable way of generating hydrogen o Advantage is rapid but controlled, and Hˆ2 can be generated at normal atmospheric temperature o Safety concerns are reduced o The reactions produce no fuel cell poisons since sulfur is not a factor o Water vapor is also produced, which can be used to humidify the PEM membrane

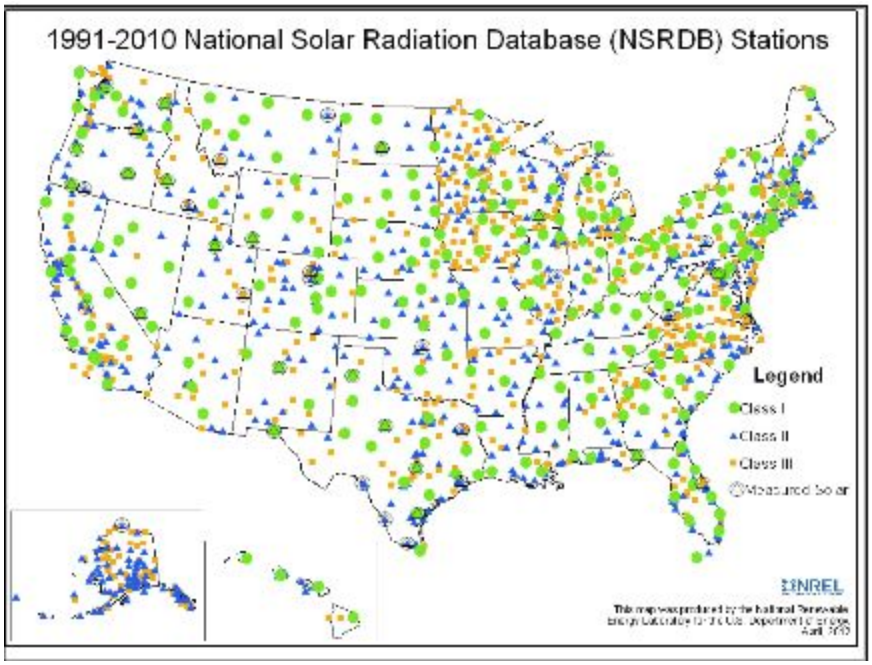
	o Big plus is that Hˆ2 gas is already pure, so not extra cleaning is needed o Far safer than gasoline, as $NaBH_4$ cannot be ignited as easily ● *Using NaBH4 solution as a transportation fuel*: ○ Its is easy to handle liquid and can be refueled similar to gas cars ○ Spent Borate residue from the reaction can be recycled into NaBH4 at plants ■ Which could also be powered by renewable energy ● Results and Conclusions: ○ NaBH4 slowly undergoes self hydrolysis without the absence of a catalyst ○ Fig ones shows H2 yield and it was expected based on the equation ○ H2 generation is dependant on the weight of NaBH4 ■ As weight percent is increased, initial H2 generation increases ■ Reach a maximum at around 7.5 - 12.5 weight percent of NaBH4 ■ Large H2 generation at lower weight percentages are due to viscosity, which does not allow catalyst to contact surfaces ○ High initial H2 generation is important in high power applications like vehicle acceleration. ○ NaBH4 need NaOH, so it does not have a continued self hydrolysis ■ Prevents it from having a shorter shelf life ○ Activation energy is different for each type of catalyst ○ Each mole of NaBH4 reaction produces 4 moles of H2 = 8, H2 = 98 1 H2 at 25 deg celcius ○ NaBh4 is a convenient no pressurised way to store H2 ○ Cars using NaBH4 hydrogen generators can be easily refueled
Cited references to follow up on	1) Amendola SC, Sharp-Goldman SL, Janjua MS, Kelly MT, Petillo PJ, Binder M. A safe portable hydrogen gen- erator using aqueous borohydride solutions (II). Presented at the Fall 1999 Electrochemical Society Meeting, Honolulu, Hawaii, Oct. 22. 1999. 2) Schlesinger HI, Brown HC, Finholt AE, Gilbreath JR, Hoekstra HR, Hyde EK. Sodium borohydride, its hy- drolysis and its use as a reducing agent and in the gener- ation of hydrogen. Journal of the American Chemical Society 1953;75:215.

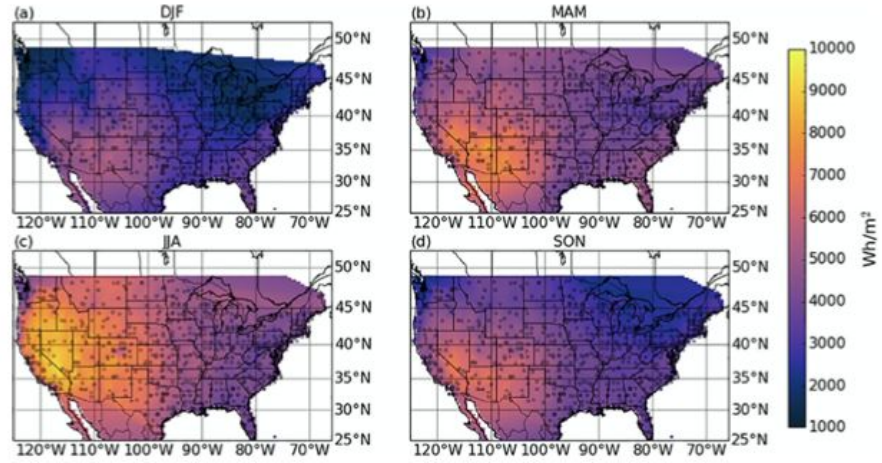
	3) Amendola, SC, Sharp-Goldman, SL, Janjua, MS, Kelly, MT, Petillo, PJ, Binder, M. A safe hydrogen generator using aqueous borohydride solutions. Journal of Power Sources 2000; 85:186.
Follow up Questions	1) How is sodium borohydride generated normally in factories? a) Are there ways to make it less expensive? 2) What is the exact chemical reaction going on inside a hydrogen car? 3) What are PEMs? 4) What is stoichiometric yield ?

Article #5 Notes: A climatology of solar irradiance and its controls across the United States: Implications for solar panel orientation

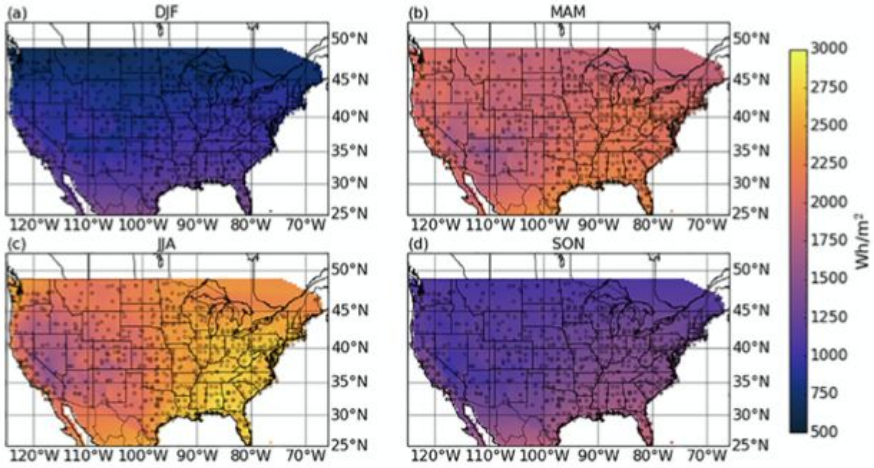
Article notes should be on separate sheets

Source Title	A climatology of solar irradiance and its controls across the United States: Implications for solar panel orientation
Source citation (APA Format)	"A Climatology of Solar Irradiance and Its Controls across the United States: Implications for Solar Panel Orientation." *Renewable Energy*, vol. 135, May 2019, pp. 897–907. *www.sciencedirect.com*, doi:10.1016/j.renene.2018.12.057.
Original URL	https://www.sciencedirect.com/science/article/pii/S0960148118314964
Source type	Journal Article
Keywords	Solar radiation, Solar panel, Diffuse radiation, Clouds Panel orientation, US radiation climatology
Summary of key points (include methodology)	Idea Scrapped
Research Question/Problem/ Need	What are the regional differences in direct and diffuse radiation in different regions of the United States? And what causes those discrepancies to occur?
Important Figures	





Âverage Direct Radiation



Average Diffuse Radiation

Notes

Abstract:

- Energy demand will increase by about 30% from 2016 to 2040
- Global market share for Solar energy is expected to rise
- PV cell were introduced at 1950 with about 2% efficiency, but now they have grown to 22.5% efficiency
- So experimental models even have 46% efficiency.
- Electrical output of PV cell is also dependent on latitude, sky cover, elevation, latitude, and cell orientation related to solar radiation field

