

COVID-19 Contact Tracing

Background

COVID-19 presents unique challenges to the world today. We don't know enough about the disease; no vaccine is available currently and there are no known treatments. COVID-19 is highly contagious and is spreading rapidly around the world overwhelming medical treatment facilities. The first wave of COVID-19 is currently upon us and our health care system will do whatever they can to protect and treat as many of us as they can.

We have an opportunity now to prepare for a potential 2nd wave of COVID-19 or other future pandemics. Contact tracing is a critical tool when done during the early spread of a communicable disease. ExactData makes high quality simulated data that is engineered to contain the features, complexity and interconnected data points to enable testing of the most advanced applications in development today. Testing contact tracing software makes sense. We can help.

Technology

ExactData currently uses a **Social Network** super field to support insider threat and cyber data models. We could create **Travel Network** and **Contact Network** super fields to support data sets.

- **Social Network:** defines known and intentional interaction with others through:
 - Work: coworker/supervisor/manager
 - Interest groups: church/bowling league/star gazers club/...
 - Family: immediate and extended family
 - Neighbors:
- **Travel Network:** a single or series of travel activities that may have individual or group components. Travel can be local or international in any mode plane/train/bus/ship/auto. Consider the following:
 - Purpose:
 - Business: Symposium, Training, sales route, long haul truck driver
 - Personal/Entertainment: Concert, guided tour, cruise, vacation
 - Family: wedding, funeral, reunion, birthday party, anniversary, Mother's Day
 - Mixed: business/personal/family
 - Mode:
 - Plane: assigned seating
 - Train: open seating unless a sleeper cabin purchased
 - Bus: open seating with random individuals unless on a group tour
 - Ship: an overnight+ cruise will have assigned cabins, while a dinner cruise will be open seating
 - Auto: generally open seating with infants in car seats in the back seat
 - Bike:
 - Walk:
 - Lodging: Overnight accommodations
 - Hotel/Motel: assigned room
 - Extended Family: Couch or spare room
 - Camping: tent or open sky as in hiking the Appalachian Trail

- **Contact Network:** proximity to other individuals sometimes repeated while at other times sustained for a few minutes or longer. While there is overlap with a **Social Network**, a **Contact Network** focusses on physical proximity potentially including physical contact between individuals. A large portion of the proximity/contact will be with individuals known to the subject, but there is a significant portion of the proximity/contact where the individual is unknown to the subject. Contact tracing is much easier when the parties know each other but must include situations where unknown individuals need to be identified whenever possible. Consider the following examples:
 - Dining out: casual contact
 - Hostess greeted you, walked you to your table, handed you a menu
 - Waitress greets you, takes your order, brings your beverage and food, brings doggy bag and bill.
 - Buffets are even more casual where guests serve themselves using the same utensils while standing next to open food.
 - Church: most people know each other in a small church, but not so in a large church. A member would likely know the individuals in a bible study group but unlikely to know all the members especially the children by name in all Sunday school classes. Less active members are unlikely to know and interact with the ushers even though they share regular proximity.
 - Lodging: Hotel/Motel, Family, overnight cruise, etc. Sure we know that we interacted with the front desk, but cleaning staff, laundry (bedding and towels) and other guests are examples of unknown individuals in proximity.
 - Grocery shopping: Most people will frequent a select few local grocery stores on a regular schedule. They may get to know a few of the cashiers but are unlikely to know the stock hands and cleaning crew. They are likely to occasionally run into a neighbor but rarely know the other shoppers. There are also spontaneous visits for a few items.
 - Physical fitness: shared use of equipment, may have become acquainted with some individuals, but most guests are random individuals who happen to use the gym at the same dates/times.
 - Coffee Shop: casual contact with other patrons in line and at the condiment counter.
 - Pubs and sports bars: may develop familiarity with some patrons while most patrons will seem random
 - Sports entertainment:
 - Fan: likely to know a few individuals in the stands but most will be random fans
 - Competitor: will know teammates if playing a team sport, but many participants will be random for a pick-up game
 - Concerts: most attendees will be unknown to the individual

Data Sets

- **Common Features:** ExactData creates a data model that is engineered to test software applications or processes complete with answer files that enable the scoring and lessons learned from the exercise. Basically, create a haystack of activity (travel and contacts with proximity to some other individuals/attendees) and then a few days after the event show some COVID-19 infections of a conference presenter, or tour guide, or hotel cleaning staff, wedding bridesmaid,

etc. leads to the realization that contact tracing is required to test and isolate individuals to slow the spread of the virus.

