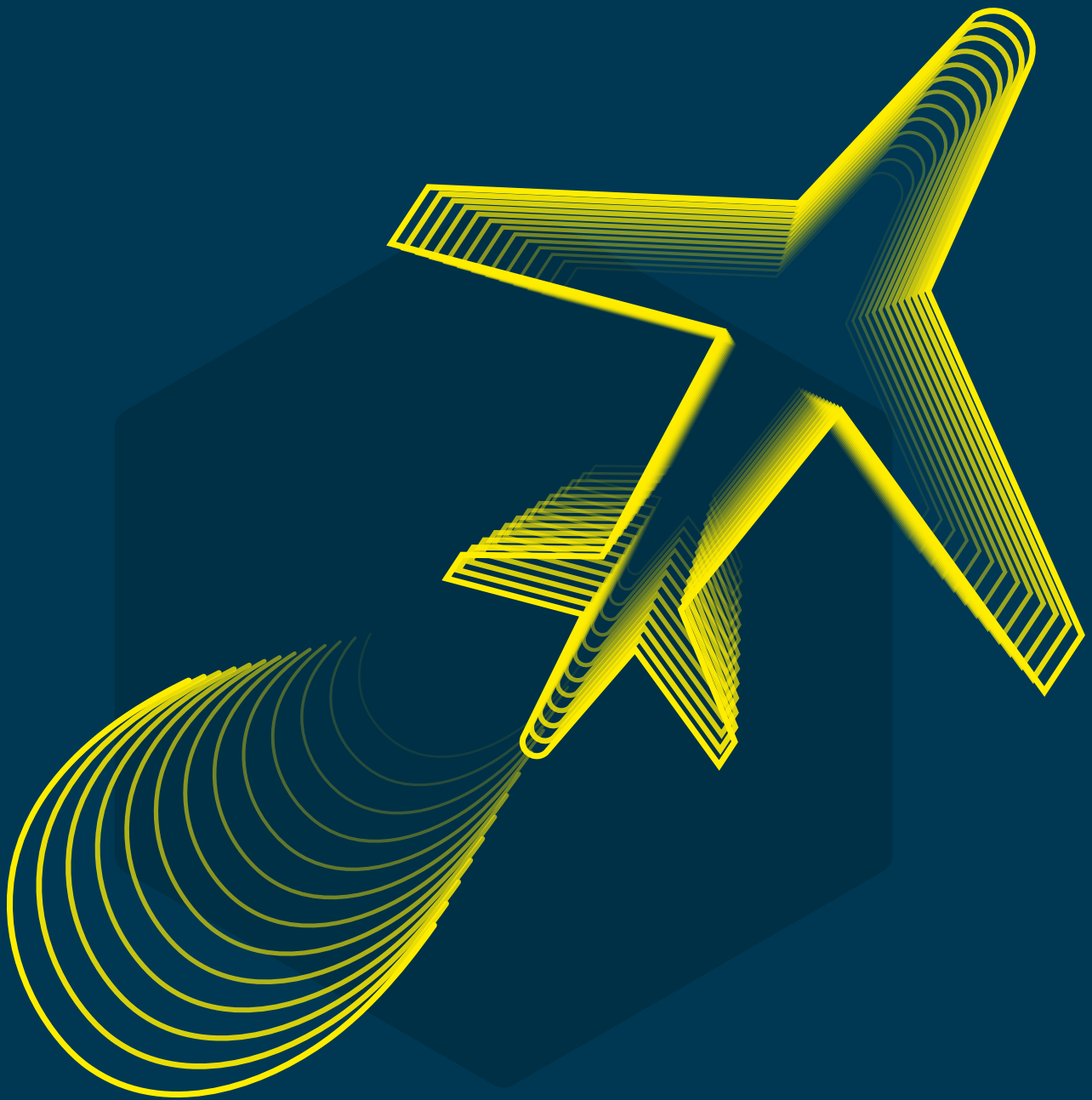
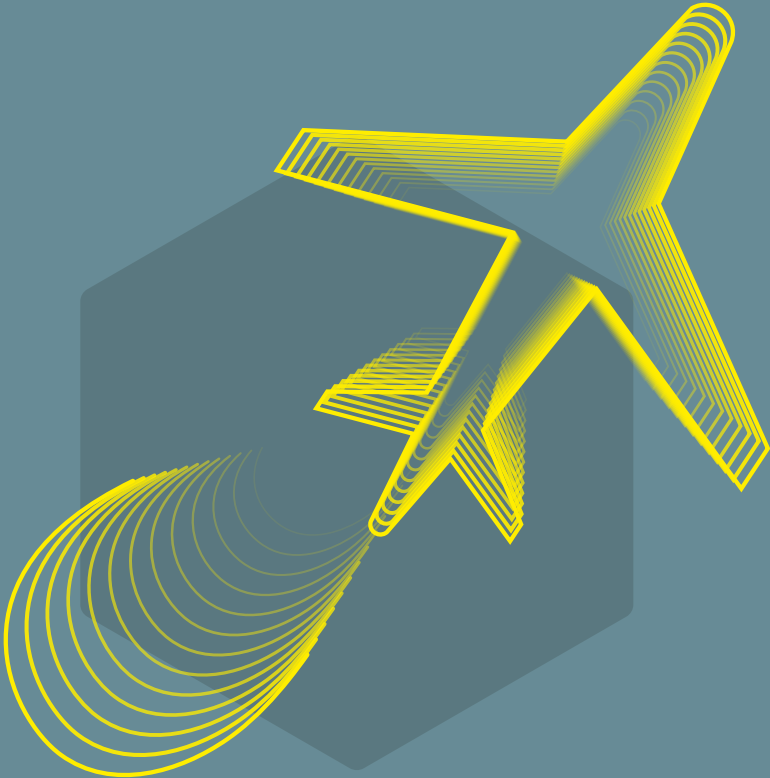


