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STRENGTHENING RESILIENCE AND RESPONSE TO CRISES

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AIRBEL CENTER
DESIGNING & TESTING SOLUTIONS IN CRISES

UKaid
from the British people

SUMMARY OF INNOVATIVE FORECASTING TOOLS FOR REFUGEE CRISES

TOSCANE CLAREY

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EXPERT ADVISORY CALL DOWN SERVICE – LOT B

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This document provides a summary of innovative conflict and displacement forecasting initiatives that could potentially be used to underpin related financing.

UC Berkeley, School of Information is using mobile phones to track internal migration. The team is granted data access from phone companies and then tracks mobile phone data, "turning that information, such as the number of calls made per day, SMS volume, and international contacts, into interpretable metrics".[1] This was most notably done in Rwanda. In team leader Joshua Blumenstock's 2012 paper, *Inferring Patterns of Internal Migration from Mobile Phone Call Records*, he describes how the sequence of cell towers that an individual uses allows for the reconstruction of that individual's approximate path.[2] The advantages of this approach are the ability to track a population that would otherwise not be able to regularly respond to questionnaires or other traditional survey methods. Blumenstock can account for circular migration and can track when people move, where they go and how often they go back to a place of origin or a specific destination. One of the obvious disadvantages is that subjects need a mobile phone and need to regularly use their device. This could potentially show a demographic bias, though in 2012 77% of the world's population did own a mobile phone. There are also privacy and confidentiality issues to using people's locations, even if the data is stripped of sensitive information such as names. There could also be potential issues accessing the data from the phone companies themselves.

Blumenstock is also looking into social networks and how those affect migration decisions. In the description to his current work in progress *Migration and the Value of Social Networks*, he writes, "using the universe of mobile phone records of an entire country over a period of four years, we first characterize the migration decisions of millions of individuals with extremely granular quantitative detail. We then use the data to reconstruct the complete social network of each person in the months before and after migration, and show how migration decisions relate to the size and structure of the migrant's social network. We use these stylized results to develop and estimate a structural model of network utility, and find that the average migrant benefits more from networks that provide social support than networks that efficiently transmit information. Finally, we show that this average effect masks considerable heterogeneity in how different types of migrants derive value from their social networks."[3]

Samuel Bollier analyses texts to determine whether displacement is linked to disaster or conflict. His software can predict the number of people displaced, location of displacement and create both a chart and a map visualization. He received an honorable mention for this work during the 2017 Unite Ideas Internal Displacement Event Tagging and Extraction Clustering Tool (#IDETECT) data challenge that required the invention of an open-source tool able to estimate the number of IDPs around the world and their locations. The Internal Displacement Monitoring Centre will expand upon his work.

Brunel University's Diana Suleimenova, David Bell and Derek Groen published a paper in 2017 outlining their computer simulation allowing them to predict refugee movements and potential destinations. They used publicly available refugee, conflict and geospatial data as the baseline for their simulation development approach. They tested their computer simulation on the 2015 Burundian crisis, the 2013 CAR crisis and the Mali civil war in 2012 with 75% accuracy.[4] In the paper they compare their results with the UNHCR data. Shortcomings of the simulations thus far are that their model does not include certain factors that are important for predicting refugee flows due to the complications in converting empirical conclusions to

[1] https://www.devex.com/news/want-to-reach-the-world-s-poorest-design-for-dumb-phones-90993

[2] http://www.jblumenstock.com/files/papers/jblumenstock_itd2012.pdf, p.110.

[3] http://www.jblumenstock.com/research

[4] https://phys.org/news/2017-10-simulation-technology-refugee-destinations-aid.html

simulation parameters, they do not know the level of data-related uncertainty their model holds, and empirical data collection during conflict is challenging which limits the accuracy of the prediction model.[5]

Data4Democracy is using news events to visualize internal displacement. They won the 2017 Unite Ideas Internal Displacement Event Tagging and Extraction Clustering Tool (#IDETECT) data challenge that required the invention of an open-source tool able to estimate the number of IDPs around the world and their locations. "The D4D team's winning solution uses an artificial intelligence algorithm to predict the number and locations of internally displaced people through URL tagging and word frequency by drawing on a vast amount of online data."[6] They had enough information for the challenge, but the visualization and data need to be greatly expanded. The Internal Displacement Monitoring Centre has taken this on and will implement the solution.[7]

Earth-I's high-resolution satellite data can be effectively employed to assist with the global refugee crisis. From collecting data in difficult zones to improving camp management and health care distribution, satellite imagery can paint a more complete picture than data collected on the ground in certain scenarios. Satellite intelligence can provide detailed images of borders to determine crossing hotspots and predict new crises to help humanitarian actors better coordinate and deploy aid.[8]

The European Space Agency is developing service packages to harness big data to better mitigate, prepare and respond to refugee crises. It will provide evidence-based indications for how current Earth Observation based services can help in such an endeavor. Due to the complexity of migration crises the end users and services portfolios are very diverse. Thus far they have explored mobile phone data, social media data, traditional data (administrative, border statistics), satellite data and intelligence data (OSINT, HUMINT). They are planning to detect changes, track trends, analyze internal movement, and monitor situations and indices for sudden/slow onset events with the data.[9]

