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Moving ML forward

2023 Machine Learning Practitioner Survey

Executive Summary

As machine learning (ML) has delivered growing business value on common use cases such as detecting fraud, recommending products, and predicting customer churn, more companies and industries are seeking to apply AI to innovative use cases.

Challenges related to sustainability, governance, team structure, and budget are creating friction that makes it difficult to track model training runs and results, collaborate across teams, and iterate faster during the complex machine learning development process. This friction can cause delays in ML development that delay or halt model deployment to production and to help ease these tensions, many teams are now turning to commercial experiment management systems to reduce friction and promote ML models in production for increased business value.

For the second year in a row, an independent research firm conducted a study of 500 US-based machine learning practitioners to better understand their challenges, tools, and processes.

82% of machine learning practitioners say it's challenging for them to effectively evaluate the risks and limitations of ML models.

28% of practitioners say their company's machine learning budget will decrease in the next 12 months.

41% of practitioners say process sustainability is one of their biggest challenges.

42% of ML teams are using a commercial experiment management tool.

27% of machine learning practitioners believe that bias will never truly be removed from AI-enabled products.

Censuswide surveyed 503 US 18+ - 500 Machine Learning Practitioners between 20.12.22 - 29.12.22.

Key Takeaways

41%

SCRAPPED
EXPERIMENTS
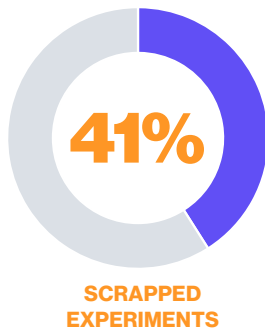
1. Scrapped projects

On average, machine learning practitioners surveyed said **41% of their machine learning experiments had to be scrapped** due to mismanagement in 2021. The top four reasons why survey participants said that some of their machine learning experiments had to be scrapped were due to API integration errors (26%), lack of resources (25%), inaccurate or misrepresentative data (25%) and manual mismanagement (25%).

On average, 15% of machine learning projects failed once launched from an experiment into real-world production (data shift) in 2021.

28%

EXPECT ML
BUDGET DECREASE

2. Tightening budgets

It appears budgets might be tighter as 28% of machine learning practitioners surveyed thought that their company's machine learning budget would decrease within the next 12 months. These budget cuts are more clearly seen in that 40% of the respondents say their company's current annual budget for machine learning is only $25- $50k. However, 28% said their company's current annual budget for machine learning was at a higher range of $50-$75k.

2+ MONTHS

INCREASE IN
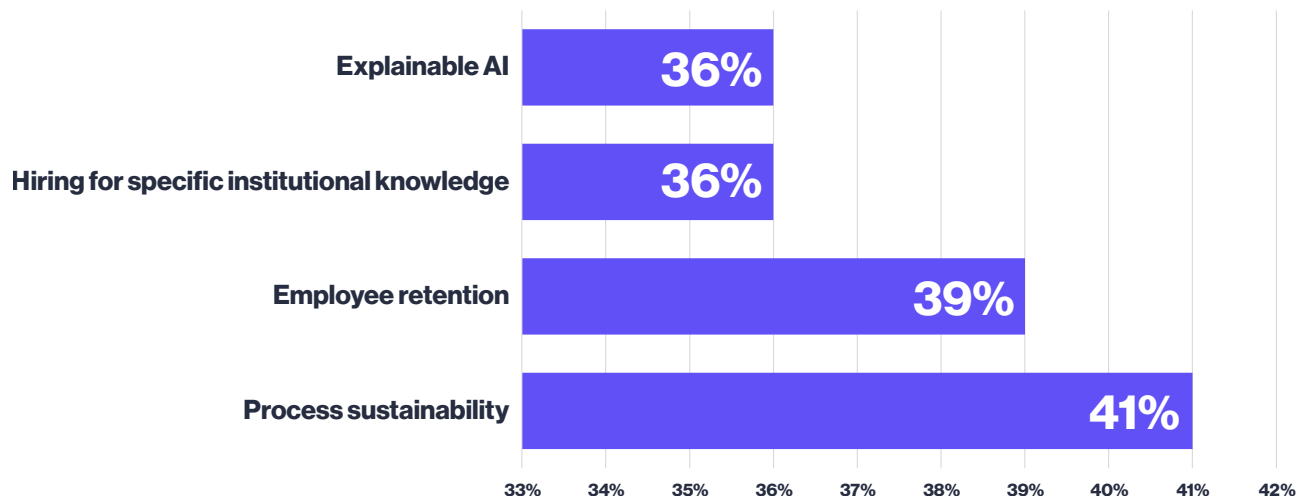DEPLOYMENT TIME

3. Increased time to production

On average, machine learning practitioners surveyed say it takes their team **seven months** to deploy a single machine learning project. This is significantly longer than the 2021 results which showed that machine learning teams took an average of **five months** to deploy.