# Operationalising Artificial Intelligence in the Enterprise



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# Preface

Dear reader,

As I write these lines, 2020 is coming to a close. The COVID-19 pandemic made this a year like no other, shaping all aspects of our private and public lives. Many companies came under immense economic pressure and were forced to approach their businesses in entirely new ways.

At adesso's data and analytics practice, we saw that these challenges posed by the pandemic significantly increased the need for an accelerated digital transformation. This led many of our clients to fundamentally rethink the way they leverage technology in core business processes. As a result, advanced analytics and artificial intelligence (AI) technologies proliferated across industries to meet these new challenges.

This whitepaper focuses on the state of AI in the enterprise. It analyzes the status quo of AI adoption across industries, discusses key challenges businesses face when implementing the underlying machine learning technologies and offers a perspective on the requirements that firms need to meet in order to successfully put AI to work in their business. Next, the whitepaper introduces adesso's proven approach to building AI systems leveraging Taktile, a state-of-the-art machine learning platform that makes it easy to turn AI prototypes into production-grade software that generates business value. To illustrate our approach towards building AI projects using the Taktile platform, we then present the case study of a client project for Hamburg Airport in which an AI system was developed to predict traffic at security lines.

We hope you enjoy this paper and find it presents useful frameworks that challenge the way you think about AI in your organization.



Sincerely,

**Benedikt Bonnmann**

Leiter Line of Business Data & Analytics  
adesso SE

# About

## **Flughafen Hamburg GmbH**

With over 17 million passengers served per year, Hamburg Airport is northern Germany's largest airport. Last year, 71 different airlines took passengers out of Hamburg Airport to over 120 destinations in 40 countries. In addition to offering its passengers the ability to reach a great number of destinations worldwide, Hamburg Airport is well known for its extraordinary service quality and was crowned the "Best Regional Airport of Europe 2020" and placed second in the "World's Best Regional Airport" ranking which is conducted annually by Skytrax.

## **adesso SE**

A successful business grows out of innovative ideas, sound technologies and a cost-saving implementation of IT operations that support your company regarding your individual challenges, and always having people involved who bring technology know-how and sound knowledge for the customer's business. adesso combines this technology competence with sector-specific know-how. Our work is based on strong customer orientation and flexibility; on proven methods when implementing software projects; on networking of research, teaching and practice; and on an open, employee-oriented company culture.

With a team of round about 5,000 employees on 38 sites, adesso is one of the leading IT providers in the German-speaking market. We assume responsibility. And we have the experience that makes us a reliable partner for your IT projects.