Flowminder is a Swedish non-profit that "collects, aggregates, integrates and analyses anonymous mobile phone operator data, satellite and household survey data". They work with large datasets, mapping vulnerable populations in low and middle-income countries. They then provide their analyses to relevant parties.[10] They work on a range of projects, namely research, capacity building, policy, socioeconomic analyses, precision epidemiology and disaster response. "Flowminder researchers pioneered the use of de-identified data from mobile operators to follow population displacement during the 2010 Haiti earthquake response."[11] This allows them to see population movement, size of population, where people went, how long they stayed in that location and when they returned home. They have worked in other contexts such as Nepal and Bangladesh since 2010 though their most current work seems to date to Haiti's Hurricane Matthew in 2016.

IBM's Refugee & Migration Predictive Analytics Software predicts the average number of migrants between any two of 189 countries over a coming year. According to Rana Novack's TED talk, the software predicts global refugee flows using metrics such as news, weather, historical ties between countries, social media and GDP. It also conducts "what if" scenario analysis, accounting for migrant movement in the case of border closures or

[5] https://www.nature.com/articles/s41598-017-13828-9
[6] https://www.un.org/press/en/2017/pi2207.doc.htm
[7] Ibid.
[8] http://earthi.space/blog/satellite-solution-refugee-crisis/
[9] https://business.esa.int/projects/big-data-for-migration-study
[10] http://www.flowminder.org/about
[11] http://www.flowminder.org/practice-areas/disaster-response

lack of transportation.[12] "The team gave its model the inputs — the historical data on these push [what pressures people to leave home countries], pull [what draws people to particular host countries] and distance [the distance between two countries] factors for 189 countries — and the output — the last 15 years of migration numbers as sourced from the UNHCR. By analyzing these inputs and outputs, the model figured out a mathematical relationship between them so that, given push, pull and distance factors, it could calculate migration numbers for the year ahead."[13] As of now the software would only work for mass migrations since the average error rate was about 1,000 people per year per country.[14] They have partnered with the Danish Refuge Council to further perfect and expand the project.

The IBM team also came up with a shorter-term forecast that predicts arrivals at a refugee camp on a day-by-day basis, within a three-week window. It uses recent refugee arrival data, news and current weather in a given area to do so.[15]

Institute for the Study of International Migration at Georgetown University is developing a pilot to track forced displacement using media and social media. The multidisciplinary team of scholars and practitioners is creating a large-scale early warning system that is highly data intensive. Their primary source is Georgetown University's Expandable Open Source (EOS) database that contains over 600 million publicly available open source media articles. They are also including social media data from Twitter so that they can discover significant patterns for triggers and trends.[16]

The Internal Displacement Monitoring Centre (IDMC) has been globally monitoring IDPs since 1998. They deploy a range of tools to do this: an annual global report; daily flash displacement updates; overviews by country; thematic, country and case study research papers; a displacement risk platform that predicts the number of IDPs per year; a data exploration tool that generates custom charts based on IDMC's data, UNHCR refugee data and the World Bank's open data catalogue; an Internal Displacement Event Tagging and Clustering Tool (IDETECT) that reads articles and UN/government reports for keywords indicating displacement events; and a satellite imagery analysis that detects and quantifies displacement. They are working on tools that will estimate future displacement risks for all natural hazards, monitor displacement in real time and fill current data and monitoring gaps using social media data and satellite imagery. IDMC's Global Internal Displacement Database is interactive and allows the user to sort and filter the data, visualize risk metrics and generate custom charts.[17]

Jetson is a predictive analytics engine built to analyze and predict mass migration in Sub-Saharan Africa. Babusi Nyoni took World Bank data like population growth, extreme weather events, and GDP growth to determine patterns around tipping points for mass migration and their relationship to other events such as famine and shrinking economies.[18] There is currently a 10-15% error margin, but the team is working on shrinking this number. Nyoni says the software goes beyond predicting migration to actually suggest remedies to an impending crisis. If the software tracks an escalating famine threat it will generate recommendations such as

[12] https://www.youtube.com/watch?v=tCts6UoTg8c, 9:29-10:13

[13] https://ideas.ted.com/how-can-we-save-more-lives-during-a-refugee-crisis-see-it-coming-before-it-hits/

[14] Ibid.

[15] Ibid.

[16] https://isim.georgetown.edu/forecasting

[17] http://www.internal-displacement.org

[18] http://www.unhcr.org/innovation/how-artificial-intelligence-can-be-used-to-predict-africas-next-migration-crisis/

alternative farming methods or food sourcing to adapt to a changing climate.[19] Nyoni's project was taken up by UNHCR. The algorithm is currently private but will hopefully be publicly available soon.[20]

[19] Ibid.
[20] http://www.unhcr.org/innovation/experiments/