As well as an increase in the amount of time it takes to deploy singular machine learning projects, the number of experiments that have had to be scrapped remains high, adding to a waste of time, resource, and budgets. As mentioned, nearly half of experiments were scrapped for mismanagement.

Challenges

When it comes to challenges over the next year, machine learning practitioners surveyed anticipate the biggest to be:

| Challenge	Percentage
Explainable AI	36%
Hiring for specific institutional knowledge	36%
Employee retention	39%
Process sustainability	41%

These challenges involve creating data processes that work across teams, building and maintaining data science and ML engineering teams, hiring best-in-class talent with institutional expertise, and creating explainable and reproducible ML models.

Explainable AI is a feature that allows decisions to be tracked back through the decision making process, in order to help understand reasoning behind conclusions or forecasting and assess model accuracy.

When looking at respondents' views on this, in order of top to lowest benefits, they feel that the following outcomes are the benefits of Explainable AI:

- **Reducing cost of mistakes (34%)**
- **Increased stakeholder confidence (34%)**
- **Reducing risk of bias occurring (33%)**
- **Increased model performance (33%)**
- **Minimizing the probability of poor choices (32%)**
- **Informed decision making (32%)**

Trends and Roadmaps
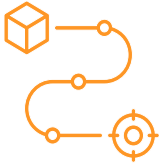
Focusing specifically on generative AI, (AI that can generate novel content such as images) the majority (61%) of machine learning practitioners surveyed think it will have a positive impact on their business, whereas under 1 in 7 (13%) think it will have a negative impact.

When it comes to AI roadmaps, over 4 in 5 (82%) machine learning practitioners surveyed say it's challenging for them to effectively evaluate the risks and limitations of ML models and (63%) of machine learning practitioners surveyed find it difficult to get stakeholder buy-in.

Furthermore, for those who find it difficult to get stakeholder buy-in, the top two reasons why are:

1. **Because it's difficult to prove the benefits (47%)**
2. **Because it's difficult to communicate the risks (44%)**

Meanwhile, over 2 in 5 (42%) find it difficult due to competing business priorities and almost 2 in 5 (39%) say it's difficult to get buy-in because stakeholders don't understand it.
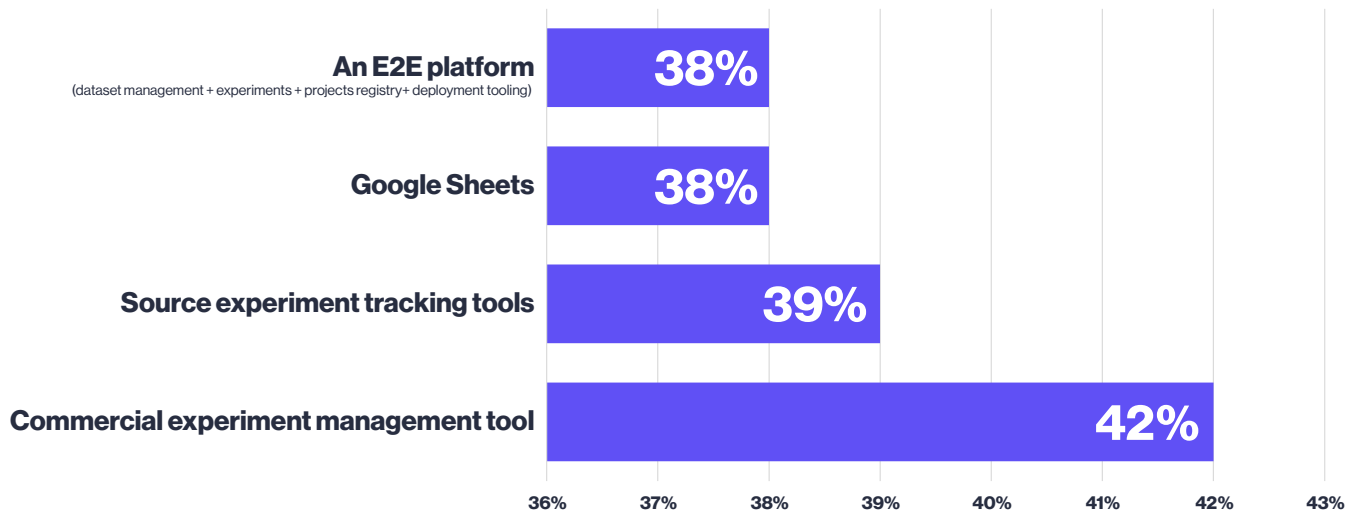
The biggest pain points slowing down AI roadmaps for machine learning practitioners are:

Category	Percentage
Resources	24%
Reproducibility	26%
Infrastructure	27%
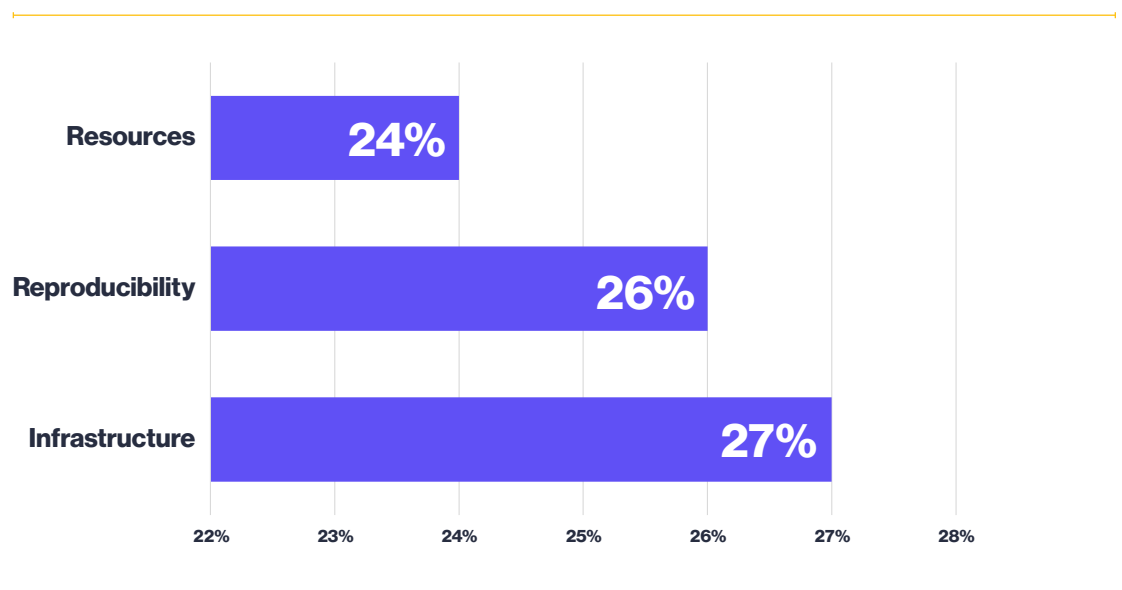
Machine Learning Tools

The most common ML tools being used for tracking the machine learning projects development process are:

Tool	Percentage
An E2E platform (dataset management + experiments + projects registry+ deployment tooling)	38%
Google Sheets	38%
Source experiment tracking tools	39%
Commercial experiment management tool	42%

36% 37% 38% 39% 40% 41% 42% 43%

Looking at what machine learning / deep learning (ML/DL) domains tasks belong to, these most commonly belong to predictive analytics (42%), reinforcement learning (41%) and NLP (40%). Less commonly, these tasks belong to the CV domain (37%).

A far higher percentage of machine learning practitioners surveyed say their data scientists are free to use any tool that they want to build the ML models than say they are not free to use any tool (62% vs 28%).