- Incoming solar radiation consists of two components: direct component and diffuse component
- Cloud cover increases the diffuse component of solar radiation
- The efficiency of a solar panel that tracks the sun can increase output, but it is very costly
    - A fixed panel is much cheaper
- SImple rule for fixed panels is to orient the panels to the south and angle it towards towards the latitude of the site (or southernmost facing side of the roof)
    - So the panel is orthogonal to the sun's disks at noon
- To get most energy from diffuse radiation is to orient them flat
- It is clear that efficiency is impared when one has all flat panels or all titled panels

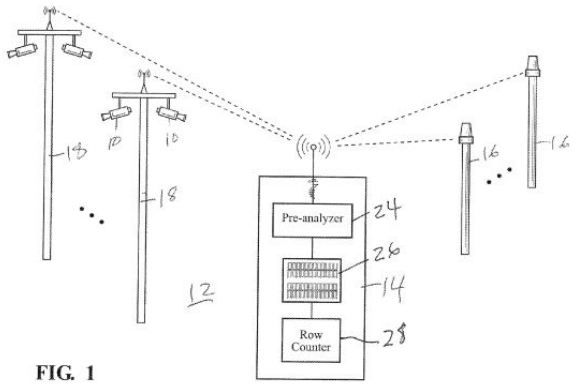
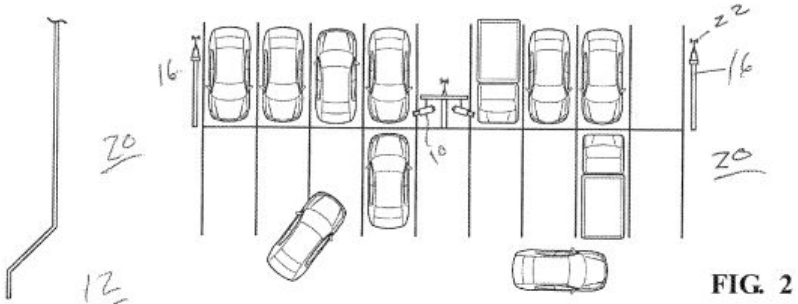
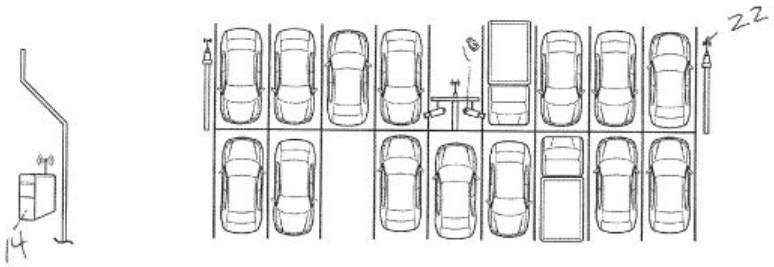
- Purpose of this paper is to identify regions where harvesting diffuse light may be more beneficial than direct radiation
- They examined 8 different US climate zones
- This analysis can will be used to determine with areas of US are best for for solar energy development and which will be best with a hybrid model

	Materials and methods: ● Got solar radiation data from NSRDB Findings: ● Direct Radiation relation: ○ East West in summer and spring ○ North South in fall and winter ○ Elevation is one of the causes ○ Air and smoke 2nd cause ○ Third cause cloud cover ○ Elevation plays a major role in direct radiation hitting the ground year round ○ Latitude plays largest role in the fall and winter time ○ Cloud cover plays the largest roles during the spring and winter ● When there is a lot of cloud cover, cloud droplet scatter direct radiation ○ Which is why there is more diffuse radiation in high cloud cover ● North east, south east, south-central, and midwest regions has a lot of diffuse radiation in late spring and summer, so diffuse radiation harvest will be most beneficial there ● South west, desert south west, and plains is vice versa ● Having both tilted panels and flat panels may be the most effective way to capture all types of solar radiation
Cited references to follow up on	n/a Idea scrapped
Follow up Questions	n/am Idea scrapped

Patent #6 Notes: METHOD AND APPARATUS FOR LOCATING VACANT PARKING LOCATIONS IN A PARKING LOT OR STRUCTURE

Article notes should be on separate sheets

Source Title	METHOD AND APPARATUS FOR LOCATING VACANT PARKING LOCATIONS IN A PARKING LOT OR STRUCTURE
Source citation (APA Format)	Osment, M. (2015). U.S. Patent No. 20150310745A1. Washington, DC: U.S. Patent and Trademark Office.
Original URL	https://patentimages.storage.googleapis.com/be/9f/21/2be36b6ed45664/US20150310745A1.pdf
Source type	Patent
Keywords	n/a
Summary of key points (include methodology)	Many drivers are frustrated with long waiting times to search for vacant parking spaces in crowded parking lots. This camera system in the parking lot is able to detect vacant spots and turn on a green or red light and the end of a parking row to indicate if they are vacant or fully occupied, respectively. The inventor claims that this will reduce times for drivers and also cut a portion of carbon emissions, as drivers will not need to waste additional fuel while they are trying to find a vacant parking space.
Research Question/Problem/ Need	Problem: finding places to park for drivers seeking to park in a parking lot or parking structure information as to the location of vacant parking spaces in the structure.

Important Figures	 FIG. 1  FIG. 2 
Notes	● Low cost ● Not distracting ● Uses CCTV cameras mounted in elevated supports to detect vacancy in parking spaces ● CCTV Cameras provide their outputs either in a wired or wireless manner ○ Server analyzes the data based on empty spaces noted in the camera ● In snowy conditions where lines are covered, the camera can make predictions on if the gap between cars is enough to park in
Cited references to follow up on	There are no references :0

Follow up Questions	● How would the camera detect vacant spaces? ○ Did they use novel camera detection systems? ● Are there any real world cases where this device is used? ● Does harsh weather impact the usability of this system? ○ Rain, heavy snow, natural disasters?

Patent #7 Notes: SYSTEMS AND METHODS FOR A MULTIPLE TOPIC CHAT BOT

Article notes should be on separate sheets

Source Title	SYSTEMS AND METHODS FOR A MULTIPLE TOPIC CHAT BOT
Source citation (APA Format)	Wu, X. (2015). U.S. Patent No.10366168B2. Washington, DC: U.S. Patent and Trademark Office.
Original URL	https://patentimages.storage.googleapis.com/95/08/a6/5110a591dcfbdf/US10366168.pdf
Source type	Patent
Keywords	n/a
Summary of key points (include methodology)	Bots are becoming smarter and faster every year. This has allowed them to be used in more fast paced situations such as conversations and give users info related to their conversation's topic. This chat bot in particular is able to determine multiple topics in the conversation and provide even more helpful information related to the user's conversations. This makes the bot more effective, human like, and helpful.
Research Question/Problem/ Need	Bots are very popular these days and can provide customers with phenomenal support without the need of humans.

