WHITEPAPER

ARTIFICIAL INTELLIGENCE IN BUSINESS

KEY DRIVERS AND FUTURE VALUE

APPANION

OVERVIEW

WHERE WILL ARTIFICIAL INTELLIGENCE TAKE US? AND HOW TO START?

About this whitepaper

Artificial Intelligence is undoubtedly a hyped topic at the moment. But what is the reasoning for investors and digital platform players to bet very large amounts of money on this technology *right now*? To better understand the current market dynamics and to give an overview of renown predictions for the upcoming 2-3 years, we compiled a practical overview about this topic. This report covers the major driving forces of AI, assumptions for the future from the industry thought leaders as well as practical advice on how to start AI projects within your company.

WHERE CAN TECHNOLOGY TAKE YOU?

Appanion in a nutshell

We provide high-quality insights on real-world technology-driven business applications and help you as innovation partner with actionable strategies, technology knowhow and business model competence.

I hope you can take away some valuable findings and new ideas to improve your business!

Tobias Bohnhoff
Founder

WHAT DRIVES THE DEVELOPMENT

KEY ENABLING FACTORS

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DATA IS THE RAW MATERIAL OF AI - AVAILABILITY AND QUALITY DRIVE INCREASING ADOPTION

#1 Data starts the engine

Location, location, location – is the mantra of the real estate industry. Data, data, data is probably the equivalent for the AI space. Data is the raw material from which algorithms ideally produce added value – driven by computational power.

Just like in physical raw materials, the input quality determines the final product quality. Digitally processable data was at about two zettabytes in 2010 and it is expected to reach an incredible 163 zettabytes in 2025.[1]

Data comes from all kind of human activities in a consumer or business context – shopping, searching, communication, entertainment, navigation, health, finances, insurances and so on...

The handling of data at this scale is only possible through the advantages in cloud computing.

#2 Just the tip of the data iceberg

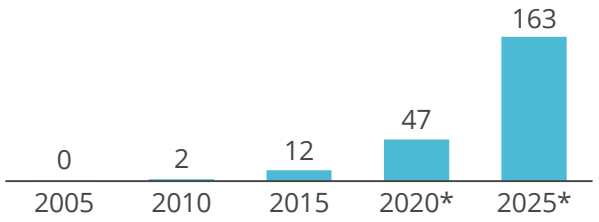
With IoT devices, smart homes, connected cars, robots, cameras and sensors all over the place, data gathering is still at the beginning. Machines, tools and vehicles are increasingly connected to the internet and produce even more data.

Besides theoretical data availability, also practical availability plays an important role. This requires a shift in how we deal with data today and how we regulate the use of this raw material in the future with concerns to privacy rights and protection from monopolistic structures.

Mistrust, data breaches and regulations such as GDPR lead to huge amounts of data that is excluded from the use of AI applications. With secure and decentralized on-premise systems this will open up significant potentials in the future.

Volume of data created worldwide

In zetabytes[1]



*In 2020, **every human** produces on average **6 terabytes** of processable data - this would equal 8 months of continuous Netflix streaming.*

#3 Data quality is key

It's not only about big data it's also about data quality. Today, we have no measure or seals for data quality even though it is essential for deriving actual value from data through (partly) autonomously working systems.

Five characteristics that indicate suitable data quality for AI purposes:

- **Unique** (brings additional value to the market)
- **Continuously captured** (to grasp even small changes)
- **Well-structured** (filtered, cleaned and organized in a data warehouse)
- **Easy accessible** (efficiently available via API for analysis and enrichments)
- **Non-biased** (in case of sample data)

1) Source: IDC, KleinerPerkins, Seagate

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OPEN SOURCE ALGORITHMS MAKE AI A PROJECT OF GLOBAL COLLABORATION

#1 Global Collaboration

AI undoubtedly is a global project. There is no moving backwards from something that AI has once touched and its impact doesn't stop at boundaries or national territories.

