COOPER & SACKS

PLANNING, MONITORING AND EVALUATION

AI for NGOs

A practical guide for small and large organizations

João Lobato

Title: AI for NGOs - A practical guide for small and large organizations
Author: João Lobato
Date: October 2022
Series: Innovation and Technology
Publication Type: Guide
Version: Peer Review

Terms

Algorithm - rules or processes computers follow to solve problems

Artificial Intelligence (AI) - there is only a vague consensus of what AI actually means. We loosely adopted Stanford University's definition: Artificial intelligence is the activity devoted to making machines intelligent. Unlike traditional programs where a human coder tells the machine what to do in each situation, AI programs (after being trained and calibrated by humans) find their own solutions to problems. AI is used in the book in a very broad sense, encompassing Natural Language Processing, Machine Learning and some analytical tools.

Machine learning (ML) - a subfield of AI, although some say it is the other way around, and others argue that ML and AI are distinct things. An interesting distinction is that AI is loosely based on the human neurons while ML is based on human reasoning[1]. For our purposes, having a strict definition of AI or ML is not essential. What matters is applying techniques to help understand and change a certain situation.

Natural Language Processing (NLP) - Simply defined, NLP is the use of algorithms in the classification, extraction of content and translation of texts.

Neural networks - a computer algorithm whose architecture was originally inspired by human neurons.

Deep learning - one of the most powerful types of neural networks.

Artificial Intelligence for Development and Humanitarian Work

A practical guide for small and large NGO's

Purpose of this Guide

[1] See The Elements of Statistical Learning Data Mining, Inference, and Prediction, Second Edition, p 48

Artificial Intelligence is a broad field that involves the use of computers to solve problems. The first studies in the field date from the 1950s but the major revolution started in the 2000s thanks to the increased speed of computers, improvement of the algorithms and data availability[2]. In only a few years algorithms like deep learning became the industry standard, being the basis of applications used by Google, Amazon, Spotify and Facebook.

Such applications, however, have had only a limited impact on social development and humanitarian projects. It is true that there are a number of initiatives such as UNICEF's Office of Innovation, United Nations Institute for Training and Research, Google AI, Microsoft AI for Good, and Data Science for Social Good but these are led by IT oriented organizations or departments.

The reality is that most Non-Governmental Organizations (NGOs) do not have a data science team to lead similar initiatives. For example, one of UNICEF's Office of Innovation's projects was a partnership with a mobile network operator in Iraq to assess child poverty in the country. While a valuable application of AI for social development, few organizations would be able to establish such a partnership, which would also be time consuming, expensive, involve complex data collection and impractical for localized projects.

Similarly, Google AI promotes the application of machine learning to social and humanitarian challenges but all featured projects were complex and done by data scientists teams[3].

A recent paper discusses the requirements to unlock AI's potential to drive progress but again it is based on complex implementations which, important as they are, can only be developed by highly specialized IT organizations.

However, NGOs, bilateral and multilateral organizations **can** make use of AI and analytical tools in projects of almost any size. The goal of this guide is to indicate how this can be achieved.

It is important to make a distinction between what I will refer to as "high complexity AI" and "low complexity AI". We will call in this book **high complexity AI** any application of AI that requires a high level of expertise for its design and implementation. **Low complexity AI** (or perhaps more appropriately, analytical

[2] "The impact of deep learning in industry began in the early 2000s, when CNNs already processed an estimated 10% to 20% of all the checks written in the US, according to Yann LeCun. Industrial applications of deep learning to large-scale speech recognition started around 2010." https://en.wikipedia.org/wiki/Deep_learning#Deep_learning_revolution accessed 25.03.2020
[3] https://ai.google/social-good/ accessed 25.08.2022

tools) refers to applications that require less time and are simple, which can usually be done by organizations with limited resources.

Those terms do not necessarily relate to outcomes. Low complexity AI might be just as efficient as high complexity AI in certain situations. We will discuss both high and low complexity AI in this guide but will focus on the implementation and usage of low complexity AI whenever possible. The idea is to make the most with the minimum available.

As summarized in the chart below, it is perfectly feasible for NGO workers of any background to learn **when** and **how** AI will be relevant in a project cycle.

The chart below summarizes how people with different levels of expertise can contribute to a project.

Table 1. Competence levels AI for NGO workers

Capacity	Level	Profile
Ability to develop and implement AI applications in development and humanitarian context	Expert	At least a few years working in AI plus several years of experience in the third sector
Ability to understand the technical rationale of an implementation or model	Advanced	Ability to code and experience in the third sector
Ability to supervise the development of application and make suggestions	Intermediate	Courses on AI in the third sector and at least a couple of years working in AI related projects in the third sector
Ability to include AI in a project cycle with realistic assumptions and, for example, describe expected outcomes in a bid or report	In progress	Significant achievement. Complemented by workshops and more reading materials
Understanding of potential of AI and practical challenges	Basic	Satisfactory goal of this guide
Understanding key terms and how AI tools have been used	Potential to learn more	Minimum goal of this guide
No understanding	Opportunity to start learning	

The next section will present an overview of key areas of AI that can be used in development and humanitarian work. It is important to note that most projects presented below require high levels of technical expertise, and some of them require a long time for designing and implementation (they are high complexity AI applications). Later in this guide we will discuss these tools in detail as well as low

complexity AI alternatives that can in many cases achieve similar results when time, budget and technical expertise are limited.

Akshaya Patra Foundation used data analytics to significantly reduce the costs of delivering meals to Government and Government-aided schools in India.

Chapter 1

Overview of AI for Development and Humanitarian Work

This section outlines **three key** areas that can be used in development and humanitarian projects. Most projects could benefit from ***at least one*** of them and often from a combination of them.