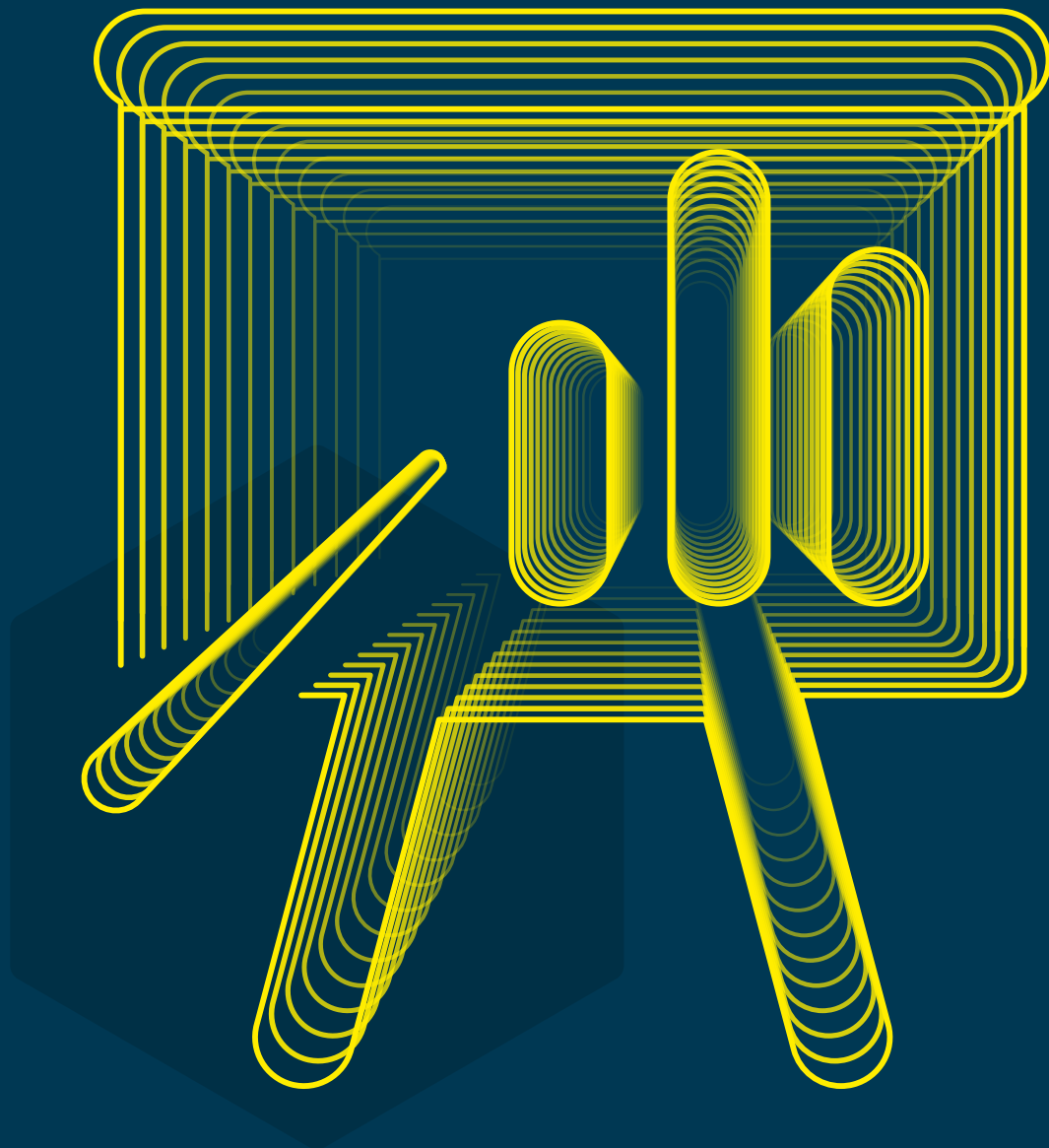
## **Taktile GmbH**

We are convinced that machine learning (ML) and artificial intelligence (AI) are powerful tools that can make the world a better and more prosperous place. Taktile exists to speed up the adoption of those tools and increase their positive impact on business and society. To achieve our mission, we develop software that makes it easy to control the quality of machine learning systems, deploy them to production, and make them more accessible to non-technical stakeholders.

Taktile is one of only ten German ventures to ever be funded by the prestigious Y Combinator programme. With over 25 combined years of building custom ML solutions for enterprises, we have deep expertise in all things data science.

## Executive Summary

1. Executives know they need artificial intelligence (AI) tools to succeed in their business today. Yet only few companies have managed to generate meaningful value from their investments in AI technology.
2. While many companies have successfully developed first AI prototypes, moving them to production in a robust and transparent way is currently the biggest challenge needed to be solved to generate business value from AI.
3. In order to move models to production, companies need to master five key capabilities: rigorous testing, deployment and scaling, model explainability and inspection, production monitoring, and model management.
4. adesso and Taktile empower enterprises to build AI models, move them to production, and generate substantial business value from AI. While adesso has developed a holistic approach to build modern AI systems for their clients, the Taktile platform's advanced capabilities make it easy to turn AI models into production-grade software.
5. A case study of a project for Hamburg Airport shows the immense potential that adesso and Taktile can generate for their clients.



*AI has left the “hype phase” – and corporate decision makers believe that an investment in AI will yield significant competitive advantages.*

# State of Enterprise AI in 2020

## Executives know AI is critically important for their business today

Over the last few years, most industries have witnessed a rapid rise in the proliferation of AI applications. adesso project experience has shown that early adopters have been able to create significant business value by leveraging these new technologies.

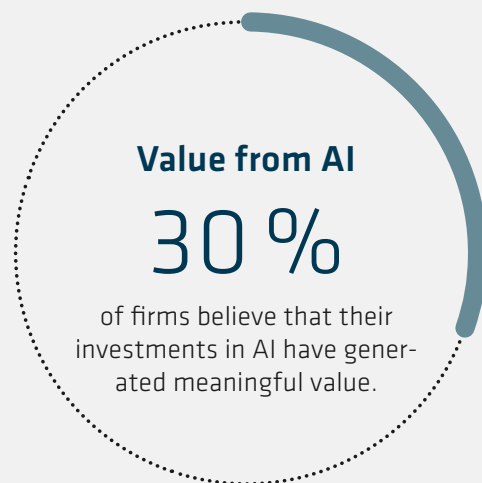
As more and more companies try to catch up and emulate the success stories of AI-first companies, investments in AI systems and hiring of related talent continue to increase (IDC, 2019). A related LinkedIn report showed that hiring for AI and machine learning (ML) roles has grown 74 % annually over the past four years (LinkedIn, 2019).

