

# DIGITAL INNOVATIONS FOR PEACE

**Mapping of pre-existing solutions  
with a focus on MIL and countering  
hate speech and disinformation**

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# I. INTRODUCTION

With the near-inescapable ubiquity of the internet and social media in recent years, hate speech and disinformation have become an evident cybersecurity threat to digital human rights and democracy. In the span of less than two decades, the public sphere has seen a major transformation due to digitalization, access to information, and the high-speed evolution of mass media. The immense influx of data shared on the internet every day, along with its rapid circulation, makes hate speech, fake news, and disinformation pressing issues that need to be addressed in earnest. Journalists, academic institutions, think tanks, and public and private entities around the world have dedicated prodigious time and resources to tackling these issues. Media and information literacy (MIL) is an important tool that has the potential to be used by media consumers around the world to adapt to the ever-changing mass media landscape.

Funded by the European Union, Digital Innovations for Peace (DIP) aims to develop social resilience against the growing danger of disinformation in societies in the Middle East and North Africa (MENA) and promote peace in the digital space.

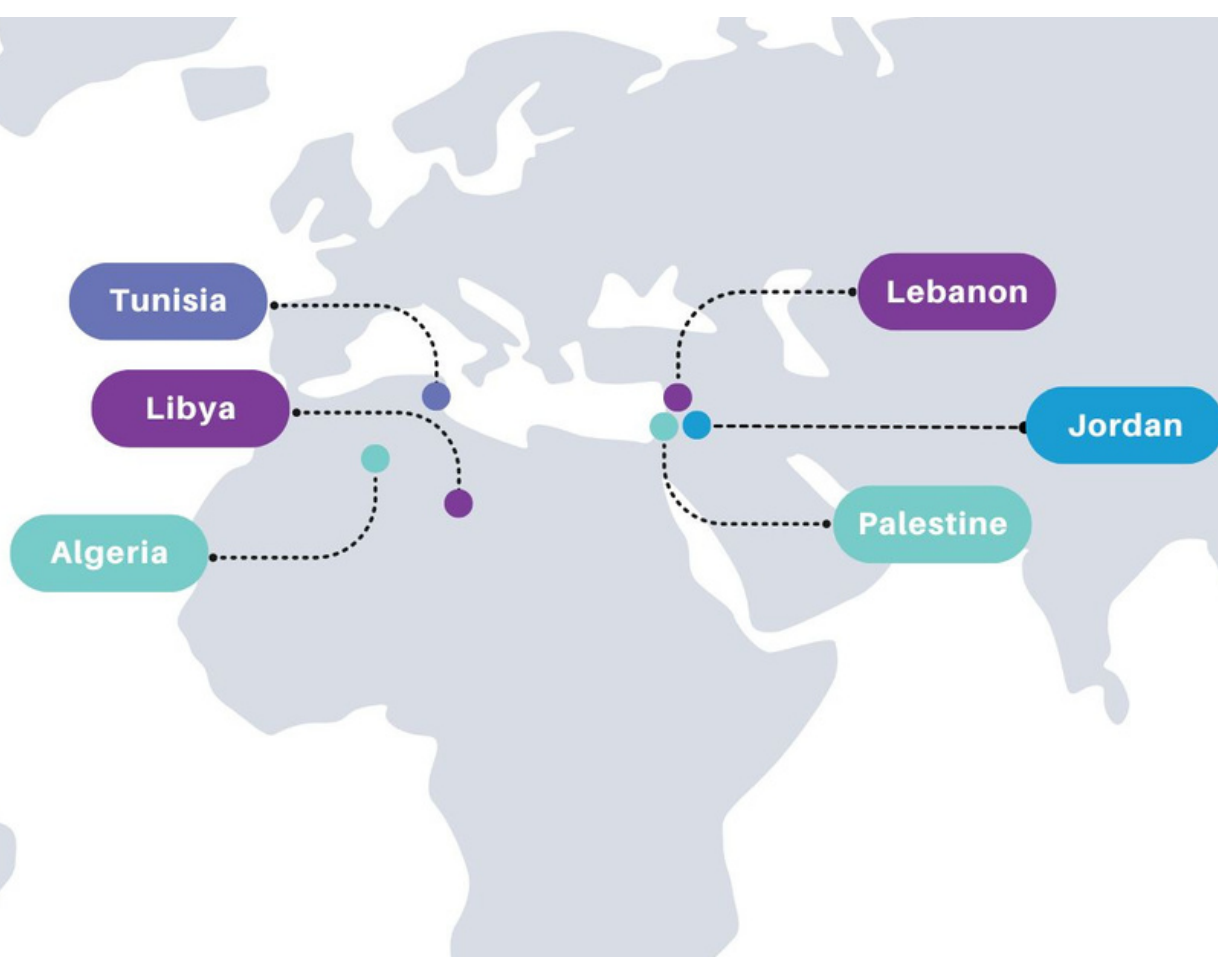
The project places a niche focus on Algeria, Jordan, Libya, Lebanon, Palestine, and Tunisia. DIP aims to create a cross-regional online community network for professional exchange and capacity building. It brings together media professionals, digital technology activists, and creative entrepreneurs to encourage the creation of cutting-edge information and communication technologies (ICT) solutions that improve media users' MIL capabilities and their resistance to disinformation.

