One example of a supervised machine learning model based on classification is *sentiment analysis* applied to potential client interactions (or, in my field of philanthropic fundraising, *major gift prospect* interactions). For example, suppose a large volume of potential clients has just received a mass communication about a new product offering. Each recipient’s reply to the communication has been captured and stored in a database. *How can we determine quickly determine which clients are interested vs. which are not, without having to manually read each and every response?* Using Python’s Natural Language Toolkit library (NLTK) which comes with built-in language classifiers, we can supply all of our captured client response data as well as examples of our desired output –responses that are clearly *positive*, and responses that are clearly *negative*. The resulting program that is produced is a binary classification model that can quickly divide all responding clients into one of two camps – *interested* and *non-interested*. My team at Cleveland Clinic Philanthropy has developed and uses a version of this program in our work, and this type of analysis has become prevalent enough throughout the customer relations field that Salesforce recently introduced *Salesforce Einstein Language*, its own natural language processing model which integrates with its popular CRM software (Robinson, 2018).

Another example of a supervised machine learning model – this time based on regression – is *dynamic pricing* used for sports events. Try to picture your experience purchasing tickets online to attend a Cleveland Guardians home game: You view the tickets for a Friday night game at the end of September, only to find that there is a drastic price difference between the game on Friday night versus the game on Tuesday. Two weeks go by, and now the team is on a winning streak – making Guardians games suddenly a hot ticket. Now the Friday night game you were planning on attending is even more expensive than when you checked it two weeks earlier. *What’s happening here?* Dynamic pricing utilizes a range of data inputs that are available to sports teams’ ticketing offices – historical customer purchasing trends, the team’s recent quality of play, the quality of their opponent, the day of the week and time of the year, etc. – to create a program that sets an optimized ticket sale cost based on constantly-fluctuating market conditions.

**References**

Robinson, S. (2018, October 18). *How does Salesforce Einstein language NLP improve productivity?* SearchCustomerExperience. Retrieved September 5, 2022, from <https://www.techtarget.com/searchcustomerexperience/answer/How-does-Salesforce-Einstein-Language-NLP-improve-productivity>

Curtis, your mention of snow and snowplows caught my eye. Being an Ohio resident as well (and a Cleveland-area one at that), it brought to mind an interesting announcement from this past winter, which was that the City of Cleveland had introduced a new *snowplow tracking system* for snowstorms, allowing residents to view in real-time which streets have been plowed and where plows are headed next(Anderson). Here is the link to the map if you are interested: <https://experience.arcgis.com/experience/46a9d479045c4882a32c8b2d6b32f467>; obviously, I hope we don’t have any “snow events” anytime soon.

While the tracking itself is just an ArcGIS map overlaid with real-time GPS data coming from city plows, it and your discussion post got me wondering: *What would a machine learning model to optimize snowplow routes during a snowstorm look like?* For example, what would the data inputs be? It would certainly include data on things like traffic patterns and volume, population density, and snow distribution (which areas are likely to be harder-hit by snow, versus which areas will be hit less hard). What about the desired output? That would have to be some ideal combination of variables that would include *speed of getting all roads cleared*, *amount of normal traffic disrupted, amount of productivity lost, number of residents still without plowed road access after x number of hours*, etc. What would the ideal program look like? Would it result in main roads and arterials being plowed first to prioritize business commuters, or would it prioritize something like school bus routes instead? While this is clearly a civic problem as opposed to a business one, it nevertheless is an interesting one - I do wonder if something like this has been developed or is in use by other cities currently, and I also wonder what the real-world implications of the program might be.

**References**

Anderson, C. (n.d.). *Interactive map allows residents to track Snowplow Progress in Cleveland neighborhoods*. https://www.cleveland19.com. Retrieved September 5, 2022, from https://www.cleveland19.com/2022/02/02/city-program-allows-residents-track-snowplow-progress-cleveland-neighborhoods/