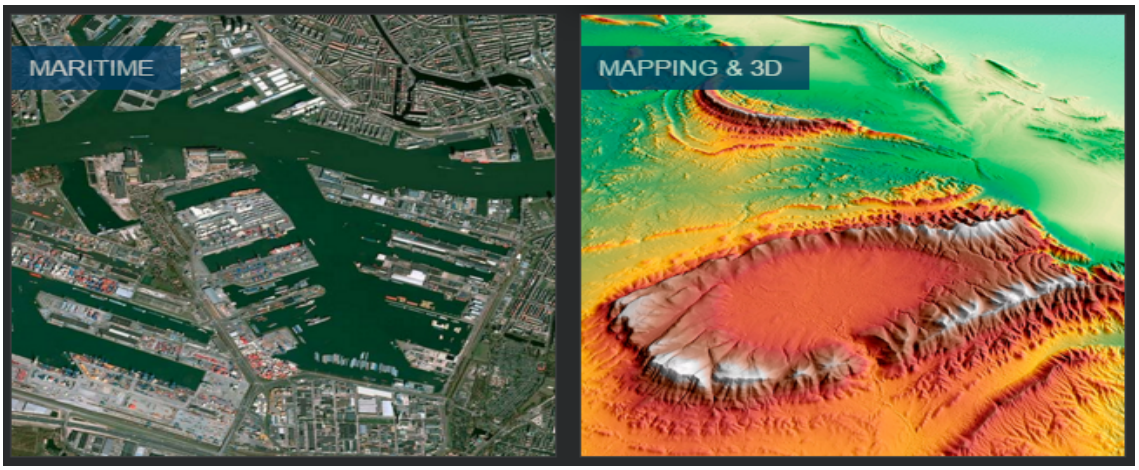
Please remember that this is an initial overview of the areas. Don't worry if the technical terms are new to you or if the application of those areas are not clear yet. They will be discussed as part of a project cycle later.

1. Geospatial Data Analysis

Geospatial data concerns everything related to mapping of the physical space. It is a field of its own and does not strictly require AI. However, AI is largely used to identify types of land cover (forests, crops, lakes, grassland), structures (hospitals, houses, markets) or resources (rivers, wheels, ponds, sand).

The volume of geospatial data available today is huge and can be applied in many ways. The most common types of data are:'

Satellite Images: data collected by satellites like MODIS, Landsat, and Sentinel are freely available although with lower quality than commercial alternatives. Satellites like MODIS see every point in the world every 1-2 days in 36 spectral bands. AI can be used to identify features such as types of dwelling, material of roofs (a proxy economic indicator in some regions), land use and others.

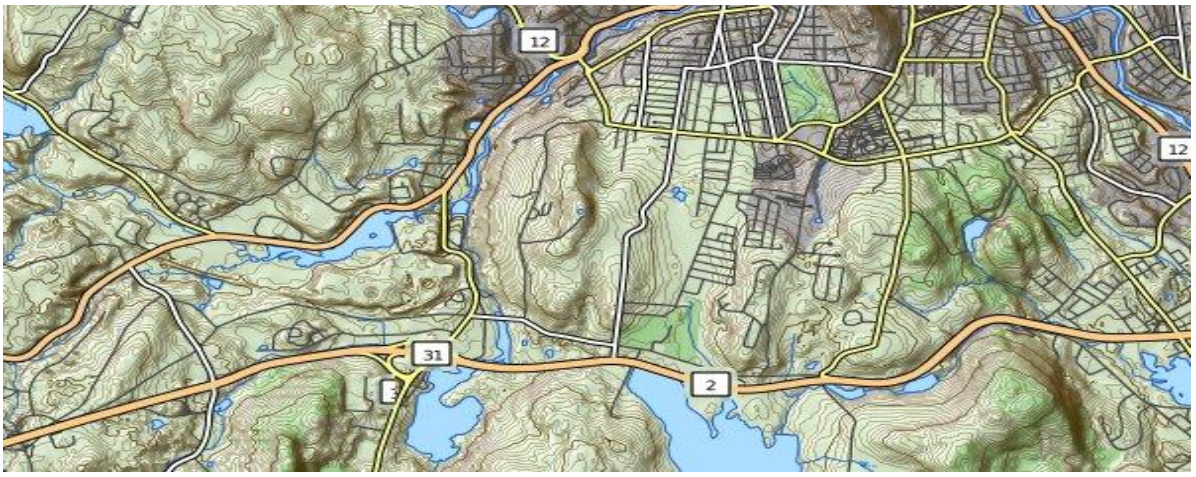


Satellite image and 3D representation. Source: https://gisgeography.com/free-satellite-imagery-data-list/

Aerial images: these are photos taken from devices such as drones and aircraft. There are many free datasets, such as Open Aerial Map. Several firms offer free (limited) or paid (full) access to their collections, including MapTiler and Planet.


Aerial image. Source: bigstock.com

Others: Google Maps includes photos, aerial images, satellite and terrain compositions. Google Earth Pro includes historical data, permitting to see what an area looked like months or years ago, which can be useful for project evaluation. OpenStreetMap is an open platform (anyone can edit the code) with similar but less developed functionalities.



Visualization in Open Street Map. Source: https://wiki.openstreetmap.org/wiki/Applications_of_OpenStreetMap

Applications of Geospatial Analysis in Development and Humanitarian Work

Economic livelihood indicator

Example 1: A team of academics trained a deep learning algorithm to predict wealth indicators in Malawi, Nigeria, Rwanda, Tanzania, and Uganda. The key assumption, corroborated by previous studies, was that wealth is to some extent correlated to light intensity (more affluent areas tend to be better illuminated). They used free and publicly available multispectral daytime satellite images from Landsat 7 satellite. While not perfect, the method can be very helpful in areas where data from census or household surveys are not available.
https://arxiv.org/pdf/1711.03654.pdf

Example 2: Part of the same team of researchers combined data from Wikipedia articles and satellite images to improve prediction of economic indicators. They combined Natural Language Processing (NLP, see details later) and geospatial analysis. The model extracted textual information from Wikipedia about features like hospitals, markets and dams present in the areas studied and combined them with nighttime satellite images, surpassing the predictive power of previous studies. This was the first study of this type.
https://arxiv.org/pdf/1905.01627.pdf