This research presents a thorough mapping of at least 60 open-source solutions and preexisting tools, including a wide range of linguistic and social media analysis and data visualization tools

that can aid in the process of creating solutions that benefit Arabic-speaking media consumers.

It brings together media professionals, ICT experts, digital technology activists, and creative entrepreneurs to shift paradigms to improve media users' MIL capabilities and resistance to disinformation and hate speech.

Project participants will be enrolled in crowdsourcing competitions, hackathons, and acceleration hubs, providing them with the opportunity and knowledge to be effective change agents.





## II. LITERATURE REVIEW

### The Media–Technology Nexus

The past decade has witnessed significant technological advancements that have had a positive impact on our lives and livelihoods. Ultimately, these shifts have engendered an increase in our productivity and boosted economic growth (Gimpel and Shmeid 2019). Without a doubt, the media sector is one that is constantly undergoing a process of revolution—courtesy of communication technology advancements (Khajeheian 2017).

The rapid and consistent proliferation of media technologies has transformed our perception of the world and has influenced the cultures of young people and their social connections. Now more than ever, internet users and media consumers around the world are surrounded by a plethora of information from newly introduced media channels and praxes—such as “citizen journalists”—social media platforms, influencers, and traditional media outlets. As a result, the internet has become a dynamic, user-centered platform for sharing information. For instance, more than 500 million tweets are generated daily on Twitter. Inevitably, the credibility of this data on the internet at such a large scale varies, and it is becoming more and more difficult to determine whether or not the information is factual and honest (Al Zaatari et al., 2016).

While there are countless examples of ways in which the evolution of media technologies and the revolutionary access to information have facilitated improvement in our lives, there are many adverse, unexpected, and unintended effects, such as hate speech, fake news, disinformation, and misinformation,

particularly with the ever-increasing intelligence of IT (Gimpel and Shmeid 2019). This phenomenon is called “the dark side of IT.” It includes incidents that could potentially violate, hamper, or injure individuals, organizations, and societies, whether arising from malicious or nonmalicious use of these technologies. One example of nonmalicious IT harm is information overload. By contrast, malicious IT use can consist of such acts or products as hacking, spamming (Gimpel and Shmeid 2019), and disinformation.

While the world has progressed technologically, it has regressed socially. In the mass communication era, hate speech and disinformation are among the prevalent threats to democracy (Turner 2018). These are major challenges that we must face.

In other words, digital media is a double-edged sword. As it becomes more intelligent by the day, it can be utilized to build social cohesion between different groups and communities. Yet, its misuse can be detrimental to democracy, social cohesion, and peace. Taking that into account, efforts need to be put into mitigating the risks and side effects of digital technologies in order to ensure that the positives of using advanced technologies outweigh the negatives (Gimpel and Shmeid 2019). Among the solutions are data journalism and MIL. Both are valuable tools that enable internet users to transcend the obstacles standing in the way of truth.