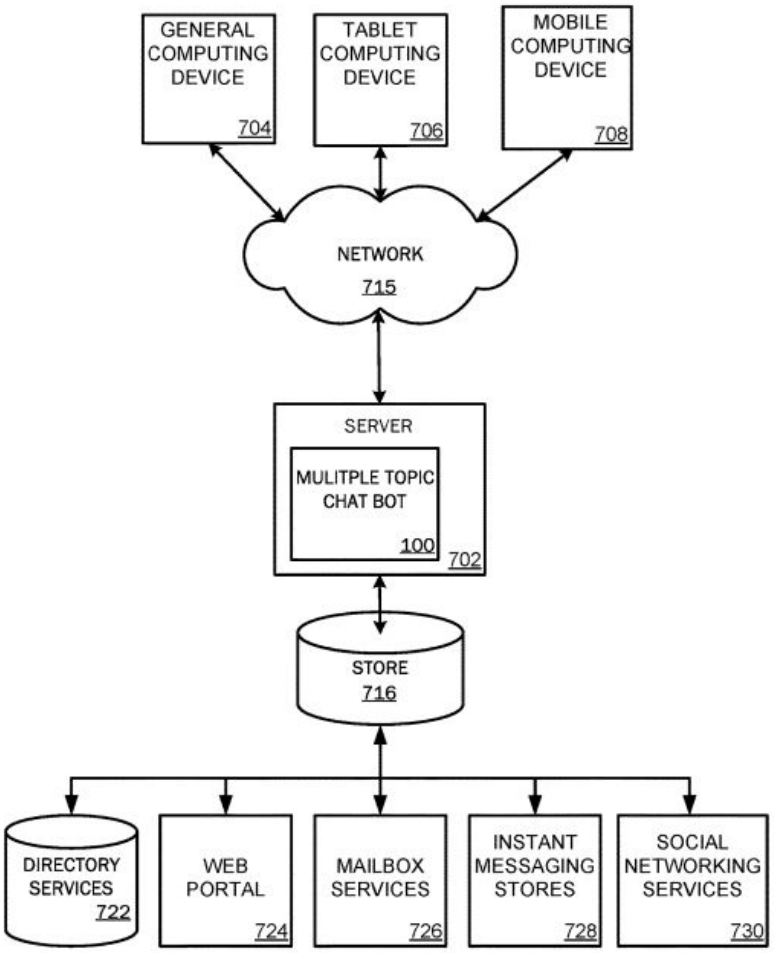
Important Figures	 FIG. 7

FIG. 3A

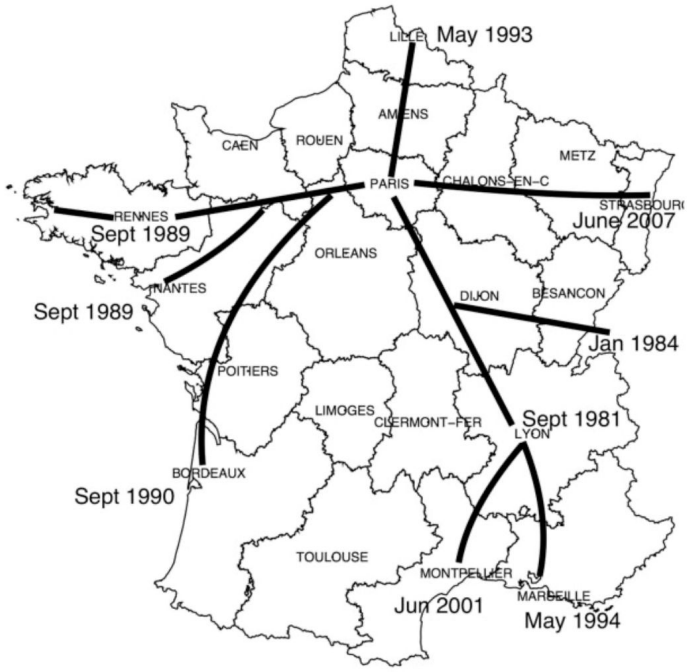
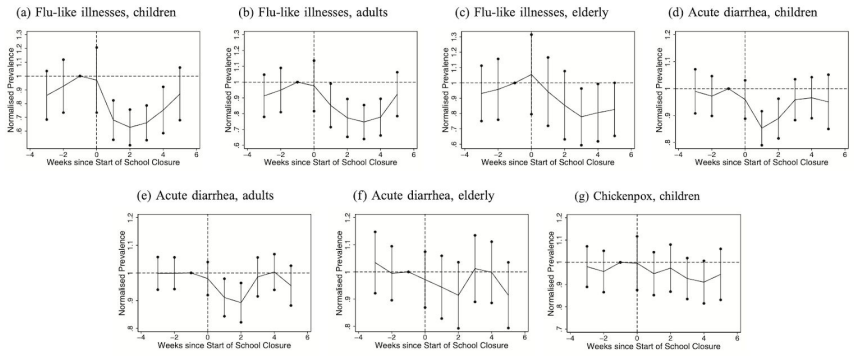
Notes

- The AI chatting system is able to "chat" about more than one topic by getting inputs from a user and then determines a number of topics it can reply about
- This more engaging, more effective, and easier to use, and more human like
- System needs at least one processor and one memory
    - Memory holds the code
    - The processor can use this code to many things like:
        - Make connections
        - Detect emotions
        - Get engagement rating for each topic/response

	■ Create a knowledge graph ■ Provide one or more responses to the conversation ○ Collect inputs to for collection to analyze to predict topic for the conversation ● Basically it can score all of the topics that the bot determines could be in the conversation
Cited references to follow up on	1) 2015 / 0286709 A1 * 10 / 2015 Sathish . . . . . GOON 77005
Follow up Questions	● How do you code something like this? ● What were the specific hardware components used to make this bot?

Article #8 Notes: Economic Activity and the Spread of Viral Diseases: Evidence From High Frequency Data

Source Title	ECONOMIC ACTIVITY AND THE SPREAD OF VIRAL DISEASES: EVIDENCE FROM HIGH FREQUENCY DATA
Source citation (APA Format)	Adda, J. (2016). Economic activity and the spread of viral diseases: Evidence from high frequency data. The Quarterly Journal of Economics, 131(2), 891–941. https://doi.org/10.1093/qje/qjw005
Original URL	https://academic.oup.com/qje/article/131/2/891/2607116
Source type	Journal Article
Keywords	Was not stated
Summary of key points (include methodology)	The author gives a good introduction for his reason to use France as a country to make his model. He states the French Gov. started recording minor outbreaks of Influenza, Acute Diarrhea, and Chicken Pox from 1983, giving him much more data to work with. Also, France has had a train strike, which effectively simulates a full shut down of public transportation during an outbreak. He then gives clear examples of his mathematical model to predict incidence rate. He also clearly describes each iteration. This model is then used to make predictions of potential economic loss for each of three age groups (child, adult, and elders) and how it may affect first world countries.
Research Question/Problem/ Need	How do viral diseases affect economic activity? How does economic activity affect the rate of transmission of viral diseases?

Important Figures	  FIGURE IV Expansion of the High-Speed Railway  FIGURE V Event Analysis: School Closures

Notes	- Using data from france because they started to record from 1983
	- Analyzed the influenza virus and chicken pox and found out that it decrease when students are on break
	- WHen the economy is doing well there are more cases of viral disease
	  - This could mean that higher economy = more people out spending money
	  - Then catching the flu, etc,

- When france invested in new rail lines connecting cities to places other than paris there was a jump in cases
- There was drop in cases after the public transportation strike
    - Makes sense because less people are getting in close contact with each other since public transportation is closed
- School closures not only affects children, but adults and elders too
- Creates a math model that incorporate the incubation period, how many people are infected/recovered/ susceptible/ etc, to predict how many cases there can be.
- Most contaminated individuals are able to spread the virus before they show symptoms, so avoidance is the best precaution.
- In the long run, the spread of the disease depends on how economically and physically connected the city is
    - More roads and infrastructure means more travel and more cases
- Short run, economic fluctuation affect how strong a virus is (page23)
- **Page 24** talks about model for predicting amount of cases through a lot of factor, such as age, how much time the virus lingers before affects start to become visible, etx

$$I_{rt} = \sum_{k=-3}^{K} b_E^k E_{rt-k} + b_T T_{rt} + b_X X_{rt} + v_{rt}.$$

- Uses ordinary least squares regression to make a model
    - Irt is the incidence rate
    - Ert indicator var (schools closed, public transportation down, etc)
    - Trt week average temperature
    - "The coefficients bkE are displayed in Figures V and VI. For ease of interpretation, we normalize these coefficients by b□1 to display the relative incidence of the disease compared to the one in the week prior to the event."
- Eq num 5:

$$(5) \quad I_{rt} = \alpha_{within} I_{rt-\tau} S_{rt-\tau} + \alpha_{between} \sum_{c \in R \setminus r} I_{ct-\tau} S_{rt-\tau} + X_{rt}\delta + \eta_{rt}.$$

- Page 26
- Need to also account for the effect of weather on the virus
- Final Model:
    - Now the model is time varying and region specific
    - **Has weather indicators, downfall, closures, incubation period, population density, and measure of economic**

	activity
	$$I_{rt} = I_{rt-\tau} S_{rt-\tau} \sum_{k=1}^{K} \alpha_{within}^{k} W_{rt-\tau}^{k} + \sum_{c \in R \setminus r} I_{ct-\tau} S_{rt-\tau} \sum_{k=1}^{\tilde{K}} \alpha_{between}^{k} \tilde{W}_{rct-\tau}^{k} + X_{rt}\delta + \eta_{rt}. \quad (6)$$
	- This is final model
	- Economic activity leads to more mixed results for each disease acute diarrhea reduces, but opposite for other two
	- Higher population density has higher transmission rates for children and for adults, negative for elderly
	- Incident increase in warm weather
	  - Either virus can repreoduce more rapidly in warm weather or people are in contact with more people during warm weather
	- Cost Benefit Analysis:
	  - For children, accounting the lose in schooling due to leave day from illness you can predict a loss of 100eruos per case for the child
	  - (very minimal with regard to the child whole life)
	  - Adult, is loss of productivity
	  - Average 2 days at home from work
	  - Addition lose of 0.7 at work due to 50% capacity at work
	  - Elders, Most likely cost of losing money is by medical bills
	  -