Access to places

Example 1: Two academics used open geospatial data to calculate the distance to Primary Health Care Facilities in Nigeria and identified areas with low levels of accessibility.
tandfonline.com/doi/full/10.1080/10095020.2019.1645508

Example 2: The organization Direct Relief used traditional surveys and geospatial analysis to create a map of health facilities that provide fistula repair treatment. https://www.globalfistulamap.org/

Example 3: Academics used geospatial data to assess cardiac care resources in rural Thailand, and showed that having diagnostic technologies closer to populations can reduce health care costs and increase benefits.
https://tinyurl.com/wpruuzs

Mapping

Example 1: Universities partnered with the United Nations High Commissioner for Refugees to support refugees themselves in the mapping Zaatari camp in northern Jordan. The project did not use AI but is an interesting example of use of geospatial data analysis.
https://theconversation.com/i-teach-refugees-to-map-their-world-94160

Example 2: An academic developed a Geographical Information Systems (GIS) on Google maps that provided information tailored to the needs of people with disability.
https://www.researchgate.net/publication/319104771_GIS_Application_Management_for_Disabled_People

Use of land and natural resources

Example 1: A team of researchers is currently using AI and geospatial analysis to better understand agricultural land use dynamics, vital for management of crop and livestock.
https://www.ceh.ac.uk/our-science/projects/explainable-ai-uk-agricultural-land-use-decision-making

Example 2: Academics used Google Earth and a machine learning algorithm to identify land usage changes in the Savannah River Basin. They were able to observe deforestation changes over time. A similar methodology could be applied to assess changes in land use before and after the implementation of, for example, agriculture projects.
https://www.sciencedirect.com/science/article/abs/pii/S0303243417302957#!

Example 3: Academics used machine learning, remote sensing and geographic information system techniques to assess land use and land cover change in the Sikkim Himalaya, India.
https://www.sciencedirect.com/science/article/pii/S1110982318302035#!

Identify beneficiaries

Example 1: A private firm collected and mapped data on homelessness for several cities in the USA. This helped decision makers and raised public awareness of the challenges associated with homelessness (but see chapter of this book for a discussion on ethical use of AI, which the project was accused of failing).
https://www.esri.com/content/dam/esrisites/en-us/media/pdf/responding-to-homelessness-in-crisis-mode.pdf

Example 2: In 2006 academics developed the first national mapping of functional disability among older American Indians and Alaska natives, providing better information for gerontology programs and policies. The study did not use AI but used geospatial data already available.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1590018/

Coordination and Planning

Example 1: a private health carer used geospatial analysis and data analytics to place micro-hospitals in areas of need.
https://www.esri.com/library/casestudies/bringing-health-care-to-underserved-populations.pdf

Example 2: in partnership with a private firm, US agencies used geospatial data to map, track and understand opioid consumption and spread. This has helped decision makers to plan more focussed interventions.
https://tinyurl.com/qt3hw7c

There are many other applications of geospatial analysis. In combination with AI, they have been used to forecast immigration, disease outbreak, natural disasters and plan delivery of goods.

2. Natural Language Processing (NLP)

NLP is the basis of voice identification devices such as Apple's Siri or Amazon's Alexa, voice translators, automatic chats on websites or those annoying robots often used by banks in phone calls. Our focus here, however, is written text. They might be in the form of tweets, academic papers, reports, funders' strategies or government guidelines.

> NLP is a complex field with huge potential. Progress has been rapid. Algorithms are now able to write a coherent story, such as this one: https://openai.com/blog/better-language-models/

NLP application in Development and Humanitarian Work[4]

Assessing Opinions / Identify beneficiaries

Example 1: Academics used tweets to better understand response to mass shootings and the contestation over gun policy in the US. One of the findings was that the killing of African-Americans by white shooters generated less sympathy and policy discourses than when the victims were white and the perpetrators African-Americans.
https://academic.oup.com/jcmc/article/24/4/182/5489530

Example 2: A charity that supports people going through difficult moments in their lives uses AI to identify and shorten response time for high-risk texters.
https://www.crisistextline.org/

Challenge prejudices and misinformation

Example 1: Academics developed an approach to classify tweets into three classes: hateful, offensive and clean, which then can be used to identify hate speech.
https://arxiv.org/pdf/1809.08651.pdf

[4] Some of the examples were found in https://www.fastcompany.com/90344676/these-20-social-enterprises-and-nonprofits-just-won-googles-ai-impact-challenge

Example 2: The organization Full Fact used NLP to check claims made by politicians and the media.
https://fullfact.org/

Document analysis / Desk review

Example 1: A tech nonprofit scrapes information from publicly available profiles and resumes to identify individuals involved in activities like government surveillance and drone strikes.
https://www.vox.com/2017/6/22/15855492/ai-artificial-intelligence-nonprofit-good-human-chatbots-machine-learning

Example 2: NLP was used by academics, private and multilateral organizations to better understand COVID19 and answer questions posed by WHO.
https://www.fedscoop.com/coronavirus-database-natural-language-processing/

Example 3: NLP is used by a human rights organization to help lawyers in the research of cases.
https://www.huridocs.org/

Stakeholder Engagement:

Example 1: A charity is developing an AI system which connects non-English speaking parents in the U.S. with their children's teachers.
https://talkingpts.org/

Example 2: An app translates Portuguese into sign language for deaf and hard-of-hearing Brazilians, many of whom haven't learned to read and write.
https://www.handtalk.me/

Predicting trends or patterns

Example 1: Researchers from Microsoft and an academic used queries on the search engine Bing to build a model that was able to predict with significant accuracy internal migration in the USA. The rationale is that people tend to search for accommodation and jobs before moving to a new city.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3341776

