

Using machine learning to help refugees succeed

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Dominik Rothenhaeusler grew up in Oberzell, Germany, a quaint town of roughly 2,500 people along the Schussen River. Like many towns and cities across Germany, Oberzell has witnessed a surge of asylum seekers

and refugees in recent years—at first, mostly men from Gambia, Senegal, Cameroon, and Afghanistan; more recently, men, women and children from Ukraine have entered Oberzell in need of asylum.

The community in Oberzell has, for the most part, united in its support for the [refugees](#). Rothenhaeusler's old soccer coach emerged from retirement to host weekly practices and scrimmages. Other residents stepped in to show the ropes of riding public transportation or navigating municipal bureaucracy. Volunteers taught basic German.

Rothenhaeusler, now an assistant professor of statistics at Stanford University, largely watched this effort from afar, first while completing his Ph.D. in Zurich and then his postdoc at Berkeley. "I was somewhat separated from all of it, but I wanted to do my part," he says. It was convenient, then, when the Stanford Immigration Policy Lab (IPL) reached out asking for help on a refugee-placement project called GeoMatch. "With academic research, there are usually a few steps between the work and its impact. With this project, there was a clear pathway to immediately effecting positive change in the world."

Better living through machine learning

GeoMatch is a machine learning tool designed to help placement officers match refugees with the communities where they're most likely to thrive. The idea was first born when a team of researchers that included Jens Hainmueller, co-director of the Stanford Immigration Policy Lab, met with U.S. government and nonprofit agencies that assist with refugee placement and integration. Conversation veered toward the challenge faced by placement officers.

Though the resettlement process is rich with empirical questions—When are cities better for refugees and when are rural areas? Are homogeneous or diverse communities preferable? What local resources contribute to

job placement?—none of these questions had been formally investigated. Placement officers leaned on experience and intuition more than anything else when finding new homes for refugees.

"So much data exists in these management and administrative systems, but historically it has been challenging to use it effectively," says Michael Hotard, the director of GeoMatch. "We started asking how the information could be harnessed to help the people making these placement decisions."

Hainmueller and several colleagues got to work creating an algorithm that centered on refugee placement in the U.S. and Switzerland. The algorithm matched a wide range of individual background characteristics—country of origin, language skills, gender, age, and so forth—with a refugee's time of arrival and assigned location; the outcome measured by the algorithm was employment success 90 days after arrival in the U.S. and three years after arrival in Switzerland. (These benchmarks of success are used by the U.S. and Swiss governments, respectively.)

By applying the algorithm to assign refugees to a location where they would be most likely to succeed, the research team was able to increase projected employment by roughly 40% in the U.S. and 75% in Switzerland. The researchers [published](#) their results in *Science* in 2018.

More than 100 million people around the world have been forced to flee their homes. About 35 million of these displaced people are recognized as refugees, nearly half of whom are under the age of 18. Given the magnitude of the problem, the algorithm's effectiveness raised the possibility of dramatically improving millions of lives. Hainmueller and his colleagues wanted to lift this work from the pages of academic journals and get it into the hands of those working daily on the issue of resettlement.

The road to partnerships

There are roughly 10 large refugee resettlement nonprofits in the U.S. These receive the bulk of their funding from two federal agencies: the State Department and the Department of Health and Human Services. Shortly after the scholars published their initial paper, additional organizations reached out to IPL to discuss how GeoMatch might be put to use within their organizations. This work paused in 2020, as the pandemic closed borders and the number of refugee admissions into the U.S. was cut; work with the resettlement agencies resumed in 2022.

Further developed at present is a partnership between GeoMatch and the Swiss government. Since 2020, Switzerland has been testing GeoMatch in its placement of refugees around the country. "We wanted to build rigorous impact evaluation into this program to make sure that the tool we're developing achieves the effects we would expect," Hotard says. The program has been rolled out as a large-scale randomized controlled trial.

Asylum seekers entering Switzerland have traditionally been assigned to one of the country's 26 cantons, or administrative states, based on the need to balance population distribution rather than a desire to find the best economic fit. The Swiss Secretariat for Migration is piloting GeoMatch to help with location decisions for a portion of incoming [asylum seekers](#). For those in the pilot, roughly half of asylum seekers will receive a GeoMatch recommendation designed to maximize employment prospects after three years.