## Peace-building, Democracy, Social Cohesion, and Digital Media: Undeniable Connections

The rise of social networks has given billions of internet users the opportunity to express their opinions. Anonymously or publicly, locally or globally, and objectively or hatefully, the public has more freedom of expression than ever before (Carlsson 2016).

While society changes, some democratic ideals never do. One of these is the freedom to express oneself and interact with others through thought, speech, listening, and writing, as stated in Article 19 of the UN Universal Declaration of Human Rights. The media constitute the backbone of the free exchange of ideas; hence, press freedom is essential. Whether the media are offline or online, democracy depends on the plurality and independence of the media (Carlsson 2016).

Digital media are a melting pot of social and cultural resources that allow people to develop as individuals and members of a much larger community. As a result, sociality is consistently being transformed through the interactions between digital technologies and humans—and among humans themselves (Matamoros-Fernández and Farkas 2021). Needless to say, digital platforms are interwoven with societal engagements and interactions among people (Marlowe, Bartley, and Collins 2016). Whether in the public “town square” of social media or the private “living rooms” of chatrooms and messaging apps, individuals from all over the world can engage, link, and connect while miles apart, which ultimately boosts social cohesion between different communities in the virtual space.

Social cohesion has been defined as a “normative term to describe a positive state of social relations within a given locality or society to be strived for.... It can include consideration of belonging to communities or society or in feelings of attachment and identification with place; inclusion, in relation to opportunities to access labour markets, income support, community resources, education, health, and housing; participation in social activities, public space, community groups and, more broadly, civic life; recognition of different identities and the valuing of diversity; and the extent of legitimacy generated through confidence in public institutions” (Marlowe, Bartley, and Collins 2016. 3).

In essence, a strong relationship between media and government is imperative for the proper functioning of democracies. A democratic culture is one where people are given an equal chance to engage in the meaning-making processes that define who they are as people. Democratic culture is about both individual freedom and group self-government; it is about everyone’s ability to take part in the creation and dissemination of culture (Levinson and Balkin 2017).

Naturally, freedom of speech by way of the digital sphere is a vital sign of a healthy democracy. Simultaneously, access to information allows individuals some level of participation in the democratic process.

New media can boost democratization by giving citizens the tools to make informed decisions, which has the potential to ultimately catalyze social activism and cohesion (Bratic 2016). Furthermore, mass media and access to information allow citizens to hold decision makers and representatives accountable for their actions (USAID 1999).

While the social–digital nexus can enhance social interactions and ties among individuals, it can also exclude certain societies and create unequal opportunities for participation. This is particularly problematic for those who lack resources, which ultimately creates an uneven landscape of access to the internet and information, caused by socioeconomic status, geographic location, digital literacy, education levels, language barriers, and age (Marlowe, Bartley, and Collins 2016). Furthermore, excessive poverty, social injustice, inadequate education, gender, racial and religious discrimination, unemployment, and lack of access to healthcare are some of the reasons why not all citizens are in a position or in a condition to exercise their digital rights (Carlsson 2016).

Moreover, recent developments in digital mass media raise the question whether these new media praxes are emancipatory, as in allowing for a wide-ranging discourse with diverse perspectives and viewpoints, or hegemonic, contributing to ideological control (Miranda, Young, and Yetgin 2016).

Media manipulation has long been a perennial tool for oppressive regimes, allowing them to push specific agendas and influence public opinion by altering facts as they see fit (Turner 2018). This is especially true in developing nations, where attacks on journalists and free speech are most prevalent (Bratic 2016). Although information manipulation has a long history, its effect has been exacerbated in the last two decades due to the massive news consumption occasioned by social media and new technologies (Giusti and Piras 2021).