Evolutionary, there are two major aspects that enabled humans to develop to the most influential race on earth: First, usage of advanced tools to overcome limitations of the own body and second, large scale collaboration without the need to get to know each other (trade etc.).

As a consequence, it is not only necessary to develop AI on a global scale, it is also most promising in terms of development speed, quality and considerations of inequality within the system.

#2 Free Access

Almost everything can be broken down into calculation and data processing – in other words: algorithms . Just like every other application out there, AI apps can be itemized into different parts or modules that fulfil a certain task.

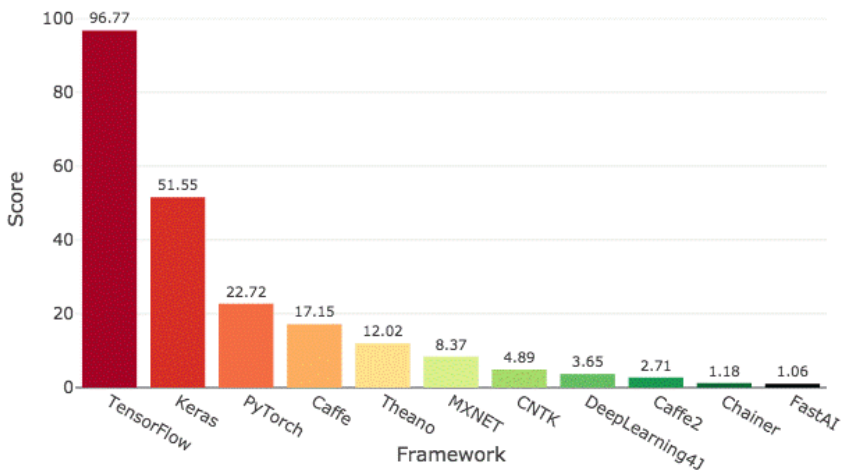
Therefore, it makes sense to compose applications from building blocks that have already been developed and proven to be successful. It also makes sense to develop a strong community and foster exchange about the progress of individual projects.

In the AI space, Google's TensorFlow currently has the strongest adoption as an open source framework to develop AI-related applications. But there are many alternatives from other vendors with slightly different focus areas.

The beauty is that many powerful frameworks are free to access and offer a broad variety of educational content for starters.

AI Framework Power Scores

Score criteria: Job listings, KDnuggets usage survey, Google search volume, Medium articles, Amazon books, ArXiv articles, GitHub Activity[1]



#3 Seamless integration

The global exchange, the unrestricted free access to tools as well as the seamless interoperability between different vendors and systems (e.g. AWS offers APIs to Google's TensorFlow) make AI a global-first project .

Learning from the problems with standalone solutions in other domains and the mess of data management most large corporations have to deal with today, AI seems to start a lot more open-minded.

1) Towards Data Science - https://towardsdatascience.com/deep-learning-framework-power-scores-2018-23607ddf297a

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COMPUTING CAPACITY SPEEDS UP THE DEVELOPMENT AND CREATES THE HYPE

#1 Processing performance

Graphic chipsets (GPUs) are way more powerful than traditional CPUs. This is why they are used not only for video games but also for AI processing and crypto mining.

One of the leading chipset makers is NVIDIA. The company released a product called Tesla V100 which increases deep learning performance by factor 30 compared to a traditional duo-core CPU.

In 2016, Google introduced tensor processing units (TPU), a highly specialized ASIC processing unit customized for high-end neural network learning.

So what is the impact on AI development? It's *time*! The time to process large amounts of data is significantly reduced which makes it easier for researchers to test, iterate fast and work with larger amounts of data.