Example 2: Twitter was used as a proxy to assess the number of people with flu in different areas of the U.S., Italy, and Spain. The model initially predicted “the week when the epidemic would reach its peak and the magnitude of that peak with an accuracy of 70 to 90 percent six weeks in advance of the event”. It is important to note that this and similar models (including one designed by Google https://www.wired.com/2015/10/can-learn-epic-failure-google-flu-trends/) later failed to predict a number of outbreaks. While there is potential in this area of research, models need constant updates and refinement.
http://news.northeastern.edu/2017/05/05/researchers-use-twitter-to-track-the-flu-in-real-time/

Academics compiled data sources and NLP techniques that have been used for mental health support and intervention. This valuable resource was published in Jan 2017 but is still relevant.
https://tinyurl.com/vtr4umf

3. Data Analytics

Data Analytics here is used in a very broad sense to indicate the use of large datasets for prediction, classification and identification of relevant patterns. It includes models based on machine learning, state-of-art AI (deep learning) and also areas that are not often considered data analytics (such as Virtual Reality) but that still combine large datasets to develop models that are relevant for NGOs.The reason for combining such different models is that we are here more interested in their application and not so much in the algorithms that power them.[5]

Data Analytics application in Development and Humanitarian Work

Skills matching

Example 1: Academics developed a software that allocates refugees to places in which their skills are more likely to be needed, which can improve integration and wellbeing of refugees.
https://www.theatlantic.com/international/archive/2019/04/how-technology-could-revolutionize-refugee-resettlement/587383/

Example 2: A similar project was done by Immigration Policy Lab (IPL) at Stanford University and ETH Zurich, in conjunction with Dartmouth College.
https://immigrationlab.org/project/harnessing-big-data-to-improve-refugee-resettlement/

Health Diagnostics

Example 1: A startup developed an app that helped health workers to quickly diagnose skin conditions in Bangladesh's Cox's Bazar district, where nearly 1 million Rohingya refugees have been living since fleeing a genocide carried out by the Myanmar military. The app increased the number of diagnoses by 25%.
https://blogs.nvidia.com/blog/2019/01/04/ai-polyfins-rohingya-refugee-crisis/

Example 2: With support from UNICEF, a healthcare firm in India developed a platform to support early diagnosis of neonatal sepsis through artificial intelligence.
https://www.unicef.org/innovation/FundGraduate/Avyantra

[5] We understand that the distinction between machine learning and AI is not universally accepted. We could have separated them by their complexity but it seemed more useful to group them.

Program Management

Example 1: An Indonesian organization used an app to help informal waste collectors find the best places to sell recyclables.
https://gringgo.co/about

Example 2: A firm uses AI to build data models that track vaccines that have to stay below a certain temperature throughout the supply chain.
https://nexleaf.org/

Example 3: UNICEF and the Government of Indonesia used RapidPro, an open source data collection and management platform, to enable real-time coverage analysis of the country's largest-ever immunization campaign aimed at vaccinating 70 million children against measles and rubella in 2 years.
https://www.unicef.org/innovation/stories/health-workers-harness-real-time-data-support-indonesias-largest-immunization-campaign

Virtual Reality

Example 1: In another project funded by UNICEF, a firm in Nigeria used Virtual Reality as a learning aid in schools.
https://www.unicef.org/innovation/FundGraduate/Imisi3D

Example 2: Alzheimer's Research UK designed a VR app to raise awareness of the complexities of dementia. The app simulates life through the eyes of a person with dementia.
https://charitydigital.org.uk/topics/topics/five-ways-charities-are-using-virtual-reality-4911

Predictive analysis

Example 1: The computer science department at Makerere University in Uganda uses data pollution sensors attached to motorcycles to track and forecast air pollution.
http://cs.mak.ac.ug/

Example 2: In a program funded by DfID, climate experts in East Africa are using AI to combat one of the biggest locust outbreaks in recent years, which deeply affects food security in the region. AI assess weather conditions favorable to breeding of locusts and track them with satellite images.

https://www.gov.uk/government/news/uk-supercomputer-to-combat-africas-worst-locust-outbreak-in-decades

By now it should be clear that AI is already making a significant impact on development and humanitarian work. It is hard to imagine a future in which AI will not be a key part in the design, implementation and monitoring and evaluation of projects. But there is still a huge gap between AI oriented initiatives and the work currently done by NGOs. A quick search on ReliefWeb or UN jobs shows that very few planned or current projects incorporate AI. While there has been considerable research and application of AI in the third sector, few NGOs have been able to benefit from such applications. In the current scenario, most projects involving AI are “AI projects”, that is, they are designed for the use of AI. While it is important to continue developing AI applications, it is essential not to design projects to use AI but find ways to **use AI in any project**.

The complexity and role of AI will depend on the nature of the project and the technical and financial capacity of organizations. What we are going to see next is how to implement AI in different contexts.

Chapter 2

AI implementation

As seen, AI is a complex area that offers a range of solutions for development and humanitarian work. In many cases it is worth investing in complex approaches. Think for example how crucial economic indicators are for certain projects. If there is no reliable data available, AI can be a better (and cheaper) alternative to time consuming and expensive traditional surveys. In contexts where respondents will not be willing or able to answer questions openly, computer based solutions might be the only alternative.

One point to bear in mind is that geospatial analysis, NLP, data analytics and other AI applications will often in our case use indirect evidence (such as land cover to predict land productivity) while surveys will get answers from respondents directly or through observation in the field. In a traditional survey, participants of a Focus Group Discussion will be encouraged to openly discuss points that might reveal important features of the dynamics and views of respondents on key issues. To extract similar information, AI (NLP more specifically) would rely on data found online. If respondents do not use online platforms such as Twitter but have access to the internet they could be engaged in online discussions. If they don't have access to the internet or do not want to participate in an online discussion, other strategies have to be used. And even if it is not possible to use NLP to extract information about stakeholders, NLP could still be used in other steps of the project cycle such as in coding qualitative data. It is vital to identify shortcomings and benefits of each method before implementing them.