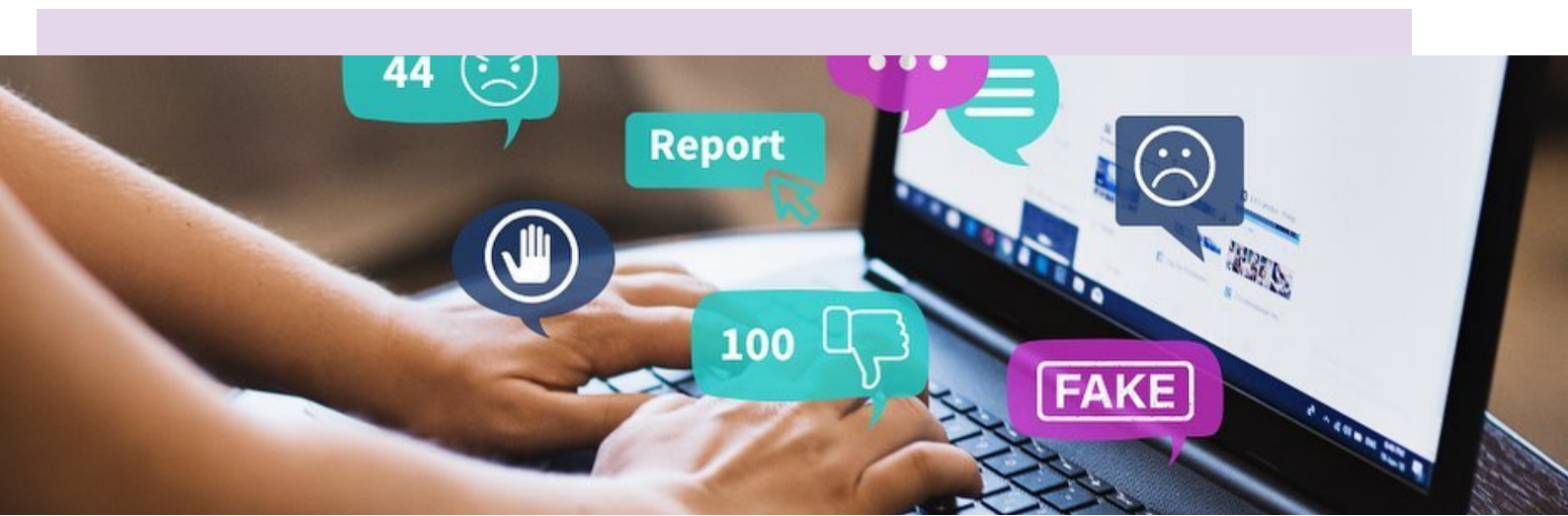


## Disinformation, Misinformation, and MIL

Regardless of its label, purveyors of disinformation, propaganda, or fake news often aim to push certain ideologies, make money, gain status, or shed light on certain issues. Multiple practices are employed to achieve these aims. Content can be circulated to disseminate certain propaganda using mainstream media, social media, or both in such a way as to maximize its reach. In parallel, fake news or disinformation can be spread by certain actors to make money or affect public opinion (Marwick and Lewis 2017). As disinformation, misinformation, and hate speech become ever more prolific on a daily basis, it is important to understand the differences and characteristics of each in order to join the fight against media manipulation. Intentionally misleading information, or disinformation, is defined as the product of a purposeful untruth, such as true facts rendered false thanks to lack of context, or truths that are jumbled with lies, which are used to deliver a certain message (Giusti and Piras 2021). It is used to purposefully deceive audiences without their knowledge. Disinformation is a serious threat to information quality (Fallis 2009). More often than not, disinformation is a carefully planned, intentional attempt at deception, and covers an array of practices: it can be a commercial, (geo)political, governmental,

or military activity. It is not necessarily always directly disseminated by the deceiver, as other institutions or individuals may fall victim to the deceit—news services may be utilized as the medium to transmit this information, with potentially dire ramifications. Furthermore, disinformation can come in written, verbal, visual, or other formats, such as concocted news articles, personal videos, doctored photographs, and forged documents. Many software applications and tools can be used to edit and manipulate pictures (Fallis 2009), and even create “deepfakes.” While disinformation certainly predates our digital age, it is undeniable that digital technologies have facilitated the process of creating and spreading disinformation on a massive scale. Usually, disinformation targets a person or a group of people, but it can also target machines or products (Fallis, 2009).