As a consequence, more and more breakthroughs can be communicated in a very short timeframe:

***2015** – Image classification surpasses human level*

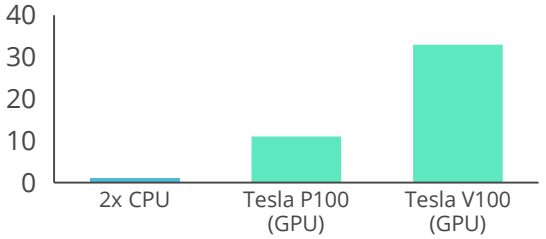
***2016** – AlphaGo defeats Lee Sedol*

***2017** – OpenAI bot wins in Dota 2*

***2018** – breast cancer detection surpasses human level*

Performance comparison CPU vs GPU

x-fold performance increase normalized to CPU[1]

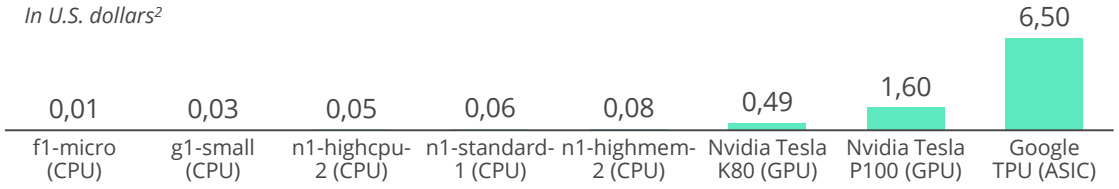


#2 Affordable pricing

In general, cloud computing capacity is quite cheap to buy as you can see in the chart of Google's pricing structure below (same for AWS or Azure). Nevertheless, cutting-edge GPU/TPU performance is still a question of financial resources. Prices are up to 80x higher compared to traditional CPU performance. As good as the progress and price reduction of the last few years in this field is, there is still room for further improvement.

Google compute engine price / hour / single compute instance

In U.S. dollars[2]

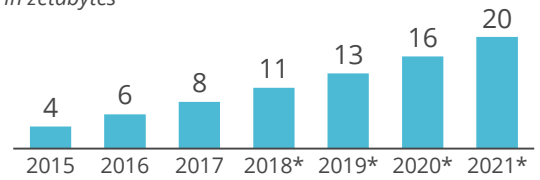


#3 Global cloud capacity & latency

Price and performance of computational resources are important factors for the increasing hype of AI and so is the sheer capacity to store, send and process large amounts of data through the cloud. Another factor that comes into play is low latency which is extremely important for real-time applications such as robotics and requires decentralized or on-premise infrastructure.

Global cloud data center IP traffic

In zetabytes[3]



1) Source: Nvidia
2) Source: Google, Goldman Sachs
3) Source: Cisco Systems

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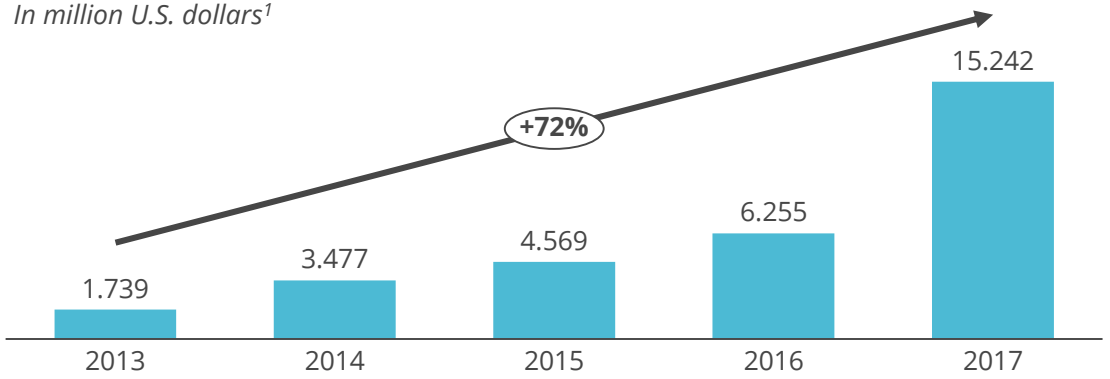
INVESTMENT READINESS OF INNOVATORS LEADS TO MORE TRUST AND MASS ADOPTION

