Data4Good

Technology
Report

Dear readers,

Vienna is one of the top five ITC cities in Europe. The city contains about 6,200 ICT companies (8 per cent of all the companies in Vienna), generating combined annual sales of more than EUR 20 billion. The approximately 8,900 national and international ICT firms in the Vienna region (comprising Vienna, Lower Austria and Burgenland) are responsible for over two-thirds of total ITC sales in Austria.

According to various studies, Vienna is particularly strong in innovation, the comprehensive support of startups and its strong focus on sustainability. Vienna also features in the top places in many "smart city" rankings. The city is an impressive business location, providing a supportive climate for research and technology, geographical and cultural proximity to growth markets in the East, high quality infrastructure, an outstanding education system and, last but not least, the best quality of life in the world.

The Austrian capital has launched the Vienna 2030[1] strategy to focus on areas in which the city is already enjoying notable success, hoping to find solutions to the great challenges of the coming years – from climate change to digitalisation. Over the next ten years, the strategy aims to make Vienna a world leader and develop particularly powerful innovations ("Vienna solutions") in six key areas. A key theme is the digitalisation of Vienna, in which high-quality digital solutions from Vienna will gain international recognition for fairness, transparency, security and autonomy. The plan is for Vienna to become a city known for developing and implementing digital solutions, sustainably and inclusively engaging its population in a new philosophy of digital humanism.

The Vienna Business Agency functions as an information and cooperation platform for Viennese technology developers to ensure that the city's potential as a location is fully realised. The Agency assists companies to make connections with development partners and key customers in business, science and city administration, and supports Viennese companies with targeted funding and a wide range of consultancy and support services.

This Technology Report provides an overview of a wide range of trends and developments around the topic of Data4Good in Vienna, highlighting prominent experts, actors and activities in Vienna.

Your Vienna Business Agency team

Contents

Artificial Intelligence (AI) is increasingly seen as the key to solving global challenges, whether it is the application of the technology to cure cancer by analysing patient data, or to mitigate climate change by developing and analysing complex climate models. However, AI can also make a valuable contribution beyond purely commercial solutions and fundamental scientific breakthroughs in order to solve the problems of individuals or groups.

Data4Good is a movement that picks up where artificial intelligence and big data meet the common good and social innovation.[2] In this context, numerous social challenges need to be solved: for example, the fight against hunger, the fight for better health, but also issues such as education, security, justice, equality and integration.

1.1 Data Science, AI, Big Data, Open Data

Big Data and Artificial Intelligence are evolving into general-purpose technologies that are used in several sectors and have far-reaching effects on existing value chains and business models. The impact of these technologies on our lives and the global economy is now being compared to that caused by the introduction of the personal computer in the 1980s. Like the personal computer, AI will lay the foundation for an immense acceleration of innovation in the coming years, which will give the global economy a significant boost.

AI can be divided into "Narrow AI" (the ability to perform only one specific task) and "General AI" (a system that can handle any generalised task – like a human). Today, when we speak of AI in an application context, we are always talking about Narrow AI, which focuses on individual tasks. Thus, Narrow AI can identify chess games, dogs and cats on pictures, translate natural languages, etc. In many of these use cases it is superior to humans. However, tasks outside the spectrum cannot be solved. The chess computer cannot perform object recognition. Merging several Narrow AI also works only to a limited extent and cannot generate General AI. Narrow AI cannot think and has no consciousness. General AI is currently a pure research topic. If or when General AI can be achieved is not known.

The term Artificial Intelligence generally refers to systems that exhibit intelligent behaviour: By analysing their environment, they can perform various tasks with a certain degree of autonomy in order to achieve certain goals. Machine Learning is used as a method that uses algorithms to analyse data in order to learn from it and ultimately make statements or predictions.

The algorithm has to be trained for this – by means of classified training data sets. In this way the algorithm "learns" and can then apply the knowledge to unknown data (so-called supervised learning). Thus, data are currently the basis for applications of AI, but the exact decision pattern is unknown. Thus, AI is also a black box. A bias (unconscious prejudice) in the training data can thus easily lead to questionable decisions or predictions. Since the decisions of the AI are not comprehensible, there is a risk that existing prejudices will be reinforced. For example, Amazon used AI – at least in a test setting – to review applications from potential employees. This was done based on historical data. Since the working environment in tech companies is male-dominated and therefore the data is biased, female applicants who graduated from a women's college were rated worse.[3]

2
www.derbrutkasten.com/events/socialtech-data4good-by-wirtschaftsagentur-wien

3
www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G

Under the term "Explainable Artificial Intelligence", methods are to be developed that make the results of self-learning systems comprehensible to the user. An important impulse is also the basic data protection regulation (DSGVO). In part, a "right to declaration" is derived from this regulation. In this case, it must be explained to the data subjects how automated processing of the data has led to the specific result. However, this is not comprehensible with a black box procedure.[4] A further advantage of Explainable AI is that correlations can be shown that were previously unknown. A black box procedure would take these into account, but would not communicate the context as such.

○ Trustworthy AI:
Framework conditions for trustworthy artificial intelligence

In 2019, the Expert Group on Artificial Intelligence developed ethical guidelines for trustworthy artificial intelligence. According to these guidelines, artificial intelligence should comply with all applicable laws and regulations, take into account ethical principles and values, and do so from a technical perspective and with due regard to the social environment.[5]

In addition, seven key requirements have been formulated that AI systems must meet in order to be considered "trustworthy". These include the implementation of appropriate monitoring systems to ensure informed decisions. Technical robustness, security, privacy and data governance are also mentioned as criteria for ensuring legitimate and integral access to data.

Data, systems and business models should be transparent; diversity, non-discrimination and fairness should be ensured. This also has the effect that AI systems should be open to all people – an aspect that is particularly deeply rooted in the basic concept of Data4Good. Finally, responsibilities should also be clearly defined. For example, the verifiability and evaluation of algorithms, data and design processes also plays a key role here.