- **Resumable Data Models:** next day/week/month in the life of all the existing people with the option of adding more persons to the data set.
- **Answer Files:** list of tier 1 contacts to the initially infected.
- **What's Inside document:** list of data set features, contents, and statistics.
- **International Traveler Contact Tracing:** Travel Network + Contact Network
 - Itinerary based travel: purposeful travel with major stops or activities preplanned. When a tour guide or symposium speaker go to the Hospital Emergency Department with difficulty breathing and clearly advanced COVID-19 symptoms, the hospital starts Contract Tracing. When they learn the occupation of the infected individual, they soon discover that this person has had a lot of contacts.
 - Flight Seat Data: A secondary opportunity is to record airline seating assignments so that individuals in adjoining seats could be contacted should the person in seat 23B of Delta flight ##### from Paris to JFK turn up infected with COVID-19 the day after the flight. This type of data set would also make it possible to track who the passengers where in seat 23B on subsequent flights of airplane #####.
- **International Traveler Previous Travel:** Travel Network
 - Itinerary based travel also enables the double checking of current traveler's previous travel such as a previous trip to Milan Italy, but now returning to US via London England while attempting to hide or deny previous travel to Italy.
- **US Traveler:** Travel Network + Contact Network
 - Itinerary based travel: like International but local within the US
- **Local Contact Tracing:** Social Network + Contact Network
 - Data set engineered for local community spread contact tracing.

Implementation

Newt for demo or POC, super field for detailed implementation

- A Newt solution (demo) would contain:
 - Seed files for business or personal travel topics that contain dates, locations, durations, presenter/instructors/vendors/tour guides, local lodging, etc.
 - Conferences/Symposiums/Expos
 - Training
 - Tours
 - Cruises
 - Family events such as weddings/funerals/reunions
 - Configurable data model to create individuals and groups traveling to attend events and tracking some level of contacts
 - Initial COVID-19 Infections are predetermined individuals from the seed files such as tour guide, hotel staff, presenter, preacher at the wedding, etc.
 - Answer files will show contacts even though most do not become infected. Some contacts are obvious such as instructor at training, but many are more casual such as another attendee at a conference or someone that road the same bus on a tour.
 - What's Inside document: Data set type, key features, key knob settings, Statistics, software version

- An Engineering super field solution would be much more powerful and would be designed and supported by the Engineering Team

Data Set Data Files and Fields

- People: a file that lists all individuals in the data set.
- Itinerary: COVID-19 data sets share common architecture where file names Itinerary, Stops, Activities have the same structure (interrelationships) but precision changes. Stops for an international traveler generally would indicate legs of a journey where a stop includes a hotel and activities include visits to conferences/sites/etc. Whereas in local contact tracing since the person is likely residing at home, stops are legs of local (same day) travel from place to place via auto/metro/taxi and activities are work / grocery shopping / restaurant / pharmacy / etc. We can get detailed including tracking infections that originate at the checkout lane of a grocery store. Sequential patrons are in proximity and grocery store purchases record patron by credit card purchases or loyalty club membership #s.
 - Stops:
 - Many to One relationship Stops -> Itinerary
 - One to Many relationship Stops -> Activities
 - Activities:
 - Many to One relationship Activities -> Stops
- Initial COVID-19 infections: list of early victims that were predetermined to be initial COVID-19 carriers with jobs such as tour guide, hotel staff, symposium presenter, preacher at the wedding, etc. Follow the proximity or contact of these individuals in the general population to see the likely next victims.
- Answer File(s): lists level 2 individuals that came into close proximity of initial COVID-19 victims in the data set
- Passport: Passport information for International Travelers
- Group Members: List of Individuals (people.id) traveling together
- Family Members: List of Family Members (people.id) traveling together
- What's Inside document:

Entity Relationship Diagrams: shows data correlations across database tables

- **Travel Contact Tracing:** Travel Network + Contact Network
- **Local Contact Tracing:** Social Network + Contact Network



Travel Contact Tracing ERD

Local Contact Tracing ERD

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