#1 Equity funding for AI startups

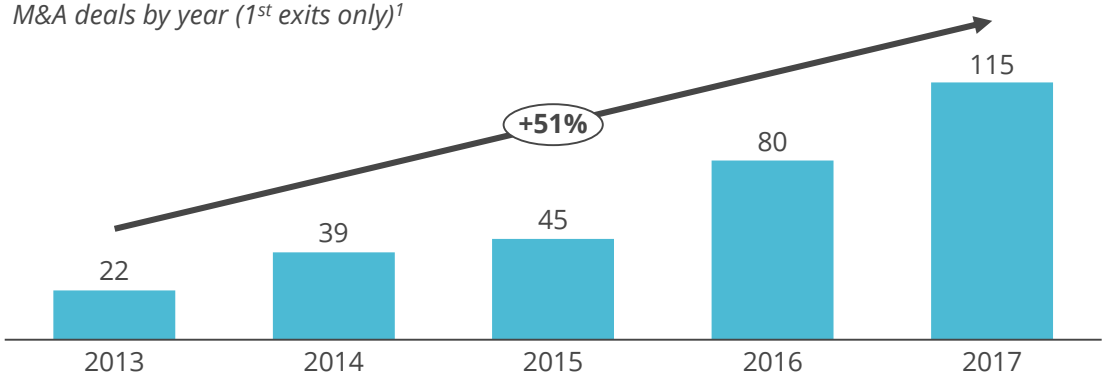
In million U.S. dollars[1]



Compound annual growth rate

#2 AI startup acquisitions

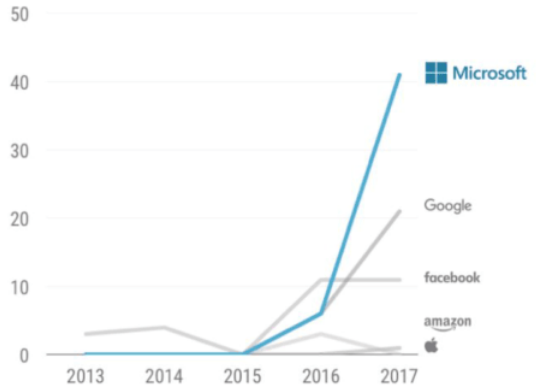
M&A deals by year (1st exits only)[1]



Compound annual growth rate

#3 "Artificial Intelligence" mentions

Mentions in public and investor-related statements[1]



The awareness of the almost commonly agreed on thesis – that AI will have a huge impact – is rapidly increasing. Part of it is of course the fact that more and more people are getting involved with the topic, and media coverage increases.

But a huge trust building element is also the increasing investment activities of large corporates and VCs.

GAFA – the acronym for the U.S. tech giants; Google, Amazon, Facebook and Apple is the fixed star for a significant share of industry players. Their innovation power and risk appetite to invest in new technologies made them successful – so everyone is now keen to adopt early. And this is what the unattainable market leaders do.

A reverse dependency of market power and innovation capabilities that can be viewed critically but in the short-term boosts trust, engagement and excitement about the topic.

The acquisition of talent into decision-making positions and financing of new ideas accelerates the overall achievements of the technology. It is also the basis for building new players that change the way we live, communicate, do business and purchase goods – just like GAFA did in the past decade.

1) Source: CB Insights

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HOW IS IT GONNA TURN OUT?

OUTLOOK

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PREDICTIONS AGREE ON THE TREMENDOUS IMPACT OF AI – POSITIVE OR AS A POTENTIAL THREAT

"I set the date for the Singularity—representing a profound and disruptive transformation in human capability—as 2045.

The nonbiological intelligence created in that year will be one billion times more powerful than all human intelligence today."

Ray Kurzweil

"The genie is out of the bottle. We need to move forward on artificial intelligence development but we also need to be mindful of its very real dangers.