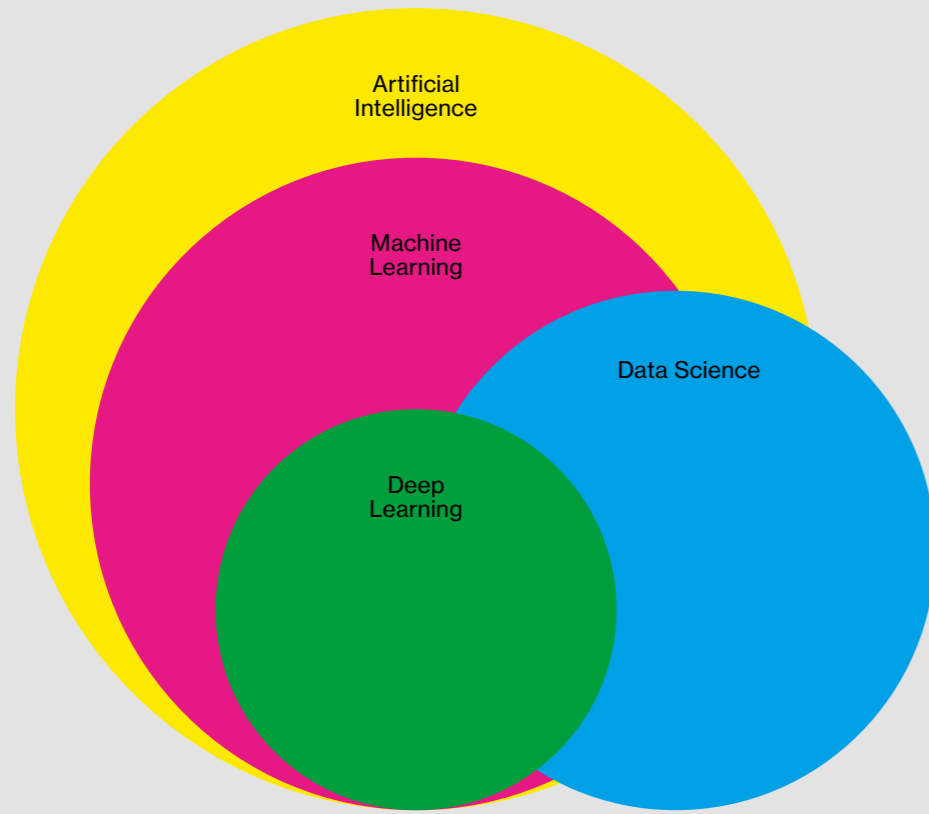○ Techniques and methods of machine learning

Thanks to advances in artificial intelligence, we increasingly use automated cars, speech recognition, and face and image recognition in our everyday lives. Machine learning and corresponding training data sets are the basis of these systems. AI is now so widespread that we probably use it dozens of times a day – without even knowing it.

With regard to machine learning, there are different techniques and methods that are used. Roughly speaking, one can distinguish between three sub-areas: "Supervised Learning", "Unsupervised Learning" and "Reinforcement Learning". Supervised Learning requires known data that already contain a logic and to which a new data set can be applied. Examples are chatbots or speech recognition software like Alexa or Siri. Unsupervised Learning, on the other hand, is suitable for supervised learning if no known, logically structured data is available for practice – this is the case in the area of customer segmentation, for example. Reinforcement learning is ultimately a less important type of learning in the economy. The idea here is to reward (and thus promote) successful behavior while suppressing the behavior that has led to undesired results.

Deep Learning – also known as Deep Neural Networking or artificial neural networks – goes one step further and focuses on a narrower subgroup of AI. Deep Learning goes deeper into data and trends to draw conclusions, such as which movies Netflix should recommend to users based on metrics such as viewing habits, length of stay and ratings. It is expected that the growth of deep learning models will continue to accelerate in the coming years, creating even more innovative applications.

In the past, there have always been highs and lows in the discourse on and use of artificial intelligence. In the "Golden Years" from 1956–1974, the findings in this area were groundbreaking for the time – computers solved algebra problems, proved theorems in geometry and learned to speak English. However, the rapid progress only lasted until the mid-1970s. The first "AI Winter" from 1974–1980 was characterized by the fact that AI researchers had not recognized the extent of the problems they were confronted with. Investments in this area were dramatically cut back as a result. It was not until 1980 that there was a further boom – favoured by massive investment in Japan and ground-breaking innovations in the field of expert systems (computer programs that can help people solve problems like an expert). The business world's fascination with AI grew in the 1980s in the classic pattern of an economic bubble. A second "AI Winter" followed from 1987 to 1993.

Many of today's machine learning methods have therefore been around for decades. But it is only through cloud computing that the huge data stocks required for AI are centrally available. In addition, the massive growth in computing power, also through the use of GPUs (graphics cards), has made the breakthroughs of recent years possible. Better algorithms and widespread investment by tech giants such as Google, Amazon, Facebook and Microsoft are further factors that explain the current upswing in this area. However, it is foreseeable

4
www.heise.de/newsticker/meldung/DSGVO-und-KI-Unvertraeglichkeiten-beim-Datenschutz-4049785.html

5
www.ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai

Artificial Intelligence

Machine Learning

Data Science

Deep Learning

1.2 Artificial Intelligence & the Sustainable Development Goals (SDGs)

In order to make an effective contribution to the general good, computer science tools must be developed in such a way that they are unbiased and do not exclude certain population groups. A central idea of the Data4Good Initiative is therefore to make mostly cost-intensive data science services more easily accessible to NGOs, social entrepreneurs and civil society actors and to contribute to the dissemination of the data science approach and a positive social impact. Often, it is necessary to overcome ignorance about the potential benefits and a lack of resources.

Big Data is also the key to understanding how to achieve sustainable development goals of the United Nations. In this sense, Sustainable Development Goals (SDGs) are indicators for social development, while artificial intelligence gives us the means to make sense of large amounts of data and contribute to a generally sustainable improvement of society.

The overlap of the two topics Data Science and Sustainable Development Goals has recently received considerable attention in public discourse.[6] The "AI for Good" congress – initiated for the first time in 2016 by the United Nations and held annually since then – has contributed greatly to this. In the course of this event, politicians and AI experts from industry, science and organizations active in various fields deal with how Artificial Intelligence can contribute to the well-being of society in the long term.

In the study "Notes from the AI frontier: Applying AI for social good," the McKinsey Global Institute (MGI) examined how AI can be used in the fight against hunger and for better health, as well as in issues such as education, security and justice, equality and integration. Based on around 160 social and societal use cases, the study concludes that AI skills such as machine vision or natural language processing (NLP) can bring about far-reaching improvements in all 17 UN sustainability goals.[7] AI technologies are particularly effective in addressing challenges in the areas of health, peace, justice and strong institutions and education.[8]

The Global Partnership for Sustainable Development Data is a global network dedicated to ensuring that new opportunities for data revolution are harnessed to achieve sustainable development goals. Partners from various governments, the private sector and civil society work together to mobilize political determination, build trust and stimulate innovation. Since the network was founded in 2015, new incentives have been created for financing and sharing information. The vision of the partnership is a world in which the opportunities of the data revolution are available to all of humanity. To achieve this, data should be used more openly, effectively and efficiently to ultimately improve the lives of all people.[9]

that the current hype will also come to an end. "General AI" is still a long way off. "Narrow AI" will be another evolutionary step in software development and will soon be accepted as a standard.