Misinformation, on the other hand, is “an incomplete, vague, misleading, or ambiguous piece of information.” Fake news is a more advanced form of misinformation that depends on the internet and social media to manipulate information in a specific and intentional way (Giusti and Piras 2021).





In the policy and strategy guidelines on media and information literacy published by THE United Nations Educational, Scientific and Cultural Organization (UNESCO) (Grizzle 2013), MIL is outlined as a compound concept that encompasses the requisite knowledge, skills, and attitudes to analyze media. Some have claimed that in order to accommodate the digital age, conceptualizations of what it means to be literate need to be expanded. The ability to use media technologies in the form of audio, graphics, digital stories, animation, video, and blended media is highly valuable. Furthermore, there is widespread consensus that being a citizen of the digital era requires an extensive skill set, including competency in technical, audiovisual, behavioral, analytical, and social domains (Reyna, Hanham, and Meyer 2018).

A number of factors have contributed to the growth of media literacy as a desirable skill set. First, the production of digital media is easier for amateur content creators than traditional forms of media, requiring as they did printing presses or camera crews and expensive distribution networks. Second, the growth and expansion of mobile and Wi-Fi networks have made the internet faster and more accessible. Finally, the digital media ecosystem on the internet has also grown thanks to the introduction of smartphones and tablets. These elements have given users a chance to change from digital media consumers into producers (Reyna, Hanham, and Meyer 2018).

More specifically, MIL allows world citizens to acquire a more complex grasp of the functions of media and other information providers in democratic societies and the conditions in which these functions can be fulfilled. The need for reliable information is also recognized. MIL also comprises knowledge pertaining to the critical analysis and examination of information and the ethical communication of this knowledge.

Alongside a perceptive conceptual grasp of media's role in a working democracy and the capacity to winnow sound information from spurious messaging, MIL is also the ability to apply ICT skills to process and evaluate information and engage with media and information providers to encourage freedom of expression, dialogue, and democratic participation (UNESCO 2013).

## The Role of Emerging Technologies and Innovation in Media

The subject of media entrepreneurship is receiving more scholarly interest within the field of media management. Even before the advent of the digital age, the media sector was known for its high level of entrepreneurial activity; nevertheless, this activity has not recently garnered much explicit scholarly focus (Achtenhagen 2017).

The innovation and digital media nexus have not been sufficiently explored or studied, despite their relevance in today's world. It is anticipated that researchers and scholars will pay more attention to media entrepreneurship and study different aspects of this phenomenon at various levels (Khajeheian, 2017).

Media entrepreneurship can be defined as "taking the risk to exploit opportunities (creation/discovery) by the innovative use of (radical/incremental/imitative) resources (ownership/control) with a view to transform[ing] an idea into activities to offer value (creation/delivery) in a media form (content/platform/user data) that meets the need of a specific portion of [the] market (businesses or consumers), either in an individual effort or by the creation of a new

venture or the entrepreneurial managing of an existing organizational entity and to earn benefit (money/attention/favorite behavior) from one of the sources that is willing to pay for [it] (direct consumers, advertisers, data demanders or any customer of generated information of consumers)" (Khajeheian 2017,).

## Categorization of Tools

Employing technology to fight disinformation is crucial. Happily, an abundance of open-source solutions and tools are readily available for innovators, technology experts, and journalists. Taking into account the regional nature of the project, understanding local languages and dialects is beyond valuable. Many local languages are used simultaneously in the MENA region, including Tamazight and Kurdish.