Cited references to follow up on	- Simonsen, Lone, Matthew J. Clarke, Lawrence B. Schonberger, Nancy H. Arden, Nancy J. Cox, and Keiji Fukuda, ‘‘Pandemic versus Epidemic Influenza Mortality: A Pattern of Changing Age Distribution,’’ Journal of Infectious Diseases, 178 (1998), 53–60.
Follow up Questions	-

Article #9 Notes: Deep learning for decentralized parking lot occupancy detection

Source Title	Deep learning for decentralized parking lot occupancy detection
Source citation (APA Format)	Amato, Giuseppe, et al. “Deep Learning for Decentralized Parking Lot Occupancy Detection.” Expert Systems with Applications, vol. 72, Apr. 2017, pp. 327–34. ScienceDirect, doi:10.1016/j.eswa.2016.10.055.
Original URL	https://www.sciencedirect.com/science/article/pii/S095741741630598X
Source type	Journal Article
Keywords	Machine learningClassificationDeep learningConvolutional neural networksParking space dataset
Summary of key points (include methodology)	Smart Camera vision systems are a great tool to detect parking lot occupancy. However, they are centralized to one server to analyze images. That makes the process hard to generalize between parking lots, so a new idea is being proposed. Instead of analyzing video/images in a central server, researchers propose a decentralized and efficient method where the images are processed on the cameras themselves. They test their process with two data sets with images from various seasons and areas. The researchers used two datasets in their testing: CNRPark-Ext and PKlot. The difference between the two datasets is that CNRpark-Ext has non-rotated squares that identify the parking lots, have pictures taken at a lower POV, and have occlusions from trees and other cars. Using two datasets allowed the researchers to validate their approach better. The average confidence values coming from each prediction for each picture from the data set to get a good summary of the total confidence values. All cameras were able to monitor 50 parking spaces individually, but ones trained with PK-plot were most accurate on rainy days. This is because the PK-Plot has more “rainy” pictures, as seen above in the table above. Their decentralized cameras were able to perform phenomenally using the CNRPark and PKplot datasets. They show that there are alternate methods to a central server classifying images; however, both are very effective.
Research Question/Problem/	Is decentralized image processing a viable way to make parking lot occupancy processing more generalized?

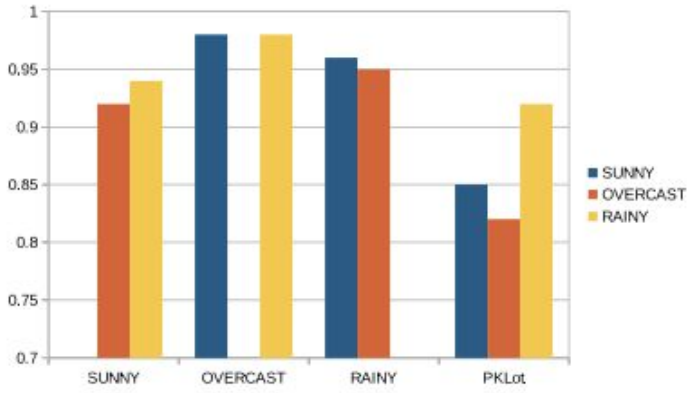
Need	
Important Figures	

Table 3
Experiments performed to test the generalization performance of *mAlexNet* and *AlexNet*. Accuracies on test sets are reported, for each combination of (model, training set, test set).

Method	Test set	Accuracy	AUC
TRAIN ON CNRPARK			
mAlexNet	CNRPark-EXT TEST	93.52%	0.9838
AlexNet	CNRPark-EXT TEST	93.63%	0.9877
mAlexNet	PKLot TEST	95.28%	0.9916
AlexNet	PKLot TEST	95.60%	0.9910
TRAIN ON CNRPARK+EXT TRAIN C1-C8			
mAlexNet	CNRPark-EXT TEST	95.88%	0.9937
AlexNet	CNRPark-EXT TEST	96.85%	0.9957
mAlexNet	PKLot TEST	90.48%	0.9738
AlexNet	PKLot TEST	96.51%	0.9937
TRAIN ON CNRPARK+EXT TRAIN			
mAlexNet	CNRPark-EXT TEST	97.71%	0.9967
AlexNet	CNRPark-EXT TEST	98.00%	0.9974
mAlexNet	PKLot TEST	84.53%	0.9699
AlexNet	PKLot TEST	93.70%	0.9923
TRAIN ON PKLOT TRAIN			
mAlexNet	PKLot TEST	98.07%	0.9967
AlexNet	PKLot TEST	98.81%	0.9984
mAlexNet	CNRPark-EXT TEST	83.83%	0.9139
AlexNet	CNRPark-EXT TEST	90.52%	0.9684
TRAIN ON PKLOT2DAYS			
mAlexNet	CNRPark	82.88%	0.899
LBP*	CNRPark	65.31 %	0.580
TRAIN ON CNRPARK			
mAlexNet	PKLot	90.38%	0.989
LBP*	PKLot	52.88 %	0.391

* de Almeida et al. (2015).

AlexNet reaches slightly higher accuracy than CNPark - Ext of 1%. AlexNet is a 3X larger dataset so it makes sense. mAlexNet is 15% to 35% more accurate.

	 (A) Inside of a camera box (B) The complete camera box **Fig. 6.** Each Raspberry Pi is mounted inside an outdoor camera box (Figure *A* on the left) and it is mounted on top of the roof of the building, attached to a steel pole (Figure *B* on the right).
Cited references to follow up on	Amato, Carrara, Falchi, Gennaro, Vairo, 2016 G. Amato, F. Carrara, F. Falchi, C. Gennaro, C. Vairo Car parking occupancy detection using smart camera networks and deep learning 21th IEEE symposium on computers and communications (iscc), IEEE (2016), pp. 1212-1217
Follow up Questions	Are there real world examples where cameras are being used for parking lot detection?

Article #10 Notes: Natural Language Processing: The Basics

Source Title	Natural Language Processing: The Basics
Source citation (APA Format)	Deng, L., & Liu, Y. (2018). A Joint Introduction to Natural Language Processing and to DeepLearning (1st ed.). Springer Nature Singapore. https://link-springer-com.ezpxy-web-p-u01.wpi.edu/book/10.1007%2F978-981-10-5209-5
Original URL	https://link.springer.com/book/10.1007%2F978-981-10-5209-5
Source type	Book
Keywords	Natural Language Processing
Summary of key points (include methodology)	Deep learning has allowed NLP to surpass computational problems of the past. It allowed NLP to mimic human cognitive abilities of language through powerful modelling. The field of NLP is always evolving.
Research Question/Problem/ Need	How has NLP evolved since it was created? What will it look like in the future?
Important Figures	n/a

Notes	- NLP investigates the use of computers to process humans language to perform useful tasks
	  - Combines computational linguistics, computing science, cognitive science, and artificial intelligence
	- How to develop practical applications for humans and computers to interact
	
	- Language is symbolic to the computer, which contrasts how we process language in a continuous format
	- The development if NLP happened in three different waves
	
	1) Wave one: Rationalism
	  - Dates back to 1950
	  - They were rational and translated/ processed language using hardset rules
	  - They were rationalist because of the idea that key parts of language are hard wired into our brains

	- Knowledge based system were able to function for a narrow range of applications
	  - They were not able to learn, so they were not good at handling new situations
	2) The Second Wave: Empiricism
	- This wave used machine learning
	- They used data driven methods
	- Pragmatic solutions
	3) Deep Learning:
	- The second wave made NLP significantly better, but they were still far below human level
	- Learning algorithms were not strong enough to replicate human understanding
	- Deep learning changed all of this
	- Exploit powerful neural networks
	  - Deep learning networks are able to utilize the multiple hidden layers to solve general machine learning tasks
	- Simple building blocks
	1.5.2 Limitation of Current Deep Learning Tech
	- They lack the interpretability
	- They need more training data and power consumption and computing resources
	- They also do not factor in decision making

Cited references to follow up on	Deng, L. (2014). A tutorial survey of architectures, algorithms, and applications for deep learning. APSIPA Transactions on Signal and Information Processing, 3.
Follow up Questions	What are some of the ways researchers are addressing the current drawbacks of Deep Learning?