○ Data as basis for Artificial Intelligence & Machine Learning

Data is essential for the application of machine learning. Here, "Big Data" is both a prominent buzzword and a prerequisite for innovations in the field of AI. Already in September 2008, the science magazine "Nature" put the term "Big Data" on the cover of a special issue. However, it took several more years before the topic had reached the market. "Big Data" means more than huge amounts of data: It is the volume of data, the speed with which data is processed (velocity), the truthfulness (veracity) and the variety of data (variety) that, when properly used, result in the value of the data (value). Big Data extracts correlations from a wide variety of data. Recognizing patterns and interpreting them correctly can give you the decisive competitive edge today.

Data must also be current, accurate, complete and consistent across multiple stages of a production process. Increasing computing power and capacities of computers as well as improved machine learning approaches and algorithms further promote the progress of innovation. Regardless of whether we are talking about explosively growing mountains of data within companies, "free" data in social media or "open" data in the public sector: According to experts, data is becoming the oil of the knowledge society and is the essential driving force in the field of artificial intelligence.

The amount of data available in Western Europe doubles every 2.5 years. From 2012 to 2020, the "Digital Universe" will grow from 538 exabytes to five zetabytes, an increase of more than 30 percent per year. 58 percent of the information comes from private individuals. Companies account for a somewhat smaller share of 42 percent of data creation. Hand in hand with this development goes the trend towards Big Data and Open Data. Open data or Open Data (OD) refers to data that is made available for free use as raw data in standardized and machine-readable form. The term Open Government Data (OGD) explicitly refers to the public sector. Pioneers in Open Government Data (OGD) – the provision of administrative data by public authorities for use by citizens, business and science – were the USA, Australia and Great Britain. "When in doubt, openness should prevail," says a memorandum on the US Freedom of Information Act, which was published on Barack Obama's first day of work in 2009. After that the hype about OGD quickly spilled over to Europe. In this context, the first Austrian conference on open data, the Open Government Data Conference 2011, took place in Vienna in 2011. Vienna was the first German-speaking city with its own open data portal. Today the city of Vienna provides almost 500 open data sets and about 500 applications based on Open Data can be found on data.gv.at. The portal data.gv.at creates a central "Austria" catalogue and makes the metadata of the decentralized data catalogues of the administration in Austria retrievable and searchable. According to experts, the trend towards Open Data could develop into a driver of innovation and, in the long term, hold macroeconomic potential worth billions. However, so far it appears that the first steps have been taken rather than an economic breakthrough in this area.

6
www.datapopalliance.org/item/reflections-on-big-data-the-sustainable-develop-
mentgoals-measuring-achieving-development-progress-in-the-big-data-era

7
www.sonnenseite.com/de/zukunft/wie-kuenstliche-intelligenz-armut-
bekaempfen-kann

8
www.mckinsey.com/featured-insights/artificial-intelligence/applying-artificial
intelligence-for-social-good

9
www.data4sdgs.org

1.3 Data Science & Social Business

Social entrepreneurship generates attention in the world of economy and social justice. With the introduction of data science, this endeavour has accelerated. Moreover, to achieve the true goal, a high level of investment and awareness of this concept is required. Social entrepreneurs quickly realized that the use of data is an important prerequisite for being more efficient and for standing out through innovative solutions. New users, who are increasingly combining expertise in the social sciences with programming skills, are also increasingly moving into the emerging field of social data science.

Numerous members of the TechForGood community – such as Tech for Good Global or the Good Things Foundation – have already racked their brains over principles, challenges and theories of technological change. TechForGood is supported by committed actors who convey an alternative vision of the use of digital technologies for the common good. As a UK registered charity, the Good Things Foundation has three main strategic objectives: To reduce the extent of digital exclusion across the UK, to improve people's lives by opening up the wide range of learning opportunities offered by digital technology, and to address social challenges through digital technologies.

Does technology give people power and freedom of action? Is it developed responsibly? Who is excluded from its use? The Data4Good approach is based on these questions, questioning the application of machine learning from the perspective of fairness, transparency and impartiality, and taking a common good perspective.

Among the established initiatives in this context are DataKind, Bayes Impact, Data Science for Social Good (DSSG), AI4All, hack4impact and Correlaid. DataKind is a global non-profit organization that uses data science and artificial intelligence to serve the public good. Correlaid is one of the oldest organizations in this field and has been in existence since 2011. Correlaid also brings data scientists together with social organizations to initiate joint projects. With a decentralized network of 850 data scientists, the potential for advanced data analysis is democratized to support a broad dialogue about the potential and limits of data science in civil society.

The new technologies could help hundreds of millions of people in both developing and industrialized countries and provide low-threshold access to data science. The AI for Good Foundation, a non-profit charity with several offices in the USA, Europe and New Zealand, is also active in this area. The foundation was established in 2015 by a team of female machine learning researchers and social scientists in the US and Europe and plays a leading role in addressing issues at the interface of scientific research, social impact and sustainable development.

1.4 Data4Good use cases

The potential to create non-profit applications with data analysis is still not fully exploited. Nevertheless, numerous examples show how diverse the applications of modern data analysis by civil society organizations can be.

Data Science can be used to analyse how effective measures taken by social institutions are. During a series of training courses for socially disadvantaged citizens, it was recognized that participants often drop out of the program shortly before the end of the training. Analyses showed that with certain characteristics they are more likely to give up. With this knowledge, the training provider can now proactively approach these people and keep them in the program.

GiveDirectly was able to identify poverty conditions in Kenya. Data scientists helped to create a system that automatically recognizes the type of roof on satellite images, so that poverty levels could be estimated. Amnesty International was also able to benefit greatly from the targeted use of Data Science in the fight against human rights violations. In this context, data scientists have identified patterns that indicate which cases have escalated into crises in the past. In the meantime, these patterns can be used to estimate an urgency level for newly incoming cases, which significantly optimizes the process of responding to requests for assistance.

Data Scientists can also perform statistical analysis using existing data sets to analyse and visualize the effect. In this context, the Chicago Alliance to End Homelessness wanted to find out which of its programs was having the greatest success. Data Scientists defined success metrics and visualized the results – a measure that can confirm the effectiveness of certain measures and thus convince potential donors. The ability to recognize patterns in existing data sets can also be used to establish early warning systems. DC Central Kitchen – a U.S. nonprofit organization that fights hunger and poverty through education and job creation – was able to take proactive measures to prevent certain participants from dropping out of their program by analysing their data.[10]

Many NGOs fear that they are not ready for Data Science or Big Data. However, the application examples outlined here make it clear that NGOs and social enterprises that do not consider themselves data companies also have enormous opportunities through Data Science and that the potential for civil society organizations here is far from exhausted.