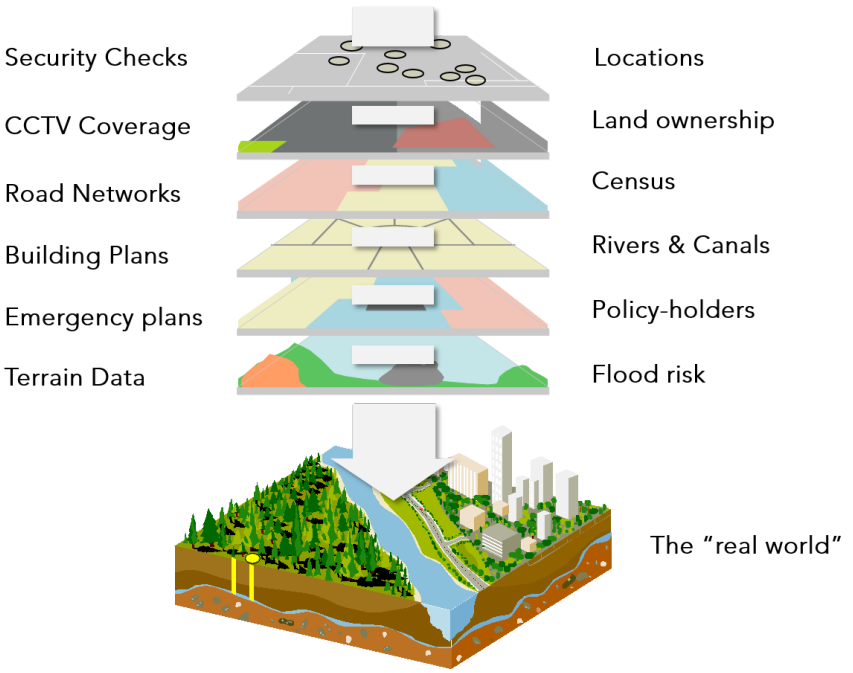
In an ideal scenario, AI and traditional tools would be combined to provide a deep understanding of the context. In more realistic scenarios there is a shortage of resources, personnel and time. So it is vital to choose the tools that best suit your needs.

In this section we will discuss the implementation of AI at different levels, from simpler and cheaper to more complex and expensive ones.

Implementing Geospatial Data Analysis:

To facilitate our discussion, we take a map as the central feature of geospatial analysis. Mapping can be used in all stages of the project cycle not only for visualization but also to aggregate data from other sources. For example, for identifying beneficiaries, to plot local dynamics (relationship between stakeholders, especially in areas with segregation), to plan delivery of goods, to engage stakeholders, to understand access to places and help in the evaluation of projects that leave a physical imprint in the landscape (new foot tracks might be evidence of the utilization of a new well in rural areas).

The most complex form of "mapping" is a Geographic Information System (GIS), which will be layered according to type of information. The simplest is adding text boxes to an online map. If the simplest solution meets your needs, certainly go for it but remember to analyze the costs and benefits of more complex solutions as well.



Visualization of a GIS. Source : https://www.cbronline.com/what-is/gis-explained/

Level 1 - Creating Maps

Google Maps and OpenStreetView have a number of intuitive features for quick and easy mapping of areas. Google Earth Pro is a bit more complex but has better resolution and includes historical data of satellites which can be used to observe changes in a region over time.

What you get: Fairly detailed maps and photos with the possibility of using (with limitation) historical data. You will be able to add information to the map (color certain areas, draw arrows, write…) either using the resources offered by the provider of the map or by exporting it into another software.

This is a good choice if you only need visualization tools and don't need, for example, to correlate the images with data on other variables such as land cover and agricultural yields. The software mentioned above have restricted functionalities but they might suffice your needs.

Implementation requirements: Google Maps, Google Earth Pro and OpenStreetView are free and they allow the use of their images as long as you provide proper attribution. Their in-built tools only require average computer skills.

Limitations: If all you need are maps, this is probably the best choice. Even someone who has never used Google Maps or OpenStreetView can learn to produce maps in no time. This approach, however, will not allow you to use more complex, and sometimes essential, features. You will not, for example, be able to train an algorithm to identify certains feature like water sources or residential areas. The maps may not be dynamic (you may not have a single map that responds to users' inputs).

Level 2 - High resolution Maps

Sometimes you might need better resolution than you get with the applications mentioned above. Or might need to put together very large datasets. In some cases the area you are working on is not well mapped, so you need to use satellite and ; or aerial images to create your own maps. In these cases you have to use geospatial data software to create maps.

What you get: Better and more flexible maps.

Implementation requirements: This requires some experience in geospatial analysis and, depending on your requirements, subscription to a private satellite images provider. Not a very complex task but will require some training.

Limitations: There will be costs, which will depend on the complexity of your mapping and quality of data available. This is also an option that will require more time than the first one.

Level 3 - AI and Mapping

Here you will be combining AI, geospatial analysis and even NLP. As seen earlier, projects using these fields vary in complexity. Some might only need one expert, others will require partnership with research institutions. While more time consuming and expensive than the previous implementations, the result might justify the investment.

What you get: You will be able to use dynamic maps that respond to changes on the ground, which are particularly useful when tracking consequences of natural disasters or displacement of people. Maps can be automatically updated with new information gathered by an algorithm in real time.

You will also be able to build predictive models related to spatial changes and GIS. This approach will permit complex analysis seen earlier, including combining NLP and geospatial data to predict wealth.

Implementation requirements: It depends on the structure of your organization and the complexity of the approach. If you have a data team, they might be able to handle some of the tasks with support from a consultant. If your data team is small or does not have the capacity, they still should be involved in the project and perform tasks that match their experience. If no data person is available, a consultant would probably form a small team. This is particularly true if your project combines different areas of AI.

Since the approach here is more complex, your organization might need support in the design of the implementation and to explain to stakeholders what they can expect from it.