In the Western digital domain, it can be argued that English enjoys a considerable hegemony. Already a lingua franca long before the advent of ICT, it would seem that English's dominance has only been further entrenched by social media, attracting non-native speakers to itself at the expense of other European languages. In the Arabic-speaking domain, however, that situation is reversed. Although the majority of traditional media outlets utilize Modern Standard Arabic as their primary language, new media mainly rely on local dialects, which are heavily influenced by external factors, depending on the sociopolitical context of the region, not least of these factors being the influence of other languages like French (Tunisia, Morocco, Algeria, Lebanon), English, and Italian (Libya). Additionally, Arabic letters change their format based on their positioning and grammar (Kanan et al. 2019). Arabic's complex morphological system, peculiarities in the Arabic orthographic system, nonstandardization of the Arabic script, ambiguity, and lack of resources are some of the factors that lead to major complications when trying to analyze Arabic content (Shaalán and Raza 2009).

Taking into account the abovementioned complexities, an extensive set of tools is needed to facilitate language processing in the Arabic language, and hate speech and disinformation recognition in particular. Among these tools are tokenization and named entity recognition (Kanan et al. 2019). Below is a description of five of the main tool types fit for this purpose:



## 1. Machine Learning

Machine learning is one of the artificial intelligence (AI) branches, one that enables systems to learn and improve automatically without the intervention or assistance of humans. The ability to learn is attained by giving the machine training data and an algorithm with which to understand that data. The training data help the machine to explore patterns in the data and make the best decisions in the future (Kanan et al. 2019).

## 2. Natural Language Processing Tools & Language Models

The morphological richness of Arabic poses a challenge to natural language processing (NLP) tasks. However, language-specific models based on the bidirectional encoder representation from transformer Bidirectional Encoder Representations from Transformers (BERT) are useful tools with which to facilitate language understanding if they are pretrained using a large corpus (Antoun, Baly, and Hajj 2021).

Arabic NLP tools automatically analyze text to enable machines to understand human language. NLP tools are crucial for understanding Arabic data on the internet. Within the NLP process, many different tools need to be employed for data cleaning, stemming (reducing inflected words to their stem), sentiment analysis, understanding polarity, and more (Kanan et al. 2019).

A language model (LM) is a pretrained AI model that is able to predict words. LMs are provided with documents or language samples, in which words and syntactical relationships and functions are ranked based on probability of occurrence.

An LM is used for speech recognition, part-of-speech tagging, syntactic parsing, and information retrieval (Antoun, Baly, and Hajj 2021).

Bidirectional encoder representation from BERT is a LM that generates semantic vectors dynamically according to the context of the words. BERT architecture relies on what is known in the machine learning field as multi-head attention, which allows it to capture global dependencies between words (Alsaaran and Alrabiah 2021).

## 3. Datasets/Corpus

Corpus linguistic methods make use of a corpus, defined as a “representative sample of actual language production within a meaningful context and with a general purpose.” A data set, on the other hand, is a representative sample of a specific linguistic phenomenon in a restricted context and with annotations that relate to a specific research question.





Through supervised machine learning, the credibility of sources can be predicted and first verified for credibility through human intervention. The annotated corpus will then be used to train the data set and build automatic credibility classifiers.

#### 4. Named Entity Recognition (NER)

NER aims to locate, extract, and classify named entities into predefined categories such as people, organizations, and locations (Alsaaran and Alrabiah 2021). It is an instrumental tool in NLP research since it allows the identification of proper nouns in open-domain (i.e., unstructured) text. For the most part, such a system is simply recognizing instances of linguistic patterns and collating them (Shaanan and Raza 2009).

#### 5. Sentiment Analysis and Opinion Mining

Opinion mining (OM) and sentiment analysis (SA) are defined as the computational study of people's attitudes, opinions, and feelings regarding people, topics, or events. The terms SA and OM can have identical meanings. However, according to some academics, each conveys a slightly distinct approach. SA identifies and analyzes the sentiments behind texts in order to recognize opinions and classify polarity, whereas OM extracts text and analyses the opinions expressed (Medhat, Hasan, and Korashy 2014).