This is certainly also true for the European market, as adesso's 2020 AI study shows: AI has left the "hype phase" and 90 % of corporate decision makers believe that an investment in AI will yield significant competitive advantages (adesso, 2020).

## Yet only few firms have managed to generate meaningful value from their investments in AI technologies

While seasoned adopters are able to capture meaningful business value from AI, most companies are still in the process of catching up. In adesso's 2020 AI study over 65 % of respondents report a significant delta between their companies' AI capabilities compared to leaders in their industry (adesso, 2020). This also translates into financial returns. Forbes magazine reports that only 30 % of organisations are able to achieve any return on investment (ROI) for their spendings on AI (Forbes, 2019). This is especially unacceptable to executives in the era of the COVID-19 pandemic, where the bottom line impact of their businesses' investments is as important as ever.

As a result, C-suite managers are increasingly taking charge of AI initiatives in an attempt to improve their financial returns (Fortune, 2020).



## Model operationalisation as the main obstacle to business value

Regardless of whether increased C-level ownership will actually lead to an increased ROI of AI projects, the related challenges executives need to solve are clear. Over the course of our extensive AI project experience, we have observed that many companies have already successfully built up dedicated data science units and developed initial ML/AI prototypes with considerable potential for positive business impact. The challenge is turning these prototypes into robust production-grade applications that support critical business processes.

Companies have not yet developed the delivery workflow required to deploy AI at scale. This is not that surprising, because this challenge is so much more complex than the merely technical challenge of deploying models. Because AI projects involve both technical and non-technical stakeholders, an AI delivery model has to include processes to generate the transparency and governance around AI applications that business stakeholders require. This is further emphasised by the following analysis of the five most common reasons why AI projects generate low business value.

### High failure rate of AI projects

Approximately 85 % of all AI projects fail (Gartner, 2019) and thus never make it to production. Most companies do not effectively involve business stakeholders in their ML projects, and therefore fail to generate the transparency required for business buy-in.

### High project costs and long time-to-market

A typical enterprise AI project, i.e. one use case which is solved through an AI application, costs between € 0.5 million and € 1 million, and takes six to 12 months to complete. Most companies cannot efficiently move models to production at scale because they do not have a functioning ML delivery model.

### High rate of costly errors in production

Approximately 75 % of ML models are not tested properly and can fail in production. Hence, many companies incur significant reputational and financial risks because they move technically flawed, biased models to production. As an example, 2020 unearthed various prominent cases of discriminatory models ranging from credit-scoring to facial recognition cases which resulted in high-profile lawsuits for the respective companies.

### Low resilience to dynamic situations (e.g. COVID-19)

For the majority of ML models in production, live performance is not rigorously monitored. Hence, systematic changes in incoming data distributions may go unnoticed, causing inaccurate predictions and costing companies significant sums of money. Reports show that this was particularly problematic this year, as the COVID-19 pandemic disrupted business and consumer behaviour in many unforeseen ways (Techcrunch, 2020).