10
www.blog.dssg-berlin.org/datenanalyse-f%C3%BCr-das-gemeinwohl-e964566cdd99

1.5 Data donation

In the age of Big Data and AI, large amounts of our personal information are collected and stored by third parties, which is invaluable to government and private organizations. However, there is now a growing interest in using data to generate public goods in order to contribute to the common good. Data collected in this way can help to better determine the nutritional causes of diseases such as asthma and diabetes. To do this, however, it is also necessary to understand the motivations for voluntary data donations and to create appropriate incentive structures so that data does not remain in private hands alone.

The funding and promotion of social data projects through traditional grants can enable organizations to scale their solutions and reach a wider audience. Private actors can also donate data or know-how through "data philanthropy". This can happen on open data platforms, for example, which can also help to identify possible gaps and potential. An example of this is 360Giving or the Open Data Monitor.

As part of i-PROGNOSIS, for example, a smartphone app was offered that can be downloaded free of charge from the Google Play Store and calls on people with and without Parkinson's symptoms to donate data.[11]

A donation makes it possible to support the early detection of idiopathic Parkinson's syndrome by using technical devices of daily life (cell phones, smart devices).[12]

So-called Online Data Science Competitions provide a relatively barrier-free entry into the world of Data4Good. Kaggle is probably one of the best-known data science competition platforms here – it is also home to numerous competitions that deal with social problems, such as the detection of diabetic retinopathy or the prediction of soil properties in Africa. Another new competitive platform is DrivenData. This platform focuses exclusively on social challenges and thus makes a significant contribution to the common good. This included the IBM Big Data for Social Good Challenge.[13] As such, the platform works at the interface of data science and social impact in the areas of international development, health, education, research and nature conservation.

1.6 Relevance for the economy

Artificial Intelligence and Big Data find possible applications in connection with the social entrepreneurship approach. Social Entrepreneurship is an entrepreneurial activity that is innovative, pragmatic and long-term oriented towards solving social problems or, more generally, towards a significant, positive change in society (so-called meta-economic goals).

Social enterprises have set themselves the goal of meeting the increasingly complex challenges of our society, such as poverty, unemployment, social exclusion, etc., with creativity, innovation and entrepreneurial spirit. They differ from CSR and other activities of purely profit-oriented companies in that the solution of a social problem is the central goal of their activities. This entrepreneurial trend is particularly evident in steadily growing metropolitan areas such as Vienna. More and more profit-oriented companies are also addressing this issue. Thus, Social Business will make a significant contribution to the functioning of our civil society in the future. The fields of activity for which social entrepreneurs create solutions include Poverty, social exclusion, aging societies, youth unemployment, climate change, migration, social conflicts, lack of democratization, securing social systems, neighbourhood, local supply, waste avoidance, inclusion. Here technology can help everywhere to achieve these goals.

The following indicators exist for assessing whether companies can be assigned to the area of social entrepreneurship:

- Solving social problems sustainably is an important corporate goal.
- Entrepreneurial action is used to achieve these goals.
- A responsible and transparent approach is part of the corporate philosophy.
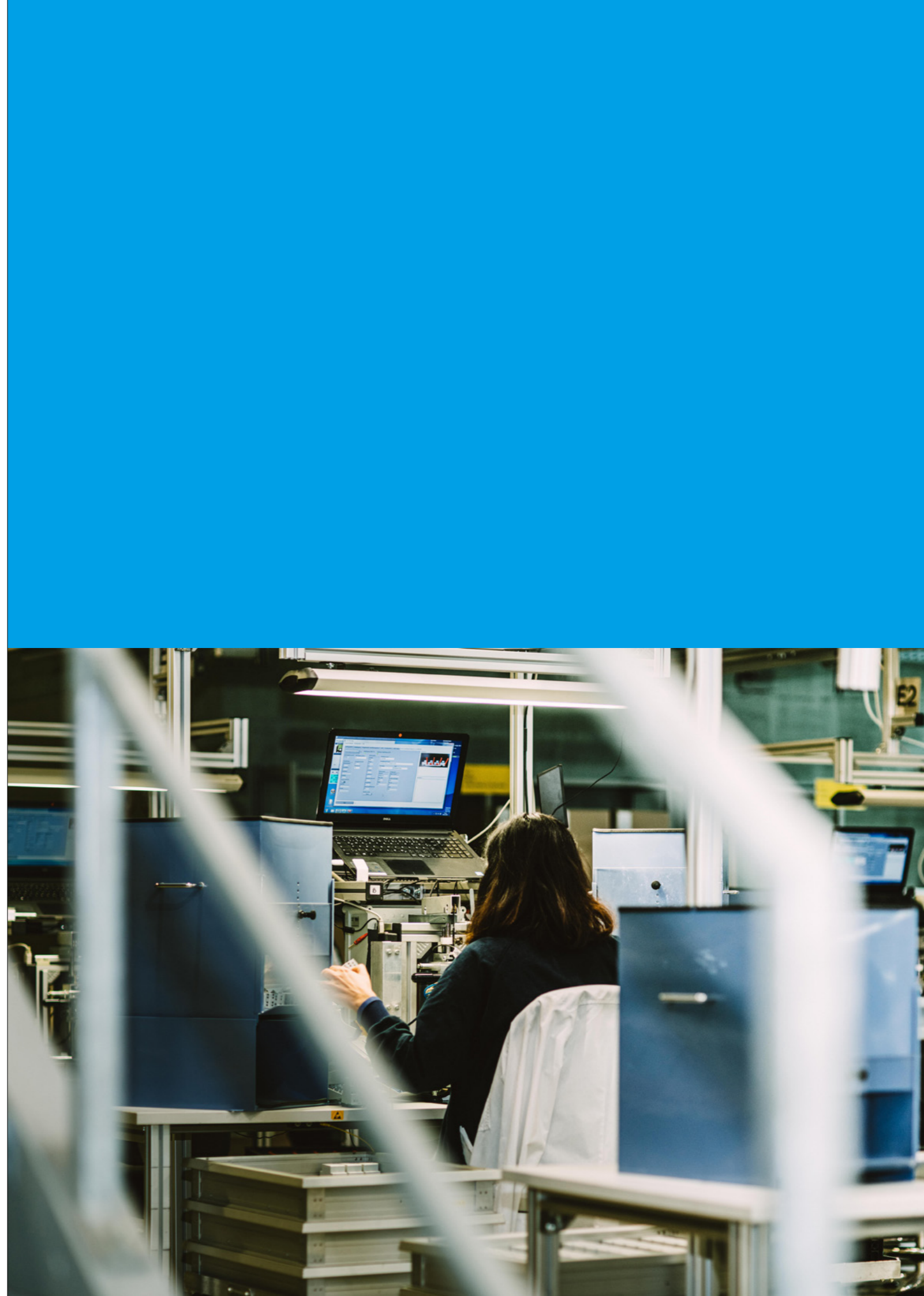- Innovative solutions are inherent in the strategy to achieve the goals.