Limitations: Even the most sophisticated tools have limitations. As many of the models are based on indirect evidence (using proximity to markets, infrastructure and others to predict the wealth of a village, for example), they might be less precise than your project requires. The complexity of the implementation means

that refining the models takes time. The key thing, however, is data. Even the best model will not perform well without adequate data. That said, there are great benefits in using low and high complexity AI tools. And the more they are used, the better we understand challenges and solutions.

Implementing NLP

NLP is probably the area of wider applicability and one of the most complex given the nature of human languages. To facilitate the discussion of how to implement NLP, we have divided them according to their goals.

1. Collecting opinions, prejudices and stigmas

This is probably the most valuable tool for development work. It is possible to in some contexts assess views of stakeholders and beneficiaries using platforms like Twitter, Reddit, comments on YouTube, Amazon, Walmart, online newspapers, official documents, reports and others. Twitter is by far the most common because it is currently the only large social media platform that allows the download (with restrictions) of users' messages.

Implementation requirements: collecting data from the platforms mentioned above is straightforward. The easiest way is to use a dedicated software to scrape the information you want. The simplest of those require no special skills but are usually paid. Software like Orange are free and relatively easy to learn. More refined data collection can be done with Python libraries such as Tweepy.

It is possible to do the analysis of the data using traditional qualitative methods but the great advantage of using NLP in this case is the large number of data you can access (studies with over 1 million tweets are common), so in general it is preferable to automate most of the analysis. This can be done using machine learning methods such as naive bayes or random forest. Currently, the transform architectures are by far the best available. They rely on pre-trained models trained on immense data sets such as Bert or GPT. Hugging Face has created a number of pipelines that simplify the use of such architectures but they still require a high level of expertise and significant computational power.

An alternative for organizations that do not have NLP specialists is to use a hybrid approach in which tweets (or texts from other platforms) are collected via a software and a sample is analyzed by a person, which provides at least an initial understanding of the situation.

Limitations: Transformers are incredible architectures that have achieved near human performance in many areas. The downside is their complexity and significant computational requirements. And they have not been as successful in classifying and analyzing social media texts as in other areas discussed below.

Probably the best option today for an NGO to use text from social media is a hybrid approach.

> Adaptive resonance theory (ART) has been used for textual analysis on social media. The algorithm is arguably less computational demanding and avoids some limitations of deep learning such as catastrophic forgetting. That said, ART is not widely used and there are only a few and limited libraries available on Python. The book Adaptive Resonance Theory in Social Media Data Clustering is a good (if rather technical) start

2. Literature review

The transformers architecture produces excellent summaries of texts allowing users to specify the number of words. This can save a significant amount of time in the literature review by allowing researchers to focus only on relevant documents.

Implementation requirements: There are several apps out there that perform good to mediocre summaries. Most are paid. You could streamline the task by creating a code that summarizes all documents in a folder and save them in a single file with title, authors, summary and link to original text but that would require some level of expertise.

What you get: Summaries can be really good but may not necessarily focus on what you are looking for. Perhaps the best approach is to produce a short summary to help you select the documents you want to read through.

Limitations: Apps may not be based on the most up-to-date algorithms but might be good enough for your purposes.

3. Data gathering

One of the most time consuming tasks in identification and design is finding the right data. I sometimes spend hours just to find a reliable figure or demographic characteristics of a region.

Traditional search engines will return tons of data, which in itself is a problem since time is always a constraint. And the data are not always accurate. One solution is to use specific search engines, such as Google Scholar, or a platform like GDELT Project (supported by Google) that monitors the world's broadcast, print, and web news in over 100 languages and identifies the people, locations, organizations, themes, sources, emotions, counts, quotes, images and events. It is possible to search the database using SQL language https://www.gdeltproject.org/

The sad truth, however, is that we are still waiting for a platform that can extract reliable, concise **social development** data.

4. **Online engagement**

One way to use AI to increase your online engagement is through chatbots. While they are not the most appreciated piece of technology around, they can be useful for projects with a high demand of online support. For example, an organization that provides online support to people at risk of suicide might need a strong system to identify and direct those who are at higher risk to experienced (human) staff.

Implementation requirements: Chatbots have evolved considerably but are far from reaching human level of engagement. They are best thought at the moment as a first filter that can help users with common queries. There are a number of apps out there, including free ones, that allow users to create their own chatbots. They might not be robust but in many cases will be good enough for simple, clearly formulated queries or at least to direct clients to the right people.

More complex implementations are more expensive and will require the work of a NLP specialist but it might be a worth investment. A healthcare provider, for example, could save a significant amount of money by having chatbots to help people book appointments. As everything else discussed in this guide, it is all about evaluating your needs, the benefits and costs of each type of implementation.

What you get: A tool with the potential to reduce costs and staff time. On the flip side, your organization might lose clients who, understandably, are not comfortable talking to a machine.

Limitations: The best chatbots are still far from being a complete solution for online engagement but they can help at the initial stages of a conversation. Designing the right chatbot for your organization is not easy and will require time and financial investment but it might pay off.

5. **Messages filtering**

Another way to reduce time with online or offline engagement is to use AI to filter emails or social media messages, assigning them a priority level and directing them to the right people.Those same messages could also be used for analysis, as seen on point one of this section.

Implementation requirements: They might go from general apps to the development of bespoken systems. Once again the level of investment will be related to the benefit of having a filtering system.

What you get: A system that can help classify messages to reduce workload. The filtering can also be used to select messages for analysis.

Limitations: Classification of online texts is a difficult task even for humans as messages will often fall into more than one category and might just not be clear. AI is not better than humans at this task. It is important to constantly review the filtering process to ensure it is relevant.

Implementing Data Analytics

As we have grouped a number of approaches under the umbrella of data analytics, we will discuss a few examples from different areas.

1. **Computer vision**

One of the main uses of AI in development work is through the interpretation of images. As seen above, they range from identifying crop diseases and skin conditions to reading x-rays to diagnose bone disease, infections or tumors.