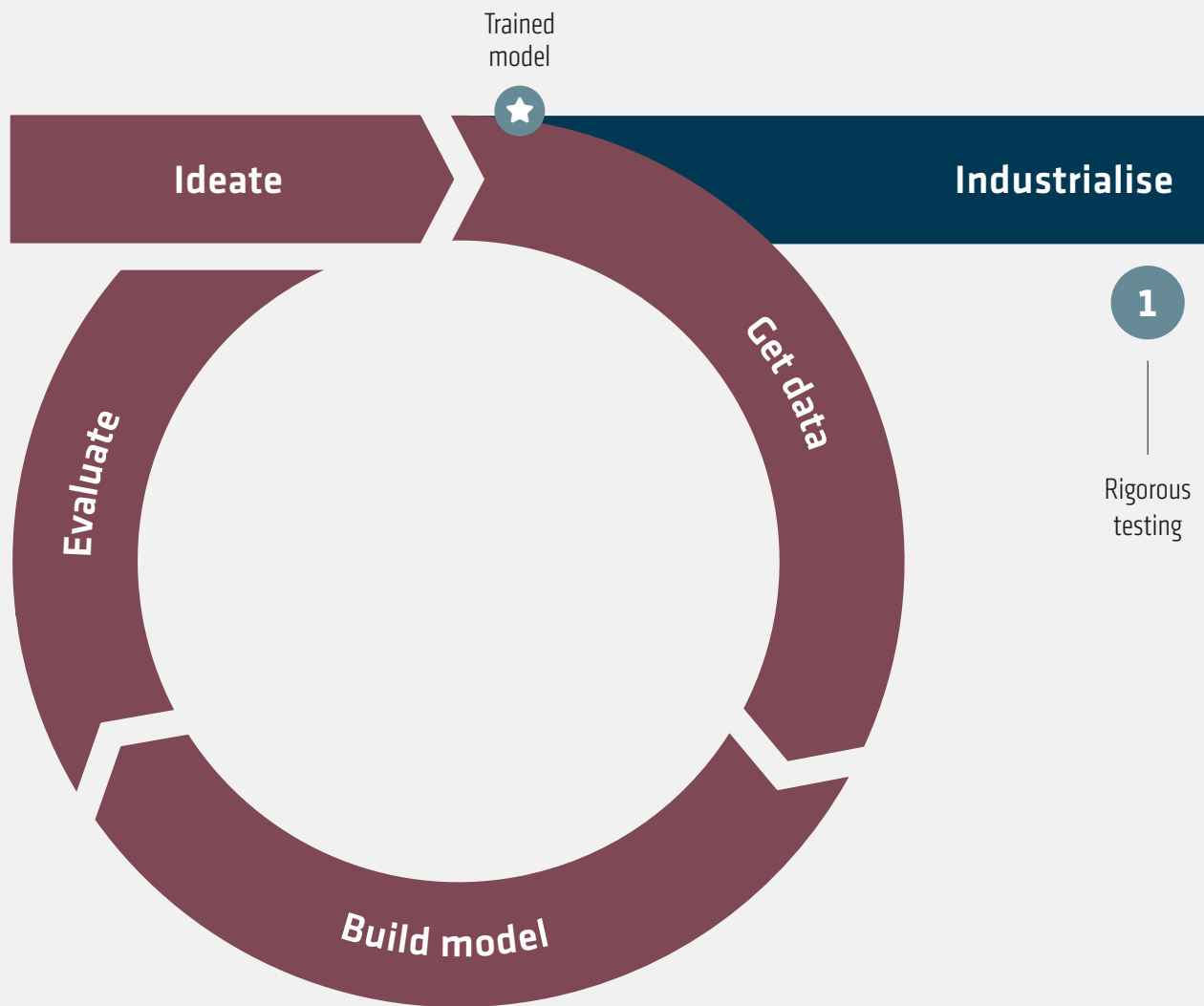
### Poor economies of scale

Over 50 % of ML models cannot be reused and have poor economics. Most companies hard-code custom ML deployments into existing applications, resulting in low reusability of models across teams and infrastructures.





*The challenge is turning prototypes into robust production-grade applications that support critical business processes.*

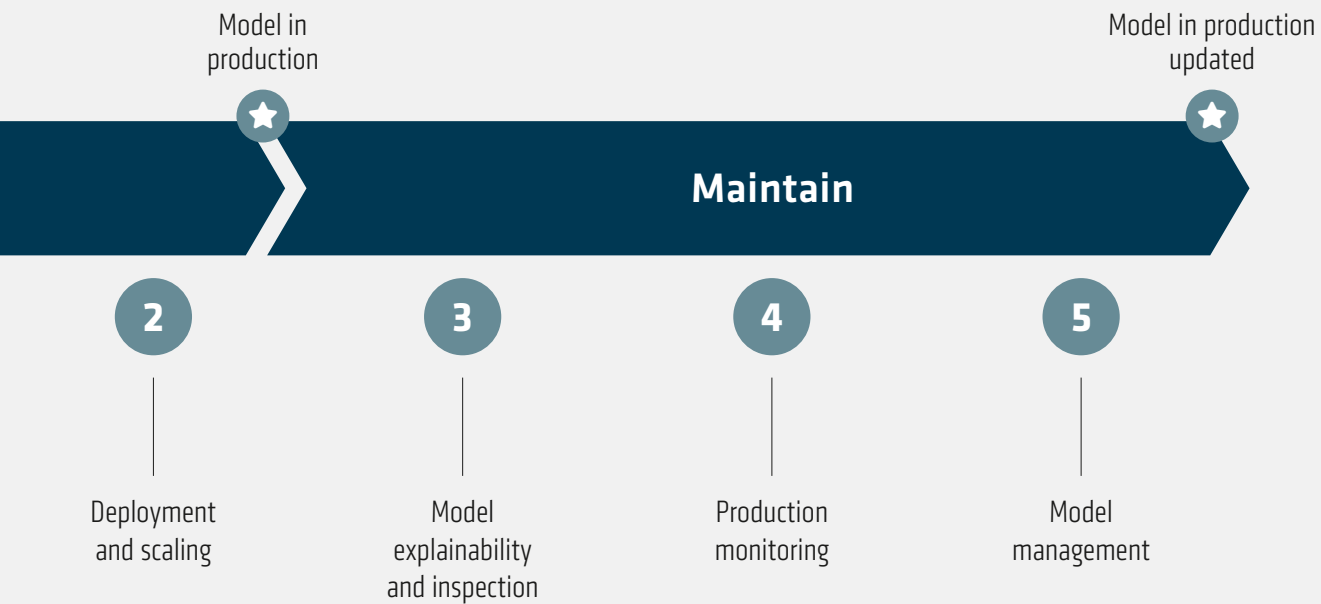


## Enterprise capabilities required to operationalise models in a robust and transparent way

As outlined above, many companies have already built up first data science units with the capabilities required to build and train models and evaluate AI/ML prototypes. The related skills are, after all, part of the core curriculum of most data science courses, and the (open-source) tooling available for these tasks has considerably improved over the past five years. Looking at the field of ML operations tooling, we see another situation entirely: tooling is still very nascent, and few

technical standards have emerged as of yet. Furthermore, the software engineering skills required to operationalise models, i.e. to move them to production and to maintain them, are typically not what data scientists are familiar with.