Article #11 Notes: Deep Learning in Question Answering

Article notes should be on separate sheets

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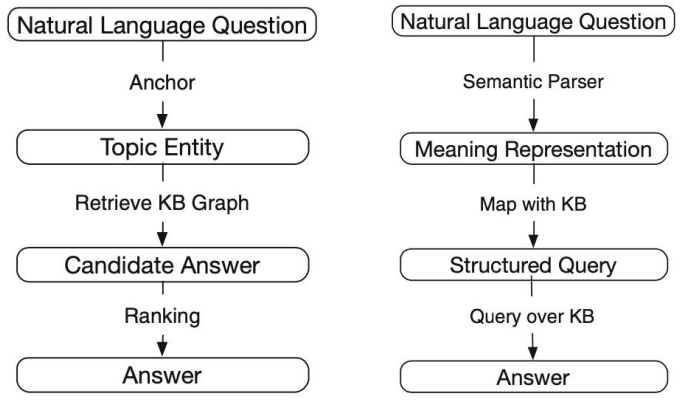
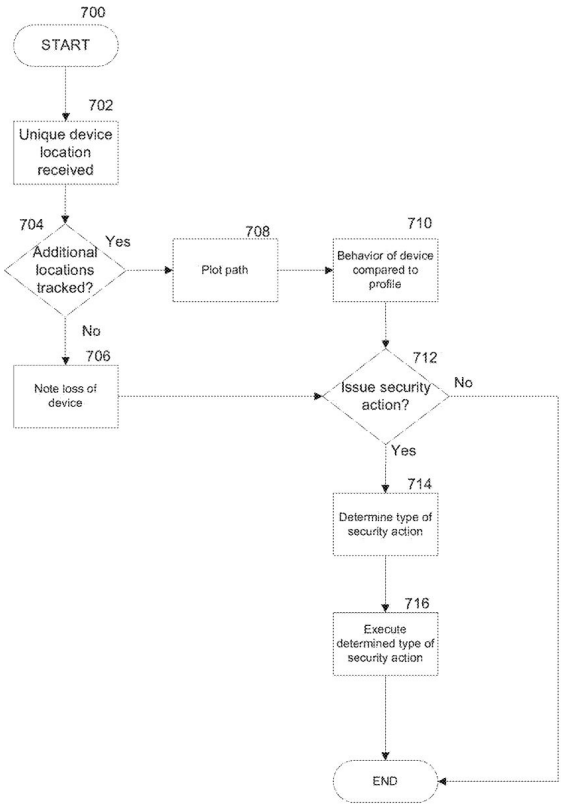
Source Title	Deep Learning in Question Answering
Source citation (APA Format)	Kang, L., & Feng, Y. (2018). A Joint Introduction to Natural Language Processing and to DeepLearning (1st ed.). Springer Nature Singapore. https://link-springer-com.ezpxy-web-p-u01.wpi.edu/book/10.1007%2F978-981-10-5209-5
Original URL	https://link.springer.com/book/10.1007%2F978-981-10-5209-5
Source type	Book Chapter
Keywords	Natural Language Processing, Deep Learning
Summary of key points (include methodology)	With the advent of Deep Learning, question answering using NLP has gotten more efficient. Knowledge based question answering utilizes deep learning to understand questions and then answer them based on the knowledge base. They may also use deep learning in machine comprehension which creates patterns to answer questions using deep learning.
Research Question/Problem/ Need	How has Deep Learning affected NLP with question answering?
Important Figures	 (a) The information extraction style (b) The semantic parsing style
Notes	- CNN

	- Convolutional Neural Networks
	- RNN
	- Most methods can be classified into two groups: the info extraction style (IE) or the semantic parsing style (SP)
	  - IE uses extraction techniques to retrieve answers from the Knowledge Base
	  - SP techniques use have structured queries from the sentence
	
	Data Set:
	- WebQuestions
	- Free917
	- Simple Questions etc
	- Training data is a long standing problem for NLP
	- Solutions include using question answer pairs as indirect supervision
	- techniques, such as lexical analysis,
	- syntactic analysis, information extraction, entity linking, reasoning, and so on
	-

Cited references to follow up on	Deng, L. (2014). A tutorial survey of architectures, algorithms, and applications for deep learning. APSIPA Transactions on Signal and Information Processing, 3.
Follow up Questions	How can deep learning and nlp be used to create chat bots?

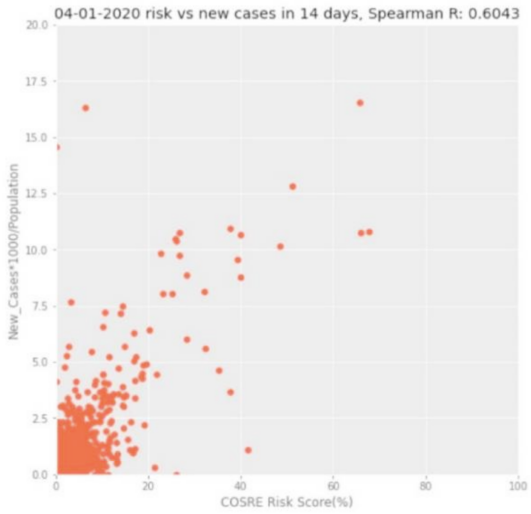
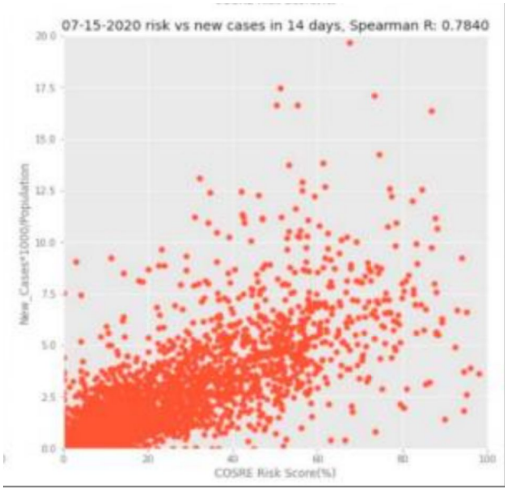
Article #12 Notes: MOBILE DEVICE DETECTION AND TRACKING

Source Title	MOBILE DEVICE DETECTION AND TRACKING
Source citation (APA Format)	Mills, Amanda . (2018). U.S. Patent No.US000009936357B220180403. Washington, DC: U.S. Patent and Trademark Office.
Original URL	https://patentimages.storage.googleapis.com/e0/70/80/1d72e1b42b86c2/US9936357.pdf
Source type	Patents
Keywords	N/a
Summary of key points (include methodology)	This device is made for owners of rental buildings, so they can detect exactly how many people are on their rental property. It detects the MAC addresses each mobile device, and is even able to detect where these devices are.
Research Question/Problem/ Need	Device to detect mobile devices. How to detect the number of guests at a property without inconvenience towards guests.

Important Figures	
Notes	- Cell signals are detected (2g-5g) - 3 network receivers - Minimum of three receivers - They will have their own processing to create the data values - “Wifi sniffer software” will be able to receive these MAC addresses the device emit - Some companies send out randomized mac addresses along with real one, so just need to see which random mac address is repeated
Cited references to follow up on	2012 / 0190325 A17 / 2012 Suhayya et al .
Follow up Questions	What devices use this technology already? And is there a privacy issue?

Article #13 Notes: Community venue exposure risk estimator for the COVID-19 pandemic

Source Title	Community venue exposure risk estimator for the COVID-19 pandemic
Source citation (APA Format)	Sun, Z., Di, L., Sprigg, W., Tong, D., & Casal, M. (2020). Community venue exposure risk estimator for the COVID-19 pandemic. Health & Place, 66, 102450. https://doi.org/10.1016/j.healthplace.2020.102450
Original URL	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7522786/
Source type	Journal Article
Keywords	Exposure risk COVID-19 pandemic Probability Birthday paradox Risk mapping
Summary of key points (include methodology)	The researchers created a tool which takes in a zip code and number of people at a venue to predict the risk of coming in contact with a carrier of COVID-19. They approach the problem by basing the model off of the well known probability problem: if there are *n* people in a room what is the probability *r* that two people have the same birthday. Their final model is tested through analysing the spearman ratio between the prediction and cases 2 weeks later.
Research Question/Problem/ Need	The aim of this paper was to create a tool that allows people to get the risk of contacting someone with COVID-19 at an establishment.