These recommendations are passed from GeoMatch to placement officers who then choose how to act on this information. Notably, the GeoMatch recommendations take into account the proportional allocation key and therefore do not affect the number of refugees placed in each canton, but they improve the quality of the match. The remaining

asylum seekers follow the traditional route of assignment.

The GeoMatch pilot in Switzerland is still ongoing. Given the time horizon for results, the team will need to wait until three-year employment outcomes are available before conducting a full analysis of its effects.

Not only does this work help refugees more quickly integrate into new economies but it dramatically lightens the administrative burden placed on host countries. As Hotard noted, simply determining eligible locations for resettlement can be quite complex, to say nothing of taking into account which city or town might be optimal.

"In countries like the U.S. or Switzerland, the government has created a network of eligible locations in which refugees can be resettled," says Hainmueller. "Each year the government determines a quota for the number of refugees that can be resettled in each location. Placement officers cannot just send refugees to any location; they can only place refugees within the existing network of eligible locations. They also need to make sure that each location receives only as many refugees as are allowed by the quota."

It is this complex process that the algorithm at the heart of GeoMatch is designed to address. It can incorporate the various constraints that placement officers face when trying to find the right location, such as medical needs, family size, languages spoken, schooling needs, and so forth. In addition, GeoMatch can lighten the administrative load on these officers.

"What once took multiple people hours of research can now be done in minutes," Hotard says. "GeoMatch can be incredibly useful as a tool that simplifies the process of gathering information and making connections. It automates much of what has traditionally been done manually."

Building guardrails and new applications

Automation, of course, comes with concerns. The refugee resettlement process depends on highly sensitive information, and the results of each placement decision are profoundly consequential. Given this, the GeoMatch team has developed this tool to mitigate potential harms.

To start, nobody at GeoMatch believes that the algorithm should operate without human oversight. Placement officers will remain as final decision-makers when considering where refugees land; suggestions from GeoMatch are intended to support and improve these decisions.

The team has also proactively engaged with concerns around bias. "We've been hearing more and more from our partners that they're thinking through issues of fairness in the algorithm," says Elisabeth Paulson, a professor at Harvard who recently completed a postdoc at IPL. "My work at IPL tried to preemptively ensure these algorithms produce fair outcomes."

With several colleagues, Paulson crafted a modified set of algorithms that allow resettlement agencies to carefully examine results like employment across distinct subgroups. If, for instance, one agency in the U.S. wants to make sure specific employment thresholds are achieved based on a refugee's country of origin, this can be set as the desired outcome. Another agency could instead tune the algorithm to look at employment rates based on gender. The goal is to maximize overall employment without accidentally harming one subgroup.

In a related push to improve the algorithm, Rothenhaeusler was recruited to the GeoMatch team because of his expertise in "distribution shifts." In essence, the fact that machine learning models are trained on historical data creates unseen problems when present-day circumstances don't mirror historical circumstances. Rothenhaeusler noted that looking for

employment today in the Bay Area is a different endeavor than it was two years ago; likewise, asylum seekers showing up in Europe eight years ago—many from Africa and the Middle East—are different in important ways from the Ukrainians seeking asylum there today. Rothenhaeusler's work builds resilience against these kinds of changes into GeoMatch.

In the future, the group hopes to increase the number of countries it partners with—work is ongoing in the Netherlands—as well as the populations that it serves. An emerging partnership in Canada, for instance, is testing how GeoMatch might assist economic immigrants rather than refugees, matching their individual skill sets and location preferences with the best localities for them and their families. Though the situation is not as dire as it is with refugees, Hotard says, there is just as much potential for improving community integration and economic outcomes.

"With our current partnerships, we are just starting our work to resettle refugees," says Hainmueller. "There are more refugees and other migrants on the move today than ever before—and all countries experience challenges in finding the best locations for resettlement. Our goal is to expand the use of GeoMatch in service to the well-being of refugees throughout the world. The countries we're working with today are just the beginning."

Provided by Stanford University

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