11
www.socialinnovationexchange.org/insights/blog-how-philanthropy-can-support-growth-data-social-good

12
i-prognosis.eu/wp-content/uploads/2018/12/i-PROGNOSIS_PR_App-Release-AT_December-4-2018.pdf

13
www.kdnuggets.com/2015/07/guide-data-science-good.html

The strategic orientation of the City of Vienna with regard to projects and activities in the field of information and communication technology is defined in the Digital Agenda Vienna, which was first adopted in 2014. In this Agenda, Vienna is openly, actively and critically examining current digitization trends and attaches great importance to a lively culture of participation by inviting citizens to submit their proposals in an ideas forum.

The Digital Agenda Vienna 2025 has set itself the goal of making Vienna the digitization capital. Artificial intelligence is an important topic in many areas here. Ideas and opinions on the topic of AI were also collected here, for example, in the course of the online participation platform www.partizipation. wien.at. The Digital Agenda of the City of Vienna is also based on the Smart City Vienna Framework Strategy (SCWR), in which the use of Artificial Intelligence for resource conservation and maintaining a high quality of life has already been defined.

In order to exploit the potential of using methods of artificial intelligence, a strategy of the City of Vienna was developed with the aim of identifying AI use cases to increase the efficiency of existing processes as well as new services, thus taking Vienna a further step on its way to becoming the digital capital. It is of particular importance to the City of Vienna to always use artificial intelligence under consideration of ethical and moral principles and the highest possible security and economic efficiency.

Artificial Intelligence has a noticeable impact in Vienna, especially in the areas of public transport, health & care, education and public safety. The city pilots Artificial Intelligence use cases in the areas of image recognition (e.g. video analytics), intelligent text analysis (e.g. natural language processing), smart chatbots, detection of anomalies in audio and video recordings (e.g. predictive maintenance) and time series analysis for forecasting using AI.

The Participation Portal of the City of Vienna[14] offers all citizens the opportunity to submit their own comments and ideas – for example with regard to various use cases, improvements in work processes or any concerns they may have. One of the most popular ideas of this initiative is an information system for passengers of the Wiener Linien, which is designed to tell them where to position themselves on the platform to get on the subway in comfort. The suggestion for a chatbot, which is supposed to answer questions about official channels, was also well received by the citizens.[15]

Through the open and participatory approach of the city, an attempt is made to orientate itself to already existing "best practices" from other cities and to take public opinion and acceptance into account. With regard to Open Government Data, Vienna is already the leader among German-speaking cities – not least because of the early start of the data portal, the good quality of the data sets and the geo-referenced data sets and real-time data of Wiener Linien. Every year, Vienna also hosts the Open Data Day, which focuses on open and freely available data.

The program "Wien gibt Raum" also uses methods of data analysis. Modern "mobile mapping" technologies are used here in the course of driving around the city, enabling precise photographic recording and further measurement of public space.[16]

Here, the Data4Good approach ties in with the Digital Agenda of the City of Vienna, as it places the individual and the common good at the centre of the digital transformation. In addition, the Austrian Society for Artificial Intelligence (AI Austria) and Urban Innovation Vienna jointly organize networking meetings and workshops to link Viennese actors and the Viennese administration. Among other things, a networking meeting on the topic of AI and mobility in the city took place within this framework. Projects such as the autonomous "auto.bus" of the Urban Lakeside or the mobility data management of the AIT Center for Mobility Systems were presented.

14
www.partizipation.wien.at/en/consultation/kuenstliche-intelligenz-ideen-und-vor
schlaege-fuer-die-stadt-wien

15
www.trendingtopics.at/diese-ai-loesungen-wuenschen-sich-wiener-von-ihrer-stadt

16
www.digitales.wien.gv.at/site/projekt/wiengibtraum

2.1   Digital Humanism

In Vienna the topic Data4Good is also discussed within the broad discourse on digital humanism. Digital humanism is based on the observation that today's technology in its global dimension is a culture, by creating a new context on a global level. Many researchers therefore assume that there is a step-in evolution that they consider to be co-evolutionary between humans and technology. The challenge here is to maintain the balance between civilizational and technological progress. In short, it is about a shift away from "computer-literate people" to "people-literate technology".

Vienna is not the only city with the intention of becoming the digital capital of Europe. From its intellectual and political traditions, however, Vienna can credibly score points with its claim to stand for digital humanism and its concerns. With schools of thought such as the Wiener Kreis or psychoanalysis, the city of the world has already triggered a revolution of thought. Digital humanism is the next step in this development, and Vienna is the ideal breeding ground for it and is well connected with the formal sub-areas of ICT, especially at the Vienna University of Technology (e.g., the "Digital Humanism"): Explainable Artificial Intelligence, which is also well compatible with the demands of digital humanism in terms of social values such as transparency). The Austrian Council for Robotics and Artificial Intelligence has also addressed the topic of ethics in the white paper "Shaping Austria's future positively with robotics and artificial intelligence" and declared it to be the guiding principle for the discussion of the topic.[17]

With regard to bias and discrimination, Artificial Intelligence requires great caution. The IEEE (Institute of Electrical and Electronics Engineers), for example, offers to have an algorithm ethically certified and has developed its own certification program (ECPAIS) for this purpose. The goal of the Ethics Certification Program for Autonomous and Intelligent Systems is to provide specifications for certification and labelling processes that promote transparency, accountability and reduction of algorithmic bias in autonomous and intelligent systems. This certification program is also highly relevant for Vienna. "We see great value in what ECPAIS is developing in the important field of ethics for autonomous intelligent systems. We consider the results of the first program phase to be very promising", said Dr. Dietmar Schabus, data scientist at Wiener Stadtwerke, Austria's largest municipal infrastructure provider, which is owned by the City of Vienna. "Vienna is one of the most successful cities worldwide when it comes to quality of life, infrastructure and innovation. Our goal is to maintain this position in the coming times. As a city that is very people-centred and digitally oriented, we see working on ethical aspects of autonomous and intelligent systems like ECPAIS as fundamental to this strategy."

2.2   AAL

The goal of Ambient Assisted Living (AAL, also Active and Assisted Living) is to maintain or improve the quality of life of older people through information and communication technologies (ICT) and to support their independence, especially in their own four walls. Here, too, data science and artificial intelligence can contribute to new and better solutions.