Implementation requirements: There are many projects out there using this type of technology and in some cases a partnership will make much more sense than developing your own.

What you get: Computer vision is a well-developed field with algorithms sometimes surpassing human expertise. That said, the involvement of experts in the field is necessary.

Limitations: the biggest limitation is the time and cost of developing your own system. There is a good chance, however, that you will be able to use a commercial or not-for-profit option already available.

2. **Statistical analysis**

There is a surprisingly high number of reports in the third sector with inadequate or simply wrong statistical tests, not to mention those that don't even include essential statistical tests. Available statistical software like SPSS, Q and Stata have a steep learning curve and in resource-limited contexts are simply not used. Cooper & Sacks has developed a simple solution in which users upload the raw data of a survey and in less than a minute they receive a complete report with all relevant statistical tests, tables and charts.

Implementation requirements: The prototype was developed in Python language and currently is a JupyterLab notebook. We are at this very moment negotiating with potential sponsors the release of an app free to everyone.

What you get: A full report with all tables, tests and charts you will need.

Limitations: The application does not replace a researcher, who will need to interpret the data and remove those tables and charts that are not relevant. That said, it provides easy access to statistical tests.

3. Predictive analysis

Even a simple diagram on a paper is better than no plan outline at all. Much better is a model that can forecast expenses, management risks or improve fundraising activities. Computer models can help in all sorts of analysis of scenarios, from developing a system for hiring bicycles to predicting the relationship between actors in complex contexts.

Implementation requirements: There is a whole range of tools, from well-established ones such as Vensim (which includes a free version) or Rapiminder (which has been used in logistics in the healthcare sector) to more recent companies that offer customized services.

What you get: It totally depends on your investment and, more importantly, how the analysis is integrated in the designing and implementation of your project. I am sorry if I am being vague here but this is such a huge field with so much potential that it is hard to summarize it in a few sentences. A recent article at Charity Digital compiled a few examples of successful implementations

Limitations: It is important to remember predictive analysis, no matter how powerful, are simplified versions of real challenges and will only help in indicating possible scenarios.

4. Surveys

This is another example of a tool not based on AI that can have a big impact in development work. While survey platforms have become very popular in the past years, it is not unusual for in-person surveys to be done on paper. This is less reliable and more time consuming as it adds a data entry stage to the research cycle. Another challenge is to access certain areas. We have seen above that in certain contexts indirect (such as luminosity as a proxy for wealth) or spontaneous data (such as Tweets) might solve the problem but if a direct interaction with respondents is necessary, a good platform is RapidPro, which was developed for the third sector by UNICEF. RapidPro allows you to create a survey that can be answered via text message and also includes management tools.

Implementation requirements: RapidPro is free to use (https://app.rapidpro.io/) and it is relatively simple to use but does require some training. To install, run and host it you will probably need technical support.

What you get: The software has been used in large scale projects, such as in a national vaccination campaign in Indonesia, and it is well tested.

Limitations: RapidPro is based on SMS, and there might be costs associated with it. The layout feels a bit outdated. Installing and running it is not straightforward.

Chapter 4

Concerns, bias and prejudice

There are serious concerns about the role of AI in reproducing prejudice. Despite their ability to learn, algorithms are designed by humans - and largely learn from data created by humans. This is particularly problematic in development and humanitarian work which should but not always challenge prejudice. A few examples of worrying uses of AI include:

The United States government developed a program called "Correctional Offender Management Profiling for Alternative Sanctions" (Compas), which was prone to mistakenly label black defendants as more likely to reoffend. Compas **wrongly** flagged them as almost twice more likely to reoffend than white people (45% to 24%), according to the investigative journalism organization ProPublica.

Israel has been investing heavily on AI. Some of the most valuable AI startups today are Israeli and a large share of capital raised in the private sector goes to AI. The Israeli government has been systematically using AI to target Palestinian activists, tracking their phone calls and social media activity (including Facebook), leading in some cases to the arrest and murder of innocent people. Since 2018 AI has also been used for attacks in the Palestinian territory leading to, according to Palestinian health officials, the killing of 253 people, including 66 children. As a senior Israeli said: "We [the military] take algorithms developed in startups and Israeli companies."

China, France and the UK have also been using AI in arguably criminal ways. The Chinese government has been using AI for profiling persecuted ethnic groups. France and the UK have been heavily investing in AI for military purposes, despite disastrous AI implementations in education in the UK, for example. A number of countries have adopted surveillance measures that are against basic rights. The French company IDEMIA'S algorithms, for example, scan faces of millions of people entering the US, Australia, and France. Nearly 1 billion faces have been collected, creating a huge potential for data misuse and unethical surveillance. On top of that, the algorithm is much more likely to misidentify black people.

Examples of abuses of AI can be found nearly every day on the news, not to mention the many other cases that are not picked up by journalists. Why then encourage the use of AI in the third sector? For better or worse, AI is here to stay. There is no way to even consider that countries, companies or individuals will stop

using it because of the harm it poses to society. On the one hand it is critical that we all actively engage in regulating and limiting the use of AI, hard as it may seem sometimes. On the other hand, it is important to continue to explore ways to use AI in a safe way to address social issues.

Looking specifically at development and humanitarian work, risks may arise whenever data on individuals or groups are collected, particularly if the data can be accessed by people with other interests. For example, a NGO may use NLP and satellite images to assess the income of a certain community but the same data could be used by the government to identify and target infra-structure if they are in a conflict area, or target people from an ethnic and/or religious group depending on the language and content they post on social media. Data collected on social media could also be used to target individuals and organizations which might be critical of governments or companies.

At the most basic level, the use of AI and analytical tools should follow the same practices as those of traditional research:

- Consent - individuals must be aware and agree with the use of their data. While this is clear when individuals are directly asked questions, as in a traditional survey, it becomes nearly impossible if the data is derived, for example, from satellite images that cover large areas or aggregate data on social media and might be used precisely when it is not possible to reach individuals themselves. Organizations need, however, to develop strategies to inform individuals that research is being carried out. A strong risk assessment needs to be done before any data collection.
- Anonymity - just like in traditional research, mechanisms must be in place to ensure no individual can be identified.
- Confidentiality - if the identity of individuals are known to researchers, mechanisms must be in place to ensure others cannot identify them.