I fear that AI may replace humans altogether. If people design computer viruses, someone will design AI that replicates itself. This will be a new form of life that will outperform humans."

Stephen Hawking

"Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don't think AI will transform in the next several years,"

Andrew Ng

"The pace of progress in artificial intelligence (I'm not referring to narrow AI) is incredibly fast. Unless you have direct exposure to groups like Deepmind, you have no idea how fast—it is growing at a pace close to exponential.

The risk of something seriously dangerous happening is in the five-year timeframe. 10 years at most."

Elon Musk

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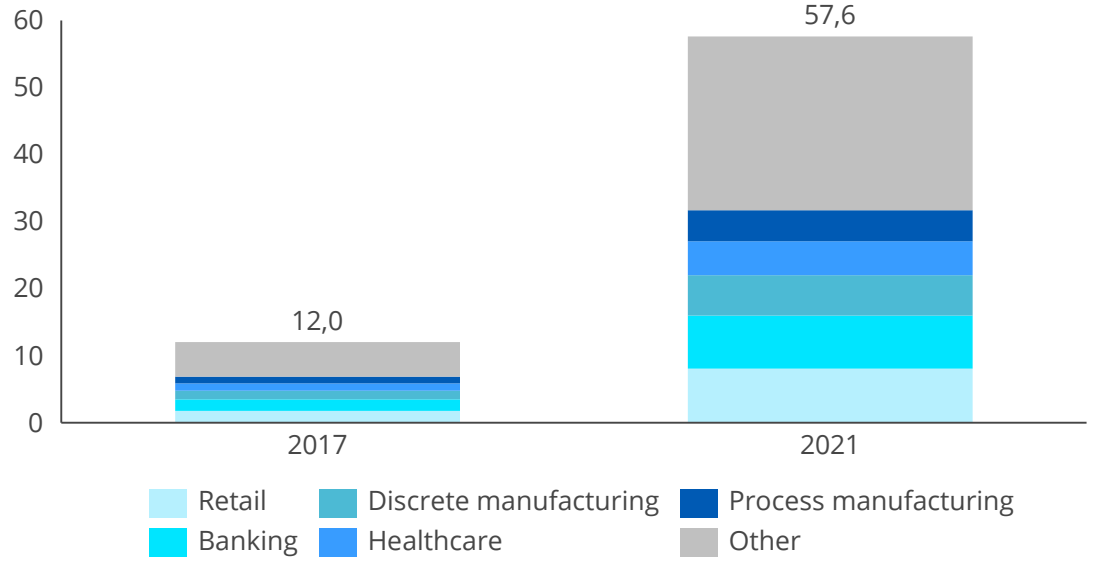
MONETARY PERSPECTIVE: ANALYSTS PREDICT 50% ANNUAL GROWTH IN THE UPCOMING THREE YEARS

Forecast: spending on artificial intelligence systems

Worldwide, in billion U.S. dollars[1]



> *In 2021, **AI augmentation** will generate*
> ***$2.9 trillion***
> *in **business value***
>
> *Gartner (2018)*

The end of market size projections

From an analyst perspective, it is very hard to predict the monetary effects of AI. The technology is rapidly evolving with breakthrough innovations every month and will impact both sides of the income statement.

Other technologies like mobile devices or virtual reality shift consumer and business budgets from legacy technologies and media and allocate it to new – at least partly measurable – revenue streams.

AI on the other hand will become a hidden layer in already existing devices or applications. It will automate manual actions, improve quality and security of operations, increase speed and cut out manual labor and delays.

As a consequence, it will be hard to measure the exact monetary impact of AI at least for external analysts. It's what can be summarized as **the efficiency revolution of AI**. It will also hugely affect society due to job losses and ethical decisions about machine behavior, liability and etiquettes.