A good example is the Viennese company cogvis. The cogvis GmbH was founded in 2007 as a spin-off of the Vienna University of Technology. Core competence is the analysis of content in images and 3D data (using AI). This expertise has been built up by the researchers of the faculty of computer science in several research projects. The original idea was the prediction of bank robberies – certain patterns of movement should be detected by surveillance cameras and identify persons who are most likely planning a bank robbery. This was not feasible because bank robbers apparently do not differ from other people by their movement patterns. After further experiments in the security sector, the company specialized in automatic fall detection in nursing homes and assisted living facilities. The main product is "fearless – the intelligent fall sensor". The system automatically detects falls and also helps to prevent falls. It is not necessary that a sensor is worn on the body or that an activity is set by the fallen person. In other words, the residents no longer have to press any alarm buttons. A 3D sensor is used, which is mounted like a lamp in the room. This sensor collects data and the AI automatically detects whether a person has fallen. In the meantime, the danger of falling can also be detected in advance, thus achieving a preventive effect. Data protection is very relevant in such a sensitive area. On the one hand, the sensor only captures a 3D model without a surface, and on the other hand, the entire data evaluation takes place locally on the device – only the alarm message "leaves" the device. The development of the fall sensor was funded by the Vienna Business Agency and the FFG, followed by a private investment in 2018.

17
gmbh.wwtf.at/wwtf_gmbh/studies/index.php?ID=9383

2.3 Further fields of application

The area of medical research and application is probably one of the most important for Data Science. There is hardly any other area in which so many breakthroughs can be achieved. However, in this report this topic will be excluded, because this would go beyond the scope of this report. The Viennese company contextflow is a good example. Contextflow was founded in 2016 as a spin-off from the Medical University of Vienna. The company offers an image search engine for radiologists to produce more accurate and faster findings. The technological basis for this is an image analysis based on AI. This allows reference cases and diagnoses to be found quickly. The basis was an EU research project at the Medical University of Vienna, which dealt with the automated evaluation of MRI and CT images. Contextflow is an alumnus of the academic incubator INiTS and has received funding from the Austria Wirtschaftsservice Gesellschaft (aws) and the Vienna Business Agency. In 2018 the first investment round took place.

Further information on Life Sciences can be found in the Austrian Life Sciences Directory.[18] Other initiatives include the Health Hub[19] and health.digitalcity.wien.[20]

Another area in which data-driven approaches are promising is the fight against climate change. Data science helps to better understand impacts and phenomena and also enables new innovative solutions. The Climate Tagger tool is another interesting example, where data management is the main focus. Climate Tagger automatically scans, sorts and catalogues data and document collections to help knowledge-based organizations in the fields of climate and development to optimize the handling of information and make it available to the broader climate knowledge community. Companies that provide climate-related information can implement the Climate Tagger as a highly accurate content classification service and enrich their digital assets with consistent metadata. Partner platforms can also exchange data via the Climate Tagger and link it to their own content.[21] Especially in the field of climate protection, Vienna also offers very interesting solutions that work with simulations. For example, GREEN PASS makes the effects of green infrastructure and other structural measures on the urban environment visible, measurable and comparable. Microclimate simulations are used for this purpose. The Viennese company UBIMET provides high-resolution weather forecasts and offers disaster and severe weather warning systems.

The World Data Lab (WDL) is a data company working on the revolutionization and democratization of Big Data. The Viennese NGO produces consistent and accurate estimates for spending and demographics. The data models are global, detailed and future-oriented and pursue the goals of sustainable development in real time.[22]

2.4 Initiatives & Networks

Vienna offers a wide range of initiatives, funding and networks in the broad field of Artificial Intelligence, but the topic Data-4Good has only recently gained importance in this context. Network meetings on the topic of Data4Good, where non-governmental organizations, companies, researchers and the interested public get to know each other, lead to the establishment of an awareness of the potentials beyond commercial use.

○ Complexity Science Hub Vienna (CSH)
With the award of "Scientist of the Year 2017" for Stefan Thurner, the "Complex Systems" science division in Austria was given further recognition. The exciting thing about complexity research is in particular the fact that it is now possible to understand these systems in such a way that partly reliable predictions can be made.

The Complexity Science Hub Vienna (CSH) was founded by Stefan Thurner and is an association for the scientific investigation of complex systems with its headquarters in Vienna. The goal of the organization is to welcome, train and inspire systems scientists to collect large amounts of data and to understand them in a meaningful way. Cooperation partners include the Graz and Vienna Universities of Technology, the Medical University of Vienna and the Austrian Institute of Technology (AIT).

The International Institute for Applied Systems Analysis (IIASA) conducts interdisciplinary research in the fields of environment, economy, technology and population with regard to the human dimension of global change. With the help of applied systems analysis, IIASA works to find help in solving global and universal problems for the benefit of people, society and the environment and to make the resulting findings and guidelines available to political decision-makers worldwide.

18
www.lifesciencesdirectory.at

19
www.healthhubvienna.at

20
www.health.digitalcity.wien

21
semantic-web.com/wp-content/uploads/2017/05/CustomerSuccessStoryREEEP.pdf

22
www.worlddata.io/who-we-are

○ Data Science Society
The Vienna Data Science Society sees itself as a student-led community for self-directed peer-to-peer education in Machine Learning and Data Science in Vienna. The community provides a place for discourse, learning and creation for Vienna's data scientists and companies in the field of Big Data and AI. In weekly meetings, interested people work on their own creative projects and they also have the opportunity to give lectures and provide input to exchange ideas in the community.

○ Homo Digitalis
Homo Digitalis – Wiener Kreis zur Digitalphilosophischen Anthropologie is a discussion group with time-critical literature in a relaxed atmosphere. Peter Reichl (Cooperative Systems, University of Vienna), Christopher Frauenberger (Human Computer Interaction Group, TU Vienna) and Michael Funk (Media and Technology Philosophy, University of Vienna) discuss various topics in the field of Artificial Intelligence.

○ Open Data Portal Austria
The Open Data Portal Austria is a cooperation of Wikimedia Austria, the Open Knowledge Foundation Austria and the Cooperation OGD Austria. It is a catalogue for all open data that is not public administration data: This includes data sets and their description (metadata) provided by civil society, science (Open Science), business, art and culture (Open-GLAM) and NPOs/NGOs. The project follows the Open Data principles of the Cooperation OGD Austria and is a supplement to the Open Government Data Portals. The project is not for profit – the data and project results are made available on opendataportal.at under the free license CC-BY AT 3.0 and can also be used commercially.

○ Open Government-Platform Vienna
The exchange between the City of Vienna and the OGD community is intensive. A direct communication channel through the City of Vienna has been established with its own platform: Administration, interested citizens, the community as well as business and research meet regularly for personal information exchange. There are also meetings for developers: The City of Vienna and Wiener Linien invite you to feedback meetings.