Through this study, the best open-source software and tools with which to counter hate speech and disinformation, promote peace, and boost MIL will be identified. Those digital technologies will then be utilized to create new solutions.





### III. METHODOLOGY

The study employed qualitative methodology to explore and identify a minimum of 60 tools and open-source software that could be used to create solutions that tackle disinformation and hate speech and encourage MIL.

Desk research was the primary form of qualitative research employed in this study, as by revealing ideas and viewpoints, it offers greater insights into the subject. Initial data on various types and subtypes of relevant tools were retrieved from an extensive search of various sources on the internet, such as scientific journals, and websites like GitHub and Hugging Face.

Taking into consideration the regional nature of the project, interviews were conducted with regional experts, both organizational and individual, in the fields of disinformation, fact-checking, hate speech, MIL, and ICT. All interviews were held online and averaged between 40 and 60 minutes. These one-on-one interviews allowed for a deeper understanding of the context in the different project regions, as well as an intensive exploration of the fields studied.

Based on the results of the initial research and the interviews, and once the data were collected, three main categories were established and divided into subcategories. First, a list of preexisting tools and open-source solutions was compiled. Second, a resource list of MIL tools that could be of assistance to project participants was compiled, and, finally, a list of tools that fight disinformation was collected from the RAND Corporation inventory, a nonprofit research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier, and more prosperous.

## 1. Open-Source Solutions and Preexisting Tools

### List:

The most functionally relevant categories of products and solutions were identified using the following headers:

- LMs:
  - a. All Tasks
  - b. Text Classification
  - c. Text Generation
  - d. Translation
  - e. Summarization
  - f. Question Answering
  - g. Name Entity Recognition
  - h. Conversational (chatbots)
- NLP/Natural Language Understanding (NLU) Frameworks and Libraries
- Data sets
- Online Classification Tools
- Language Utilities
- Computational Linguistics
- Community Work
- Computation and Hosting
- Commercial Services
- Know-How (simple tutorials, process overview)
- Resource Collections
- Research and Development
- Low-Resource Languages
- Miscellaneous/Other

Once the main categories were defined, a sheet was assembled to gather all the necessary information and resources to all the information and resources pertaining to each category necessary to assisting project participants in detecting hate speech, disinformation, misinformation, and fake news. This sheet will act as a comprehensive guide for each of the identified solutions. It includes each of the following pieces of information:

## 2. Directory of MIL resources:

In order to facilitate data compilation, a list of MIL resources was established, categorized as below:

- Data Journalism
- Digital Safety
- Booklets, Guides, Studies, and Reports
- Fact-Checking Organizations/Sites/Databases
- Fake Content Awareness
- General MIL Content
- Ethics/Governance/Inclusion
- Information Disorder

## 3. The RAND Corporation:

- Credibility Scoring
- Disinformation Tracking
- Verification

## IV. RESULTS

In brief, data were classified into two main categories: MIL resources and InfoDisorder tools. We utilized this approach in order to simplify the understanding of data and to employ it in different ways. MIL resources will be valuable for journalists, entrepreneurs, and ICT experts who wish to further their knowledge in specific areas, such as data visualization, data journalism, digital security, and advocacy on an individual level. Of primary and direct relevance to the project participants and stakeholders are the InfoDisorder tools, which encompass a vast array of mechanisms that could be used to create solutions.

A directory of open-source solutions and preexisting tools has been developed, which can be found at [dip.leadersinternational.org](http://dip.leadersinternational.org). In total, 101 relevant solutions and tools were identified from a multitude of resources. Additionally, 56 relevant tools were identified by the RAND Corporation and grouped into three main categories: Credibility Scoring, Disinformation Tracking, and Verification. Finally, 59 relevant MIL resources were included in a separate sheet.

After thorough research, it was concluded that the data would be presented in the following ways:

- Directory of solutions: The list of all compiled solutions and tools.
- Study: This study will be submitted as part of the final deliverable and will outline the methodology utilized to achieve the results.
- Website: All data will be presented on an online platform that is accessible and available to all. This site will target the general public and, more specifically, ICT experts and digital journalists.