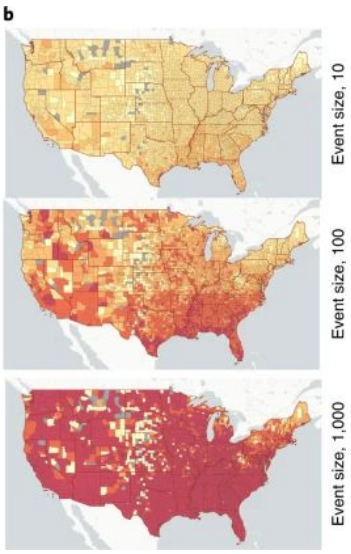
Important Figures	 
Notes	New Vocab: ● Stochastic: randomly determined; having random probability distribution or pattern --- ● Probabilistic models ● Takes in three inputs: ○ Active cases and asymptomatic cases ○ Population of local communities ○ Customer counts in a room ● Based on the social birthday paradox problem ○ If n people are in a room what is the probability that r people have the same birthday ● Takes in a zip code ○ Interesting ○ Pretty general still ● CDC has their own flu transmission risk calculator: (IRAT)

	○ Three overarching categories: ■ Properties of the virus ■ Attributes of the population ■ Ecology and epidemiology of the virus ○ Transmissive properties of COVID-19 are not known yet, so this model is not fit $$Pr_{(p,n,a)} = \begin{cases} 1 - \frac{(p - a_i + a_{i-d})^n_!}{p^n_!}, \ if\ p \neq 0\ and\ n \neq 0\ and\ a_i \neq 0 \\ 0, \ if\ p = 0\ or\ n = 0\ or\ a_i = 0 \end{cases}$$ ● ● P_r: probability that someone has an has an active disease ● P is the total community population(town, city, state etc) ● A_i is the total number of potential COVID-19 cases in the area ○ On Day i and day i-d, d is the number of days is takes to recover or die, assuming that once someone contracts the virus they cannot spread it ● Testing the model: (come back) ○ Correlation methods ○ Analyze the model with new case data ● Transmission risk: ○ Specific formula provides, not what this model predicts
Cited references to follow up on	● Should look into Moran's I ○ Spatial correlation ○ And spearman Correlation ●
Follow up Questions	Can other factor be used in this model?

Article #14 Notes: Real-time, interactive website for US-county-level COVID-19 event risk assessment

Article notes should be on separate sheets

Source Title	Real-time, interactive website for US-county-level COVID-19 event risk assessment
Source citation (APA Format)	Chande, A., Lee, S., Harris, M. et al. Real-time, interactive website for US-county-level COVID-19 event risk assessment. Nat Hum Behav (2020). https://doi.org/10.1038/s41562-020-01000-9
Original URL	https://www.nature.com/articles/s41562-020-01000-9/
Source type	Journal article
Keywords	none
Summary of key points (include methodology)	Researchers created a tool which allows users to visually see the risk of attending gatherings of various amounts in different US counties. The goal of this tool is to inform people of the risk they may be taking in attending these gatherings, and allow people to make the right decisions in preventing COVID-19 transmission. The model uses a binary probabilistic model, which can compute the probability of one or more people having the virus in a group of N people. It also accounted for the probability that
Research Question/Problem/ Need	Most tools that relate information for COVID-19 are that beneficial to users. It does not give them the right information to make decisions based on the state of the virus. For this reason, a tool is needed that gives users information which can aid them in making vital decisions to prevent the spread of COVID-19.

Important Figures	 This figure shows how the model predicts that there is low risk with gatherings of 10 people, while there is high risk with gatherings for 1000 people
Notes	• Estimated the probability of one or more than one individuals having the virus through a binomial probabilistic model • P is the probability that a randomly selected individual in a population is infected • The probability that n indiv are not infected is $(1-p)^n$, from this they found that the probability that one or more indivs are affected is $1-(1-p)^n$ 1-(p) Circulating Case Estimate: • Accounts for unreported cases
Cited references to follow up on	None
Follow up Questions	• How can other factors, such as people wearing masks affect the model? ○ Some areas people are more likely to wear masks than others, so the risk could be higher there

Article #15 Notes: Model Calculations of Aerosol Transmission and Infection Risk of COVID-19 in Indoor Environments

Article notes should be on separate sheets

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Source Title	Model Calculations of Aerosol Transmission and Infection Risk of COVID-19 in Indoor Environments
Source citation (APA Format)	Lelieveld, J., Helleis, F., Borrmann, S., Cheng, Y., Drewnick, F., Haug, G., Klimach, T., Sciare, J., Su, H., & Pöschl, U. (2020). Model calculations of aerosol transmission and infection risk of covid-19 in indoor environments. MedRxiv, 2020.09.22.20199489. https://doi.org/10.1101/2020.09.22.20199489
Original URL	https://www.medrxiv.org/content/10.1101/2020.09.22.20199489v3.full-text
Source type	Journal Article
Keywords	None
Summary of key points (include methodology)	The researchers created a model to predict the probability that one person will be infected in an establishment with a specific volume, air exchange rate, etc. They also made the model adaptable to any disease, as the factors for the virus can be changed as well.
Research Question/Problem/ Need	COVID-19 is known to spread from asymptomatic patients and patients in the first few stages of the disease. The researchers aim to model the infectious aspects of COVID-19, based on the venue's characteristics and the virus'.

Important Figures

Parameters	Standard	Range	Units
Infectious episode (exposure)	2	0.08 – 5	days
Wet aerosol diameter	5	2 – 10	µm
Virus lifetime in aerosol	1.7	0.6 – 2.6	hours
Emission during breathing	0.1	0.06 – 1.0	cm^{-3}
Emission during speaking (singing)	1.1	0.06 – 3.0	cm^{-3}
Speaking/breathing ratio	0.10	0 – 1	-
Respiratory rate	10	5 – 20	L/min
Viral load "highly infectious"	5×10^8	$10^8 – 10^9$	RNA copies/cm^3
Viral load "super infectious"	5×10^9	$10^9 – 10^{10}$	RNA copies/cm^3
Deposition probability in lungs	0.5	0.2 – 0.8	-
Infective dose (D50)	316	100 – 1000	RNA copies
Room area	60	40 – 100	m^2
Room height	3	3 – 4	m
Subjects in room	25	4 – 100	persons
Passive ventilation rate	0.35	0 – 1	$hour^{-1}$
Active ventilation rate (with outside air)	2	2 – 9	$hour^{-1}$
Face mask filter efficiency from inhalation plus exhalation	0.7	0 – 0.95	-

Notes

Parameters of the model and their reasoning:

1) Particle Size:
    a) Ignore sneezing and coughing because they are low probability events than speaking
    b) Prejudice particle between 1um dan 2um mostly
    c) Also, it is unlikely that symptomatic people will show up
    d) This model is only for people who are asymptomatic
    e) Assume that speech leads to droplets with size 5 um and quickly shrink to 1 um
2) Particle emission and vocalization
    a) Concentrations of particles produced from humans speech are 0.1 - 3 cm ^-3 depending on loudness
    b) O.1 - 1,1 cm^-3 for breathing and normal vocalizing
    c) Adopt these characteristic for the model ~ 5 um size and concentration of 0.6 cm^ -3 for speaking, 0.06cm^-3 for breathing and 6cm^-3 for singing
3) Viral load:
    a) Focus on pre symptomatic and asymptomatic as it is likely that symptomatic patients will stay home
    b) Median incubation period 5 days
    c) Transmission can happen 1-3 days before symptoms
    d) About 20% (95% confidence interval is 17-25%)
4) Virus lifetime in aerosolization:
    a) About 3 hours

	b) Research found about 1.1 -1.2 with 95% confidence interval of 0.64 - 2.64 hours c) Virus survival in the air increases with decreasing temperature and relative humidity d) Ignore temp and humidity and assume that it is the same every establishment e) 1.7 hours final result 5) Particle deposition probability a) If 6 ft is maintained most large droplets will settle and never reach the recipient b) Most viruses are contained in small particles, it may be assumed that they penetrate deeply and have potential to cause infection in lungs c) Final deposition probability of 0.5 6) Face mask efficiency: a) Surgical cloth masks have efficiencies of 53-75% and 28-30% b) For this model, they assume that mask filter efficiency is about 30% c) And reduces aeros sole transmission by 60%\ d) Yield a total risk reduction of 70% Final Models: a) $P_{RNA}(\%) = 1 - 10^{\frac{log10(0.5)}{D50}} \cdot 100 = 0.2$ b) $R_i(\%) = [1 - (1 - P_{RNA})^{D_{episode}}] \cdot 1$ c) $R(\%) = \left[1 - (1 - P_{RNA})^{(D_{episode} \cdot n)}\right] \cdot$
Cited references to follow up on	None
Follow up Questions	● What is D_episode and how does that affect viral transmission? ● Also what is D50 in general?