Moreover, there will be new business models enabled by AI-technology. Robo-journalism, specialized search engines, service robots and many more that are unimaginable as of today. These categories will generate additional revenue respectively disrupt legacy solutions.

There is no such thing as an "AI market" and with this it makes no sense to measure it in revenue. We have to find new performance indicators. Analysts from the technology firms IDC and Gartner estimate spending in AI related software, services and hardware to total at $57.6 billion in 2021 while the returned business value through 'AI augmentation' is estimated at $2.9 trillion – **a ROI of 50X!**

1) Source: IDC

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A SHORT-TERM GROWTH IN AI ADOPTION IS VERY LIKELY, WHILE SOME LIMITATIONS STILL REMAIN

Executive surveys suggest increasing AI adoption[1]

42%

of U.S. executives believe AI will be of ***'critical importance'*** *within the next 2 years*

62%

of companies reported having adopted ***Natural language processing*** *applications*

Annual global growth rate of ***AI-as-a-service*** *solutions:*

48.2%

Five limitations of applied artificial intelligence

BIG DATA DEMAND
The collection of sensitive data as well as the organizational management of necessary data sets to enable machine learning on e.g. medical records or industrial production data is extremely challenging

LABELING EFFORT
Applications that rely on supervised machine learning methods oftentimes require very large training data sets that have to be labeled correctly in advance

DATA QUALITY ISSUES
Low quality data can cause negative experiences when working with AI. Common reasons are biased samples or incompletely recorded data sets

COMPLEXITY OF RESULTS
The most brilliant solution derived by deep neural networks is hard to implement and communicate, if humans are unable to understand the "why" and "how" of the decision-making process – especially in ethics related topics (finance, justice, health)

TRANSFER LEARNING
Problems of 'overfitting' in test data samples or unforeseeable changes that require spontaneous reactions are difficult for narrow AI applications to deal with

1) Source: Deloitte (2018) – base: 1,100 IT professionals and executives from U.S. based companies in Q3 2018

LET'S DO THIS WITH AI! BUT...

WHERE TO START?

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WHAT DO YOU WANT TO IMPROVE WITH AI? START WHERE YOU HAVE THE BEST DATA

Search

- Extract information or knowledge
- Navigate to datasets related to a search term
- Trigger an event related to the search term

Plan

- Make simulations pre-dictions of future events
- Make probability-based recommendations
- Schedule tasks

Communicate

- Interpret inflowing communication data
- Process context-related outgoing communication

Decide

- Take automated action sequences, based on data
- Logically connect information and act on probabilities

Analyze

- Cluster data
- Classify data
- Evaluate the relation between datasets
- Map and consolidate data

Learn

- Find a working solution
- Optimize an existing solution

Perceive

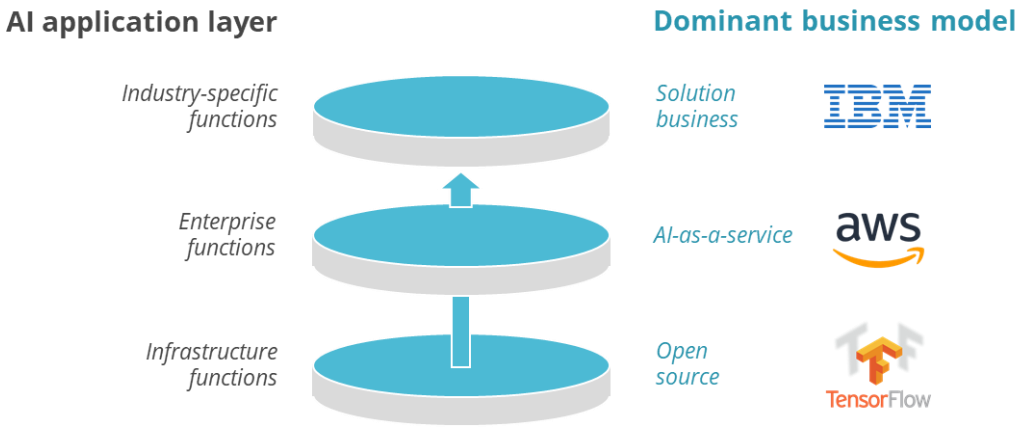
- Interpret contextual image data
- Interpret contextual audio data
- Interpret contextual tactile data