## V. CONCLUSION


Irrefutably, journalism and the media have metamorphosed as a direct and indirect result of the technological advancements seen in recent years. The immense amount of data on the internet and its accessibility have afforded citizens unprecedented access to information, the ability to reach mass audiences nationally and internationally, and freedom of speech, all signs of a healthy democracy. Nonetheless, underprivileged people remain deprived of the basic resources required to access information, such as internet connections, computers, and mobiles.

Furthermore, we are challenged by the ever-increasing threats posed by digital journalism. disinformation, fake news, and hate speech are major issues that should be tackled, and MIL and innovation are some of the means that could be deployed to confront them.

Deploying a kind of digital pincer movement, undemocratic governments can turn digital media to their advantage. From one direction, fear-mongering practices by undemocratic governments hinder creativity and innovation among journalists, due to concerns over being shunned, attacked, or punished. And from another direction, these same governments can use digital journalism technologies to manipulate and control citizens.

Moreover, the concept of journalism in the regions targeted by the project is very traditional. This is due to many reasons; part of the problem could be credited to traditional teaching methods and outdated curricula in higher education systems. Consequently, journalism graduates in the MENA region rarely have sufficient familiarity with digital media to cope with the challenges posed by ever-changing advancements in digital media and come up with advanced technological solutions. Hence, the training structure proposed in the project should be adapted to cater to their specific needs. This could be done by attempting to fill in the gaps for each target group—for instance, by orienting journalists to a better-managed media landscape by equipping them with a set of digital journalism principles. To make matters worse, only a limited number of MIL institutions operate in the project region and are often advocacy-focused, such as 7amleh - The Arab Center for Social Media Advancement in Palestine. While various fact-checking entities do exist, they mainly rely on manual research; some of them are verified by the International Fact-Checking Network, such as Fatabyyano.





As for hate speech, data sets, which are composed of texts and classification; corpora, which are composed of complex or simple sentences (like those taken from Wikipedia, for example); and annotation/labeling tools are key to creating tools and solutions in that area. SA tools may not always be ideal, however, as the sentiment can superficially indicate positivity whilst in fact acting as hate speech.

Arabic, which is the language that is most spoken in the target region, is a very complicated language and necessitates the use of many tools to understand it. For instance, many BERTs have been developed to understand certain dialects. Compounding the matter is that technical support is very scarce for low-resource languages and minorities; Tamazight is a prime example of this, despite being spoken in Libya, Tunisia, and Algeria. Kurdish, on the other hand, is rarely spoken in the target regions but nonetheless needs to be incorporated in monitoring efforts.

Taking all this into account, technical ICT knowledge is crucial to ensuring project participants are able to effectively utilize the InfoDisorder tools, with the exception of online classification tools that could be easily used by journalists. The best approach to integrating journalism with technology would be to encourage entrepreneurs, ICT experts, and journalists to apply so they could exchange ideas and learn from one another's experiences.

To that end, the project will target impact- and goal-oriented individuals and attempt to harness and develop their digital, entrepreneurial, technological, and journalistic skills. By targeting profit-driven and impact-oriented individuals, we can guarantee the sustainability of the ideas created. To pursue activities successfully, themed segmentation of activities is preferred, which means that the activities will target a particular theme at a time: e.g., fact-checking and disinformation, or hate speech and MIL.

To conclude, as a result of the relative paucity of work conducted so far in the pertinent fields, many opportunities are available for entrepreneurs, ICT experts, and media professionals aiming to develop MIL and disinformation solutions in Arabic. It is acknowledged that journalists may face technical difficulties in implementing their ideas due to possessing limited digital know-how and the current lack of resources in Arabic. However, this project will go a considerable way to remedying these shortfalls and, more importantly, offers a credible suite of actions with which to confront a major threat to peace, stability, and human flourishing, both in the MENA region and worldwide.

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