More specifically, in order to operationalise models in a robust, enterprise-ready and transparent way, data scientists typically need to master five new capabilities.



### 1 Rigorous testing

Implement continuous integration/continuous deployment pipelines to establish a gate-based process which ensures adequate quality control. Conduct domain-specific accuracy and plausibility tests before a new model becomes deployed.

### 2 Deployment and scaling

Wrap the inference logic of a trained model into a Web service such as Flask or FastAPI. Use Docker-based infrastructure to containerise the Web application. Deploy your container to cloud services of your choice and ensure it auto-scales based on incoming requests.

### 3 Model explainability and inspection

Inspect model behaviour and explain it to (non-technical) stakeholders by deep-diving into model accuracy, variable importance, the reasons behind single predictions and state-of-the-art sensitivity analyses.

### 4 Production monitoring

Monitor system-level metrics of Web services. Attribute variable costs associated with your application to different business units. Continuously evaluate model performance on live data. In case of issues, send alerts, revert to heuristic decision-making and facilitate troubleshooting.

### 5 Model management

Govern production application. Sign-off on model updates and version models, and keep track of previous live versions of models. Reproduce single model outputs for clients and regulators. Generate comprehensive audit trails and compliance reports.

# adesso and Taktile empower enterprises to capture business value from AI

## adesso's approach to "Building AI-based Systems"

As the many challenges outlined above show, we are convinced that production-grade AI systems can only be developed through flawlessly planned and executed projects. The development of these applications relies on a project structure and expertise that differs from traditional IT solutions. Paying attention to these differences when setting up and implementing a project is crucial for success. As a leading European IT provider, state-of-the-art adesso research has developed a novel software engineering approach for developing data-driven AI applications. Behind our idea of "Building AI-based Systems" approach lies a process model with phases, roles and responsibilities that does justice to the special features of AI applications. We recognise that there is no one "AI". Banks and their clients have different goals to retailers. Insurance companies have different framework conditions to car manufacturers. Hence, our approach is about first identifying use cases with the highest potential for our clients – and then building the right systems. The "Building AI-based Systems" approach is our answer to the unique nature of developing these systems (Gruhn et al., 2019).

## Taktile makes it easy to turn AI models into production-grade software

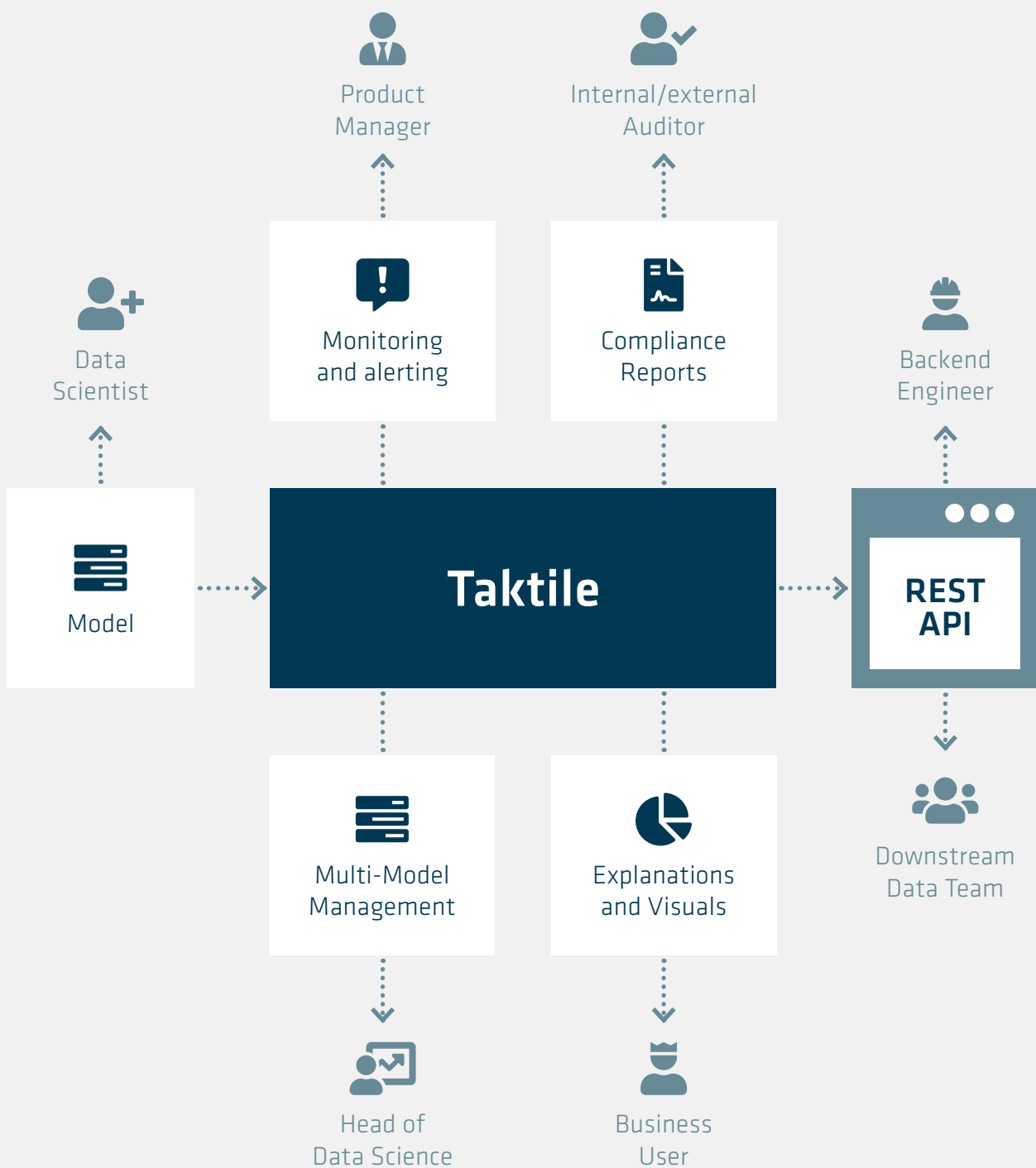
The Taktile platform is one of the favourite solutions adesso uses to operationalise machine learning models as it enables data scientists to easily industrialise, scale and maintain models. Some of its core features are:

- > Model testing: Use state-of-the-art tests to ensure no bad models ever become deployed.
- > Model deployment: Write one line of code to turn your trained model into an auto-scaling API.
- > Model explainability: Generate powerful model insights and visuals to inspect models and get buy-in from project stakeholders.
- > Model monitoring: Monitor application health, track performance of models and set up custom alerting schemes.
- > Model management: Easily manage, update and replicate the results of multiple models in production.
- > Model governance: Create audit logs and compliance reports at the click of a button.

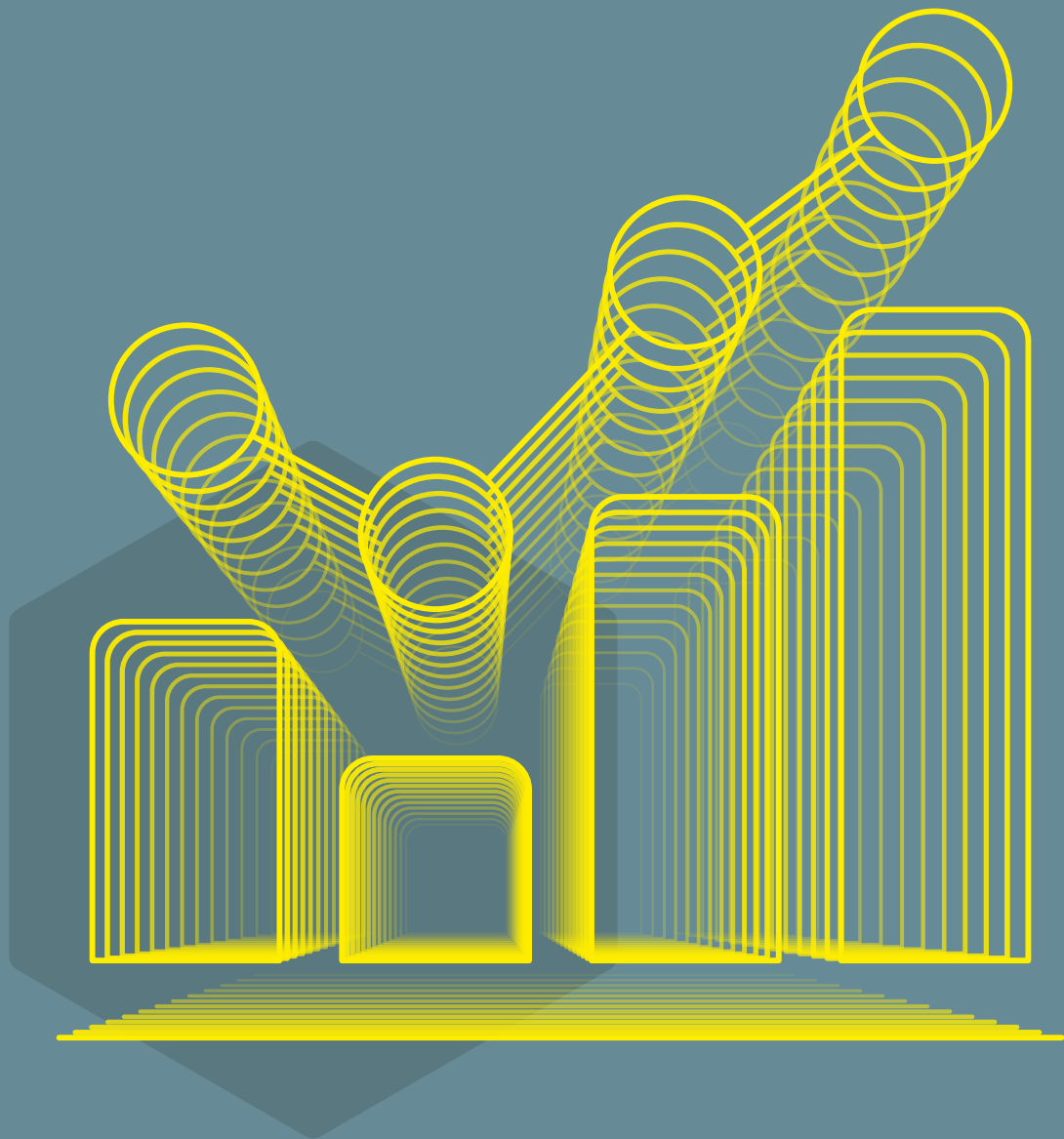
But the Taktile platform is more than just a developer tool. With only one line of code, data scientists can not only deploy a model but moreover unlock the true power of Taktile: enabling their team to become truly cross-functional.