○ Open3
Open3 is an open, non-profit network to promote Open Society, Open Government and Open Data. According to its own statements, the association tries to position itself as a mediator between politics, administration, population and economy and to enable the transfer of knowledge in all directions. Several projects have already been developed within the framework of Open3. Members and interested parties are offered networking activities, information transfer and an event directory.

○ Vienna Data Science Group (VDSG)
The Vienna Data Science Group (VDSG) is a non-profit association that promotes the dissemination of knowledge on current topics in data science. The initiative regularly organizes hackathons, workshops and other events, thereby networking data scientists from various fields of research and industry. Current topics are discussed at the monthly meetings of the VDSG. For the first time in Austria, the VDSG has organized hackathons on the topic of Data4Good to bring the potential of Artificial Intelligence closer to NGOs. Through this initiative, solutions for the non-profit portal Gruen-StattGrau, for Hilfswerk International as well as for Cive-Solutions, a social enterprise with the goal of strengthening democracy and governance through citizen participation, have been developed.

○ Vienna Deep Learning Meetup
The Vienna Deep Learning Meetup is located at the interface between research and industry and focuses on novel methods as well as interesting new applications in the start-up and industrial world. Lectures from the fields of science, startups or industry will be complemented by tutorials on software frameworks and on the use of Deep Learning in practice.

○ Vienna Semantic Web Meetup
The Vienna Semantic Web Meetup meets regularly to discuss applications about the Semantic Web, the Web of Data and the effort of "Linking (Open) Data" of the W3C. Furthermore, possible scenarios of a "Future Web" and the possible benefits of the Semantic Web for end users and enterprises are discussed. The meetings act as a hub between science, research and industry.

○ World Summit Awards
The WSA Global Congress is an international congress initiated by the UN, which has already been held twice in Vienna. Digital innovations with social impact are presented. The WSA is attended by a worldwide community. Three Viennese projects were also presented at the WSA Global Congeress 2020. Artivive was awarded with the project "bring Art" in the category Culture & Tourism, SignTime with the sign language software SiMAX in the category Inclusion & Empowerment and the City of Vienna with the project "Wien gibt Raum" in the category Smart Settlements & Urbanization.

Services of the Vienna Business Agency

The objective of the Vienna Business Agency is the continuous development of international competitiveness by supporting both Vienna-based companies and their innovative strengths, and the sustainable modernization of the city as a business location. To achieve this, the Agency provides free consultations to all entrepreneurs in Vienna on the topics of business creation, business location or expansion, business support and financing. Furthermore, networking contacts in the Viennese economy are also made available.

The Vienna Business Agency supports and helps businesses complete their research and development projects with both individual consulting and monetary funding. Depending on requirements, they will receive information about sponsorships, financing opportunities, possible development partners, research service providers, or research infrastructure, according to their needs.

The Vienna Business Agency sees itself as a network of the Viennese Green Tech & Social Tech industry and supports businesses with consultations, as well with distribution and networking among themselves. Events and workshops on topics from the sustainability sector are held regularly.

Additionally, the Vienna Business Agency helps with company relocations or internationalization services. Assistance is provided to business founders and young entrepreneurs in the start-up area. Free workshops and training sessions on topics of everyday business are offered as well as small, affordable office spaces.

Founders Labs[23] support aspiring entrepreneurs and founders with a two-month, part-time program to help them get started.

All funding programs of the Vienna Business Agency can be found here: viennabusinessagency.at/funding/programs

23
viennabusinessagency.at/startup-and-grow/founders-lab-future-technologies

In the alphabetical list on the following pages, we present an overview of selected companies from Vienna that offer services in the field of Data4Good.

Companies in the Field of Data4Good

COMPANY	DESCRIPTION	REFERENCES	CONTACT
23 DEGREES GMBH	23° brings together demographics, ecology and policy indicators in a database and prepares them in such a way that they can be used immediately – in-house or in publications. With its services, 23° not only facilitates the time-consuming research of indicators. Anyone can also optimize data-related workflows at 23°, from collecting company-relevant data to publishing their own interactive reports.	23° was awarded the Content Award in the category "Upcoming" and the special prize from Infoscreen in 2016 as well as the open4data Challenge in the category "Idea". Furthermore 23° is part of the INiTS Start-Up Incubator Program after successful participation in the Start IP Hackathon.	Westbahnstrasse 7/20 1070 Vienna office@23degrees.io www.23degrees.io
ANYLINE GMBH	Anyline offers an uncomplicated scanning solution that saves you time and money. Scan text to digital data with Anyline: Market leading text recognition software, fast and easy to use.	A selection of our current customers: Edison Energy Spa, Energy App Provider, Clizzz, Global Blue, Red Bull Mobile, Porsche Austria, Canon, Swisscom, Sigmatek, and many more More customers & partners: Innogy, Wattler, specitec, United Nations, Thomas Cook Airlines, Metro, and many more	Zirkusgasse 13/2b 1020 Vienna hello@anyline.com www.anyline.com
BRAINTRIBE IT-TECHNOLOGIES GMBH	In addition to its headquarters in Vienna, the company has branches in Sao Paulo, Zurich and Berlin. Tribefire is the Smart Enterprise Information Platform from Braintribe. It is a Data-as-a-Service (DaaS) platform, which on the one hand links data from different sources as an ECM system and on the other hand allows information modelling from the business side – not only by the IT department. This means that it provides a development environment with which apps can be developed that can evaluate the data accordingly.	Tribefire is used for Samsung, Statoil and Kapsch.	Kandlgasse 19–21 1070 Vienna office@braintribe.com www.braintribe.com