Bias and prejudices might arise if:

- Stakeholders and beneficiaries are not involved in the design of a project
- AI is developed by individuals or organizations with no experience in the third sector
- Development workers do not understand the basic principles of AI, including its limitations and risks.

An economist for the World Bank has shared some interesting ideas on the ethics of AI.

The AI ethicists compiled a large list of organizations working on ethical issues

Chapter 5

AI and Analytical Tools in a Project Cycle

For convenience, we have divided the typical project cycle into four steps:

Identification: establishment of the goal of the project and background information, including literature review, desk research, and, more importantly, initial consultation with stakeholders.

Design: how the project is going to be implemented, possible challenges and remedies. Includes logical framework.

Implementation and Monitoring: while distinct activities, monitoring is usually done along the implementation of the program and will inform the evaluation and also allow to address shortcomings before they scale up.

Evaluation: final and follow up evaluations of the project.

Based on the previous discussion, we provide examples of tools that can be used in each of those steps.

Sample tools that can be used in a program cycle

Item	Tool/Data	Usage	Technology
Identification			
1	Text summarizer	Quickly extract key parts of documents	HuggingFace has been developing accessible implementations of complex transformers architectures Applications of varied quality and costs make a number of

			NLP tasks accessible to non-technical users
2	Geospatial data	Identify areas for intervention, contact stakeholders, map places and dynamics	From easy to use Google Maps to models built on satellite and aerial images Aerial images from drones could be used to assess use of land, access to resources, presence of infrastructure, dynamics (such as access to hospitals, markets…)
3	Satellite Images	Assess income of an area, assess land use	An algorithm could use luminosity and other features to estimate wealth of an area
Design			
4	Online surveys, text messages app	Engage with beneficiaries and other stakeholders remotely	RapidPro for SMS surveys, online surveys when relevant
5	Data mining	Assess views of stakeholders on social media, documents and other text	Data can be extracted with commercial or open applications. HuggingFace has implementations for sophisticated analysis (such as clustering, labeling comments, sentiments analysis)
Implementation and monitoring			
6	Satellite Images	Identify changes in areas, particularly rural areas and large development programs	As item 3
7	Geospatial data	Similar but more nuanced data	As item 2
8	Online surveys, text messages app	As item 4	As item 4
	Data mining	As item 5	As item 5
Evaluation			

All items above could be used for evaluation, especially by comparing differences between pre and post intervention

How to begin?

This book presented a number of tools used in distinct but sometimes complementary ways. Some of them are complex but most could be done using simpler alternatives that still deliver relevant results. In any case, an understanding of the tools, their limitations and capabilities is critical.

As mentioned in different moments, the key point when using AI or analytical tools is an assessment of their benefits and costs. It is important to identify appropriate tools (as outlined in chapters 2 and 3). The assessment should follow standard participatory approaches that have been developed in the third sector. Ideally the assessment should not be restricted to a single project. If you are going to invest in AI and / or analytical tools, it makes sense to use them across the board.

Once stakeholders have agreed to embark on this new journey, there are four (not mutually exclusive) options to implement the new tool(s).

Collaborate with an AI team

A growing number of organizations are offering free AI support to NGOs and social enterprises. The modalities of support vary, ranging from guidance to building up a whole system. Some of the most well-known organizations include:

AI4good
Google AI
Datakind
Data Science for Social Good
Microsoft's AI for good
Omdena projects
Open AI

A challenge, apart from succeeding in the application, is that AI is a highly specialized field. NLP experts, for example, will probably have no understanding of geospatial data, and even in a specific field you will find professionals with different skills, such as machine learning engineers, researchers, and front-end developers. Another challenge is that few AI experts will have experience in the third sector. As emphasized in this guide, it is vital that NGO workers have at least a conceptual understanding of AI to ensure the project achieves its goals while also ensuring that

beneficiaries and other stakeholders are not exposed to any risks, as discussed in chapter 4.

Hire an AI team

Another option is to hire an individual or team who will develop a solution for your project or organization. As in the previous option, expertise in the right field and background in development and humanitarian work are the two most important points to address.

While hiring a team will give you more autonomy than receiving pro-bono work, the costs will be high, but might still be worth it.

Create in your own team

Another option, arguably more sustainable, is to set up a team in your organization. While this could radically change the impact of your work and ability to access new funding, this is the most expensive and time consuming option. Again, another big challenge will be to create a team with expertises in both the third sector and in AI.

Use tools already developed for the third sector

As discussed, there are tools already designed that can be adapted for your use. While requiring training and sometimes the acquisition of a license, this is a soft start that can help the organization to assess the viability of their AI project.

Developed your own tool

Finally, you have the option of hiring companies to develop bespoke applications that meet your requirements.

Cooper & Sacks has been developing simple to use tools for organizations in the third sector that massively improve the quality of projects while reducing costs

Chapter 6

Final Remarks

This book introduced approaches that can play a huge role in current development and humanitarian work, with potential to drastically improve the quality of the delivery of programs. There are many challenges to overcome before new technology is embedded in the work of not-for-profit organizations. Perhaps the most critical is to change the mindset of organizations. While the benefits are large and evident, behavior change is notoriously difficult. But instead of stopping us, the challenges should compel us to continuously look for the best approaches to deliver projects and, in the process, use evidence to support organizational behavior change.

The key points of this book can be summarized as follows:

1. There is a growing number of projects that use AI and analytical tools to improve interventions
2. They are, however, removed from the vast majority of projects due to organizational and technical constraints
3. AI and analytical tools can be used in virtually any project
4. Any implementation must be guided by a clear understanding of development / humanitarian work

For more resources or to join live discussions, visit cooperandsacks.org