## Taktile Platform

The Taktile platform offers distinct features for each project stakeholder and thereby becomes the central hub for effective collaboration. Engineers can easily put models to work by integrating the automatically generated auto-scaling REST API with existing business applications. Downstream data teams can leverage the same API to incorporate the model in larger ML pipelines, extracting further business value from the model across multiple use cases.



The Taktile platform offers distinct features for each project stakeholder and thereby becomes the central hub for effective collaboration.



*The deployment of ML models is usually the biggest challenge in AI projects. It often takes several months. This time can be reduced to only a few hours.*

## Case study: forecasting traffic at security checkpoints at Hamburg Airport

In one of its most recent client projects, Hamburg Airport tasked adesso to build an AI system to predict traffic at security checkpoints. Not only should the predictions help to increase customer satisfaction by showing travellers the quickest way through security, but they should also be used to improve the airport's bottom line by enabling security managers to optimise their staffing decisions.

The basis for the training of the ML model was the passenger and flight data of the last three years, and which was additionally supplemented by the holiday data of individual federal states. Following the preparation phase, the data was further optimised in the feature engineering phase. We reduced the number of features from initially 1,500 to a reasonable number using different measures of variable importance. The final dataset consisted of around 30 features that were used for the subsequent training and validation phase.

The model that was finally used consisted of different algorithms and used a GradientBoostingRegressor, a DecisionTreeRegressor and a multilayer perceptron model. Using an additional Adaboost algorithm, those weaker classifiers could be combined into an overall stronger model. In addition, a voting regressor ensured that the different model results were combined into a powerful ensemble model.

In such cases, after the final model is trained, adesso's data scientists typically use the Taktile platform to quickly double-check the model's performance and turn it into a robust Web application. The resulting REST-API contains detailed documentation (i.e. usage instructions), which makes it easy for new users to put the application to work. The Taktile platform also automatically generates model explanations, providing deep insights into the reasons behind the model's predictions. The resulting visuals can easily be shared with all key decision makers at the client site.

The deployment of ML models is usually the biggest challenge in AI projects. It often takes several months to finish, requires a lot of tedious manual engineering and dashboarding efforts, and therefore generates significant costs for the end client. Combining adesso's experiences in developing modern AI applications with the Taktile platform's advanced capabilities for turning AI models into production-grade software, this time can be reduced to only a few hours. As a result, projects can be delivered much faster and require a significantly lower budget than before.

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## Sources

- > International Data Corporation:  
<https://www.idc.com/getdoc.jsp?containerId=prUS45481219>
- > LinkedIn: [https://business.linkedin.com/content/dam/me/business/en-us/talent-solutions/emerging-jobs-report/Emerging\\_Jobs\\_Report\\_U.S.\\_FINAL.pdf](https://business.linkedin.com/content/dam/me/business/en-us/talent-solutions/emerging-jobs-report/Emerging_Jobs_Report_U.S._FINAL.pdf)
- > Forbes: <https://www.forbes.com/sites/nicholasfearn/2019/09/13/how-businesses-can-get-the-most-value-from-artificial-intelligence/#637e4b303655>
- > adesso: <https://ki.adesso.de/ki-de/oeffentliche-downloads/ki-eine-bestandsaufnahme-2020.pdf>
- > Fortune: <https://fortune.com/2020/06/23/why-the-c-suite-is-now-overseeing-corporate-a-i-projects/>
- > Techcrunch 2020: <https://techcrunch.com/2020/08/18/how-to-diagnose-and-treat-machine-learning-models-afflicted-by-covid-19/>
- > V. Gruhn, M. Hesenius, W. Koop, O. Meyer, N. Schwenzfeier, "Towards a Software Engineering Process for Developing Data-Driven Applications," 2019 IEEE/ACM 7th International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE), Montreal, QC, Canada, 2019, pp. 35-41, doi: 10.1109/RAISE.2019.00014.