COMPANY	DESCRIPTION	REFERENCES	CONTACT
COGVIS SOFTWARE UND CONSULTING GMBH	cogvis is specialized in the intelligent evaluation and use of 3D data and images based on the latest AI technology. Founded more than 10 years ago as a spin-off of the Vienna University of Technology, cogvis today develops and distributes state-of-the-art AAL solutions (Active and Assisted Living), which make life easier and safer for elderly people. The main product of the company is fearless – the intelligent fall sensor.	The 3D fall sensors are currently used in the B2B market. Main customers are nursing homes, hospitals, assisted living facilities and senior residences. In the future, fearless will also be used on the private market.	Wiedner Hauptstrasse 17/1/3a 1040 Vienna office@cogvis.at www.cogvis.at
CONTEXTFLOW GMBH	contextflow develops software, with Deep Learning, to support radiologists in their daily workflow. Our 3D image search engine with AI functionality identifies and ranks relevant, visually similar clinical pictures to facilitate diagnosis, reduce frustration and increase confidence. All within seconds.	We currently have two proof-of-concept partners: The Vienna Radiology Center and the Medical University of Vienna. We are currently in the contract phase with 5 other hospitals.	Floragasse 7/7 1040 Vienna office@ contextflow.com www.contextflow.com
DWH GMBH – SIMULATION SERVICES & TECHNICAL SOLUTIONS	dwh GmbH supports decision-makers in coping with complex challenges. In order to provide the necessary, precise answers, dwh uses System Analysis, Modelling & Simulation, Data Science, Machine Learning, Machine Vision and Artificial Intelligence.	ÖBB Rail Cargo, PremiQa-Med, Gesundheitsministerium, Berndorf, HVB, E+E, AIT, Infineon, Hörbiger, Gesundheit Österreich GmbH, MSD, VRVis, AutomationX	Neustiftgasse 57–59 1070 Vienna office@dwh.at www.dwh.at
ENLITEAI GMBH	enliteAI was founded with the goal of becoming a full-service provider for artificial intelligence – from AI strategy to prototyping and project management. To fulfill this promise, we have assembled a team of experienced industry experts for strategy consulting, deep learning and software engineering.	A selection of typical AI applications that we have implemented in previous projects Customer segmentation, recommendation systems and churn forecasts.	Schmelzgasse 3/22 1020 Vienna office@enlite.ai www.enlite.ai
MINDCOA.CH	mindcoa.ch provides a psychological platform in the cloud, which gives online advice with the help of virtual coaches. Both AI-based and human experts are provided for this purpose. New applications can be developed through the integrated development environment.	European finalist in the global IBM Watson Build Contest 2017, Best AI-oriented Social Entrepreneurship 2018 (UNIQA & Impact Hub)	Spitalgasse 1a 1090 Vienna mike@mindcoa.ch www.mindcoa.ch

COMPANY	DESCRIPTION	REFERENCES	CONTACT
ROBIMO GMBH	Robimo GmbH offers multicopter solutions and is a service provider in the fields of AI/Machine Learning, Image Analysis, and 3D reconstruction. We build solutions for machine control, analysis of medical data, or recognition of symbols and objects on mobile devices.	Wien Energie, Innovation Rocks, Universität Wien, go-4health, NorGenoTech	Rossauer Lände 28/25 1090 Vienna office@robimo.at www.robimo.at
SAIL LABS TECHNOLOGY GMBH	SAIL LABS Technology is active in the field of automatic media analysis. Both spoken and written language can be processed. The SAIL LABS Media Mining System evaluates data from different sources: TV, FM radio, YouTube, Internet (social media, feeds, websites), e-mails and electronic documents. The content is automatically analysed, transcribed, archived, indexed and displayed in text and graphics for evaluation.	With the help of a worldwide partner network SAIL LABS Technology mainly supplies end customers in Europe, Africa, the Middle East and South East Asia.	Mariannengasse 14 1090 Vienna info4speech@ sail-labs.com www.sail-labs.com
SYNYO GMBH	SYNYO GmbH is a globally operating company with focus on research, innovation and technology based in Vienna, Austria. SYNYO researches, develops and implements novel methods, approaches, technologies and solutions in various fields that address social, political, ecological and economic challenges. The SYNYO team consists of 30 highly qualified employees specialized in different scientific and technical fields such as Social Sciences, Safety & Security, Energy & Sustainability, Urban Future, Smart Technologies, Smart Health or Digital Systems.	Bonseyes: Platform for Open Development of Systems of Artificial Intelligence	Otto-Bauer-Gasse 5/14 1060 Vienna office@synyo.com www.synyo.com
TAILORPOST	tailorpost is a start-up in the news world. We have developed a service that combines several articles from different media (e.g. Kurier, DiePresse, …) into one topic/event in a "topic cluster" and recommends the best article based on journalistic criteria. Our service includes several different machine learning technologies (supervised/unsupervised ml, NLP, sentiment analysis, etc.). Through our service the reader gets different perspectives on an event.	tailorpost – intelligent message aggregator	Anastasius-Grün-Gasse 28–30/2/14 1180 Vienna hello@tailorpost.com www.tailorpost.com

COMPANY	DESCRIPTION	REFERENCES	CONTACT
THE MOONVISION GMBH	MoonVision is an award-winning company based in Vienna. Our international team consists of data scientists and developers who work together to understand the constantly evolving world around us.	References include Audi, A1 Digital, Miba and many others.	Ballgasse 6 1010 Vienna office@moonvision.io www.moonvision.io
WEBLYZARD TECHNOLOGY GMBH	webLyzard technology offers a leading Big Data and Web Intelligence platform for automated analysis and visualization of digital content. The underlying semantic processes are based on 15 years of research and development work and provide valuable indicators for decision support and strategic positioning of an organization.	Major reference customers in Europe and the United States underline the flexibility and performance of the system – including the US climate authority NOAA, the United Nations and Ketchum Publico as a strategic partner.	Liechtensteinstrasse 41/26 1090 Vienna info@weblyzard.com www.weblyzard.com
WORLD DATA LAB	World Data Lab (WDL) is a data company that produces the most consistent and credible estimates for spending and demographics. The data models are global, detailed and forward-looking, and track sustainable development goals in real time to provide unique insights to organizations.	The research results were published on CNN, in the Economist and in the Financial Times. Clients include HSBC, L'Oréal and Citibank.	c/o Impact Hub Vienna Lindengasse 56/18–19 1070 Vienna hello@worlddata.io www.worlddata.io

Photos
Vienna Business Agency/Karin Hackl
Vienna Business Agency/Klaus Vyhnalek

Technology reports are available on the following topics:
- AAL
- Big Data and AI
- City Logistics
- Cloud Computing
- COMET
- E-Commerce
- E-Government
- E-Health
- Enterprise Software
- Entertainment Computing
- Fin Tech
- Green Building
- HR-Tech
- Intelligent automation and robotics
- Internet of Things
- IT-Security
- Food products
- Mobile Computing
- Smart Production
- Urban Energy innovations
- Urban Mobility
- User Centered Design
- Visual Computing

Vienna Business Agency.
A service offered by the City of Vienna.
Mariahilfer Strasse 20
1070 Vienna
viennabusinessagency.at

The digital versions can be found at
www.viennabusinessagency.at/technology/let-s-talk-innovation/
digital-technologies

Contact
Georg Sedlbauer
Technology Services
T +43 1 25200-523
sedlbauer@wirtschaftsagentur.at

Text and Editorial
SYNYO GmbH
Otto-Bauer-Gasse 5/14
1060 Vienna

Design
seitezwei.com

The information in this document is subject to change without notice. The Vienna Business Agency does not assume any liability for mistakes or typesetting and printing errors.

vienna
business
agency

Contact
Vienna Business Agency.
A service offered by the City of Vienna.
Mariahilfer Strasse 20
1070 Vienna
viennabusinessagency.at