Move

- accordingly to the goal function and environment data
- precisely synchronized with an uncertain surrounding

YOUR BEST DATA IS UNIQUE, WELL-STRUCTURED, EASY ACCESSIBLE AND CONSTANTLY CAPTURED

Typology of artificial intelligence-powered applications



The AI application landscape

A common starting point for applying new software to the business is to make a brief analysis of the vendor and solution landscape.

In AI this is a bit tricky. First, everyone nowadays claims to use AI which is many cases just marketing buzz. Second, AI functions are diverse and will sooner or later impact every industry – so there is a lack of actual specialists at the moment.

Third, successful implementation of AI applications is not just about the algorithm or a convenient cloud interface, it is much more about the data that is put into the system.

AI application layer framework

Infrastructure: The generic toolbox for things like natural language processing or image recognition, that will be needed almost everywhere. Most of the time there will already be a lot of practical tools on open source platforms available.

Enterprise: Sales, marketing, HR, customer support – these commoditized functions will be most likely offered "as-a-service" and are designed to be used by non-tech staff.

Industry-specific: Highly specialized apps, e.g. on navigation and routing, financial risk scoring, picking robots, gene analytics etc. This is solution business with individualized interfaces and architectures to meet unique requirements.

The starting point

Having the different functions of AI applications in mind, ask the following questions to narrow your problem down to a starting point:

Which role is AI supposed to play for the business model?

- *Enhancement of existing processes*
- *Inherent value of the business (e.g. social media analytics provider)*

Where does the business capture the best data?

- *Common enterprise functions*
- *Industry-specific sensor, customer or communication data*

Does the business have its own resources to develop AI solutions?

- *Yes*
- *No, solution and implementation partners are required*

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LET'S TALK ABOUT BOOSTING YOUR BUSINESS WITH ARTIFICIAL INTELLIGENCE!

We identify suitable AI use cases and help with target-oriented prioritization.

IDENTIFY

We evaluate suitable solutions for your company-specific requirements

EVALUATE

We provide decision confidence through process design and functional prototypes

TEST

We create a concrete plan about requirements, project organization and feedback-driven iteration steps.

PLAN

We facilitate the development and implementation process and support you in the selection of partners.

EXECUTE

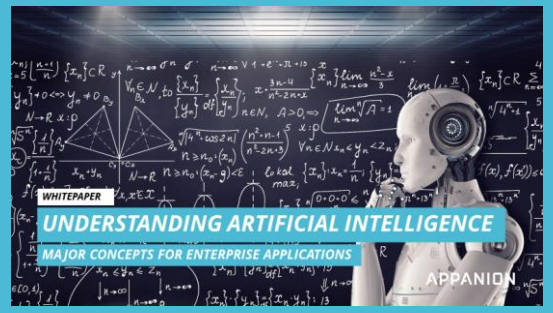
We develop a future-proof data strategy based on the company's long-term goals

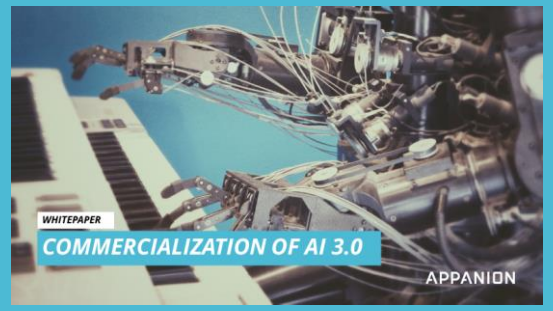
SUSTAIN

GET IN TOUCH!

Discover more at

www.appanion.com





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