Article #16 Notes: "Immunity passports" in the context of COVID-19

Article notes should be on separate sheets

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Source Title	"Immunity passports" in the context of COVID-19
Source citation (APA Format)	“Immunity passports” in the context of COVID-19. (n.d.). Retrieved December 12, 2020, from https://www.who.int/news-room/commentaries/detail/immunity-passports-in-the-context-of-covid-19
Original URL	https://www.who.int/news-room/commentaries/detail/immunity-passports-in-the-context-of-covid-19
Source type	Website Article
Keywords	None
Summary of key points (include methodology)	The author evaluates many papers and research to come to the conclusion that there is not enough evidence that supports the claim that one is immune after being infected with COVID-19. The author provides articles that show COVID-19 immunity is unknown, so anyone claiming to be immune is lying.
Research Question/Problem/ Need	This paper aims to inform readers of the state of our understanding of COVID-19 immunity.
Important Figures	None
Notes	● Immunity to a pathogen takes about 1-2 weeks ● Most studies show that people who have recovered from infections have antibodies for the virus ● As of april 24, 2020 there is not evidence evaluated whether the presence of SARS cov 2 antibodies relates to immunity to subsequent infections ● People with the other 4 Coronaviruses may have some antibodies for the Sars-COV-2
Cited references to follow up on	[1] Antibodies to SARS-CoV-2 are associated with protection against reinfection . Lumley, S.F. et al. MedRxiv. 19 November 2020.
Follow up Questions	● What is the evidence from research after April 24?

Article #17 Notes: Antibodies to SARS-CoV-2 are associated with protection against reinfection

Article notes should be on separate sheets

KEEP THIS BLANK AND USE AS A TEMPLATE

Source Title	Antibodies to SARS-CoV-2 are associated with protection against reinfection
Source citation (APA Format)	Lumley, S. F., O'Donnell, D., Stoesser, N. E., Matthews, P. C., Howarth, A., Hatch, S. B., Marsden, B. D., Cox, S., James, T., Warren, F., Peck, L. J., Ritter, T. G., Toledo, Z. de, Warren, L., Axten, D., Cornall, R. J., Jones, E. Y., Stuart, D. I., Screaton, G., … Eyre, D. W. (2020). Antibodies to SARS-CoV-2 are associated with protection against reinfection. MedRxiv, 2020.11.18.20234369. https://doi.org/10.1101/2020.11.18.20234369
Original URL	https://www.medrxiv.org/content/10.1101/2020.11.18.20234369v1.full-text
Source type	Journal article
Keywords	Antibodies, COVID-19
Summary of key points (include methodology)	It is not kwon if previously infected individuals are safe from second infection. Anti-spike and anti- nucleocapsid antibodies are beginning to be defined. Evidence of immunity is emerging because there are only few reinfection, mostly mild or asymptomatic. No other paper has compared infection rates to seropositive and seronegative individuals. Analysed symptomatic and asymptomatic patients from Oxford University Healthcare (OHU) programs Health Care Workers(HCW). Asymptomatic HCWs were invited to participate in COVID testing by nasal and oropharyngeal swab PCR and serological testing. They classified HCWs according to their baseline antibody status. Those with only negative antibody tests, were considered at risk of infection from their first (negative) antibody test until the earlier of the study end (18-November-2020) or their first PCR-positive test. Those with a positive antibody test were considered at risk of reinfection from 60 days after their first positive antibody result, to any other negative antibody test. They used a Poisson regression to model incidence of PCR-positive infections per day risk. **Results: (most important to me)** Suggested that antibodies produced by prior SARS-CoV-2 infections are associated with protection from reinfection for most people at least six weeks. Only gives them immunity for the short term.

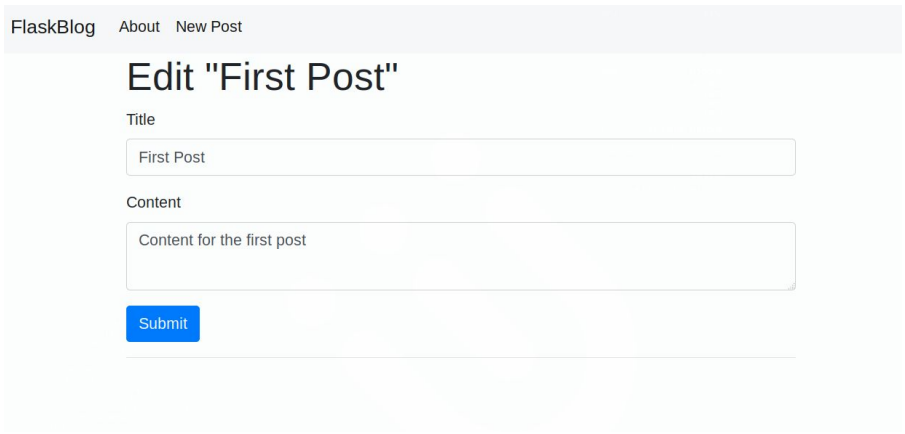
Research Question/Problem/ Need	It is uncertain if previously infected individuals are protected from second infection.
Important Figures	none
Notes	Seropositive: having a positive serum reaction Seronegative: a person does not have the same antibodies that a person who is “seropositive”
Cited references to follow up on	3.Robbiani, D. F. et al. Convergent antibody responses to SARS-CoV-2 in convalescent individuals. *Nature* vol. 584 437–442 (2020). Wajnberg, A. et al. Robust neutralizing antibodies to SARS-CoV-2 infection persist for months.
Follow up Questions	None

Article #18 Notes: How To Make a Web Application Using Flask in Python 3

Article notes should be on separate sheets

KEEP THIS BLANK AND USE AS A TEMPLATE

Source Title	How To Make a Web Application Using Flask in Python 3
Source citation (APA Format)	How to make a web application using flask in python 3. (n.d.). DigitalOcean. Retrieved December 13, 2020, from https://www.digitalocean.com/community/tutorials/how-to-make-a-web-application-using-flask-in-python-3
Original URL	https://www.digitalocean.com/community/tutorials/how-to-make-a-web-application-using-flask-in-python-3
Source type	Article/Tutorial
Keywords	Flask, webapps, python
Summary of key points (include methodology)	Flask is a small and lightweight Python web framework that provides useful tools and features that make creating web applications in Python Easier. Flask uses the jinja template engine to dynamically build HTML pages using familiar coding concepts like variables, loops, lists, etc. First step is to install flask using the pip and install commands. In this step you also have to create a project folder, virtual environment, and to install flask. Step two is to create the base application. In this step, you create a small Flask web application. In the third step, you use HTML templates from the jinja template engine using the rendre_template() function. There are templates for the main page and other pages. In addition, in this stemp you use bootstrap to style the page as well. In the fourth step, you need to use SQL to set up a database for the webapp. Fifth step, is to retrieve the information from the database. Sixth step would be to display specific information instead of displaying everything. Finally, the last step would be to edit information using inputs from the website.
Research Question/Problem/ Need	Teaches readers how to use flask by creating a mock blog page

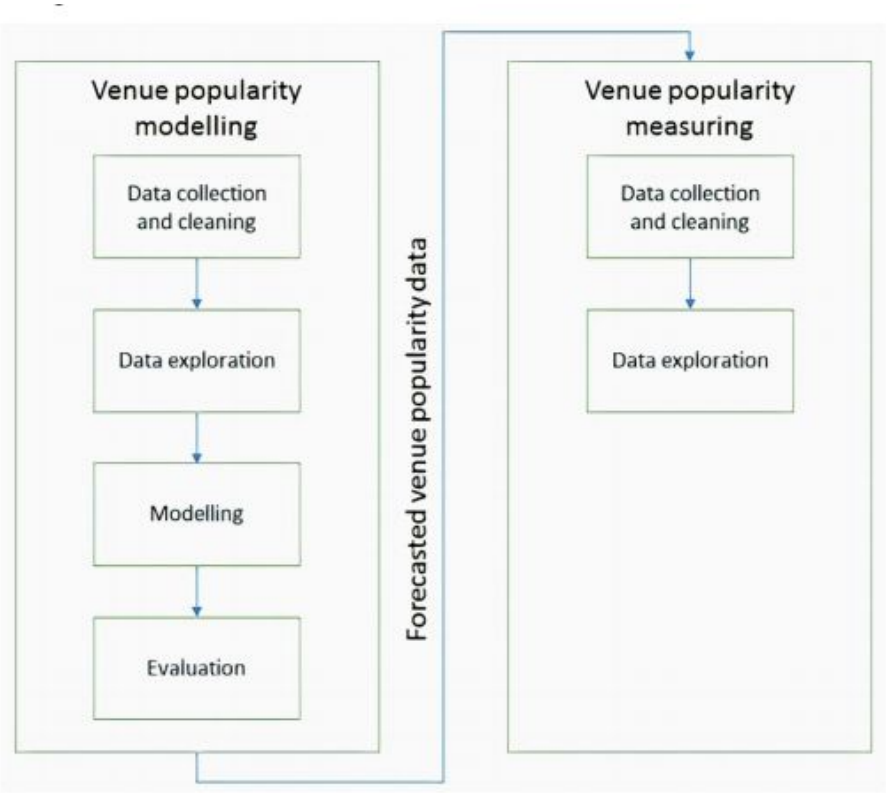
Important Figures	 Example to learn how to use flask 
Notes	• Many of the concepts taught in this tutorial will help me with my project.
Cited references to follow up on	None
Follow up Questions	How do you deploy flask to a server?

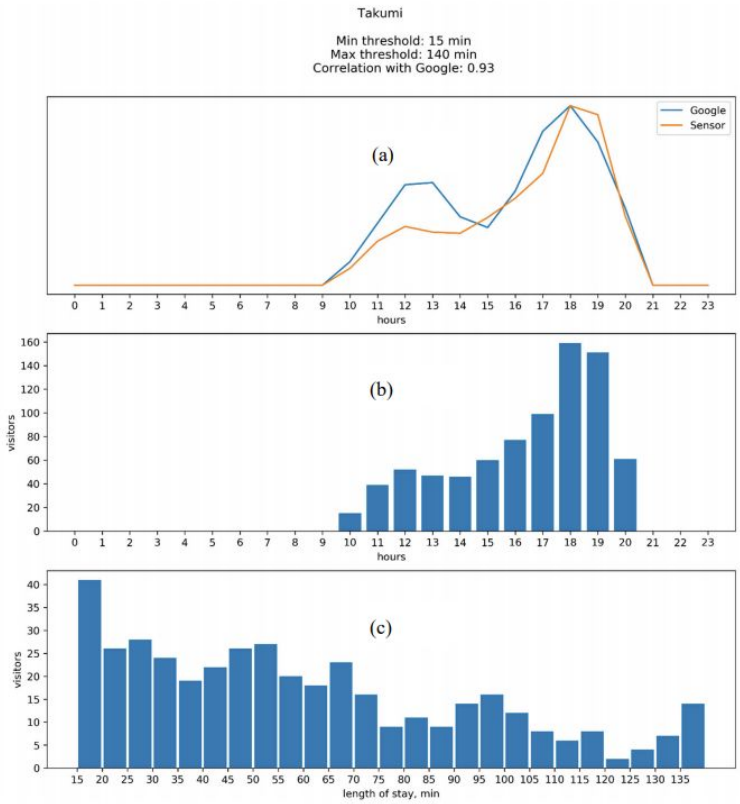
Article #19 Notes: Predicting Venue Popularity Using Crowd-Sourced and Passive Sensor Data

Article notes should be on separate sheets

KEEP THIS BLANK AND USE AS A TEMPLATE

Source Title	Predicting Venue Popularity Using Crowd-Sourced and Passive Sensor Data
Source citation (APA Format)	Timokhin, S., Sadrani, M., & Antoniou, C. (2020). Predicting venue popularity using crowd-sourced and passive sensor data. Smart Cities, 3(3), 818–841. https://doi.org/10.3390/smartcities3030042
Original URL	https://www.mdpi.com/2624-6511/3/3/42?type=check_update&version=1
Source type	Journal Article
Keywords	big data; mobility pattern; venue popularity; Google popular times; WiFi data collection
Summary of key points (include methodology)	The project consists of two main parts: venue popularity modeling and venue popularity measuring. The model leverages Big Data so as to supplement human surveys. This is very accurate since there is a tremendous amount of data online collected by google and yelp. The first part of the model uses data from open street maps, google “popular times” data and a gradient boosted regression and linear regression. The second part, they compare how accurate the “popular times” data provided by good is. Study was conducted in Munich, Germany. Data was obtained from Google Map, Yelp, OpenStreetMap, and Google API. They tested two models, one was linear regression other was gradient boosted regression. GBR provided a better fit for training set than linear regression. GBR models are able to account for outliers. However, they saw poor predictions during late evening and early morning hours. Also, they found that GBR models with Box-Cox transformation were better than those with logarithmic transformation, but for hours towards the end of the day logarithmic provided better results. They tested their model by setting up a "WiFi device presence detection." The WiFi device and Google Popular times have very similar results.
Research Question/Problem/ Need	The aim of this study is to investigate the possibility of using several different auxiliary information sources for venue popularity modeling and provide an alternative venue popularity measuring approach.

	Research Question: How accurate is Google Popular times estimation?
Important Figures	

	 **Figure 13.** Venue attendance ("Takumi"): (**a**) Google vs. WiFi; (**b**) visitors by time of day; (**c**) visitors' length of stay distributions.
Notes	• I think that I can make machine learning model similar to the researcher to estimate population density at venues • Also, since the information is real time it will factor in how social distancing is affecting the rate at which people visit the venue • However, I do not think that I can use data from Google Popularity since it would be against their terms of service. I will need to find my own data set and have to predict it that way.
Cited references to follow up on	
Follow up Questions	• How does the GBR model work, how to implement it in python? Are there different models to look at?

Article #20 Notes: StreamLit Components

Article notes should be on separate sheets

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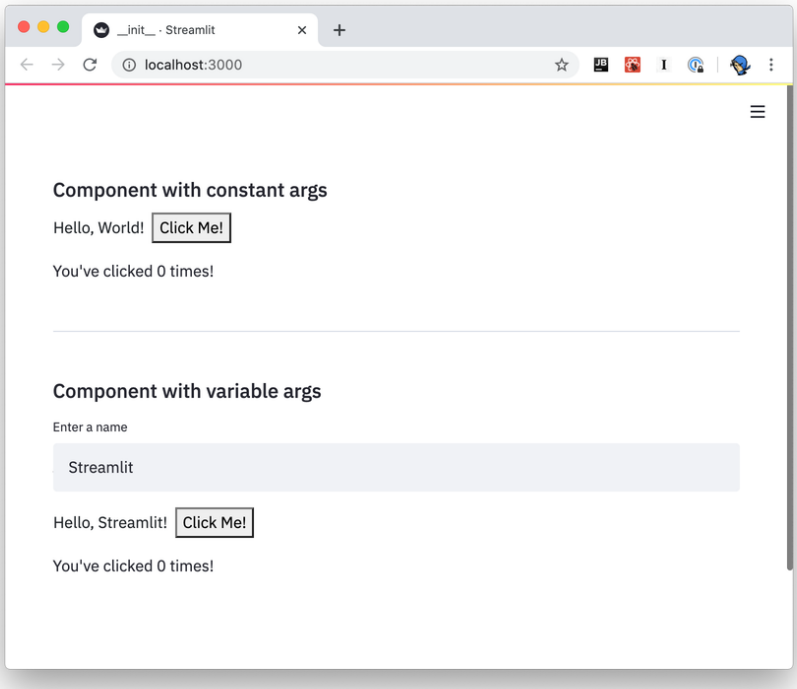
Source Title	Introducing Streamlit Components
Source citation (APA Format)	Treuille, A. (2020, July 14). Introducing streamlit components. Medium. https://medium.com/streamlit/introducing-streamlit-components-d73f2092ae30
Original URL	https://medium.com/streamlit/introducing-streamlit-components-d73f2092ae30
Source type	Article
Keywords	None
Summary of key points (include methodology)	StreamLit is a tool in Python which allows users to easily create webapps that are related to data science. It also allows users to instantly publish the web app while using minimal HTML and CSS. Pre-made functions allow users to create interactive figures and graphs almost instantly. It is easy to use and allows for a fast creation of apps. StreamLit recently expanded its "StreamLit" components. Also StreamLit allows users to import it as an iframe, so the webapp can be transferred to other websites. This tutorial will teach me how to get started with creating these widgets and tools.
Research Question/Problem/ Need	How to create data-science related webapps using StreamLit?

Important Figures	
Notes	• This will be easier to implement for my data dispersal aspect of my project since it has very simple and easy commands. • I will make a decision matrix to determine what tool I will use to make the webapp.
Cited references to follow up on	This link was not cited, but they used it as an example to find more components: https://www.streamlit.io/components
Follow up Questions	• How will I host this website? ○ The answer as off now is either AWS or running it on an older computer.

Article #X Notes: Title (Template)

Article notes should be on separate sheets

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Source Title	
Source citation (APA Format)	
Original URL	
Source type	
Keywords	
Summary of key points (include methodology)	
Research Question/Problem/ Need	
Important Figures	
Notes	
Cited references to follow up on	
Follow up Questions	