When looking at this by the type of domain their tasks belong to, those who say their tasks belong to a predictive analytics domain are more likely than those who say it belongs to a CV domain to state their data scientists are free to use any tool that they want to build the ML models (68% vs 64%).
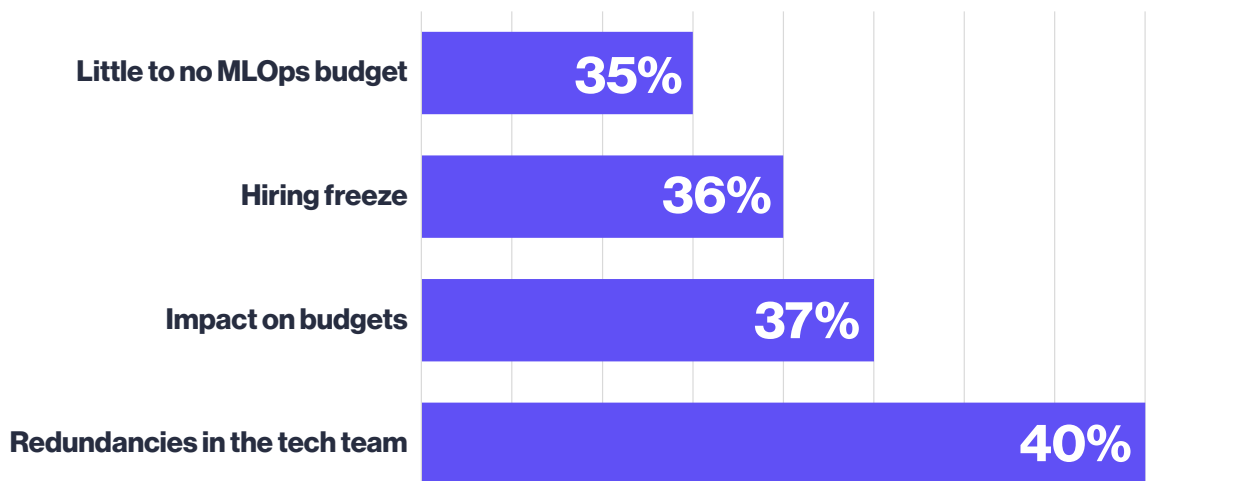
Meanwhile, looking at this through the lens of the tools used for tracking the machine learning projects development process, those who use an E2E platform (dataset management + experiments + projects registry + deployment tooling) are most likely to say their data scientists are free to use any tool that they want to build the ML models (71%) whereas those who use Google Sheets are the least likely to say the same (60%).

Budget

The average ML budget 2022 was $45,165. This is a decrease of nearly 18% from 2021 at $55,030.

100% of machine learning practitioners surveyed said the economic situation will impact their business in some way. The most common impacts:

Category	Percentage
Little to no MLOps budget	35%
Hiring freeze	36%
Impact on budgets	37%
Redundancies in the tech team	40%

Over a third (35%) of machine learning practitioners surveyed say the economic situation will impact their business as there will be no or little budget for MLOps tools, and almost a third (32%) say innovation will slow. 3 in 10 (28%) machine learning practitioners say their company's machine learning budget will decrease in the next 12 months.

In terms of other impacts, notably, machine learning practitioners surveyed are almost 5x more likely to say remote working/working from home has increased productivity at their business, rather than decreased it.

AI Bias

Over a quarter (27%) of machine learning practitioners surveyed believe that bias will never truly be removed from AI-enabled products.

Bias is a concern with ML/AI models as they (the models) can heighten any hidden bias that may be in the data that is input. This bias can, in turn, put a business at risk of reputational damage and legal repercussions if not identified and dealt with. In terms of what respondents are primarily doing to ensure they eliminate bias when planning the design and/or launch of an AI-enabled product, almost 2 in 5 (38%) have a designated point of contact or support team that is looking out for bias. Moreover, a third (33%) of respondents think reducing the risk of bias occurring is one of the main benefits of Explainable AI, which might indicate this could be a solution.

Although machine learning practitioners surveyed are taking steps to mitigate bias, still over a quarter (27%) believe that bias will never truly be removed from AI-enabled products and a further 1 in 12 (8%) are unsure. Almost two thirds (65%) are optimistic however, and think at some point they will truly be able to remove bias in an AI-enabled product.

On Tuesday, October 4, 2022, the US White House Office of Science and Technology Policy (WHOSTP) published a Blueprint for an "A.I Bill of Rights" (BOR), setting out five principles which should guide the design, use and deployment of Automated systems. The document provides a framework for how government, technology companies, and citizens can work together to ensure more accountable AI. It seems this A.I Bill of Rights is widely accepted amongst machine learning practitioners surveyed.

Almost three quarters (73%) of machine learning practitioners surveyed agree that the A.I Bill of Rights should be mandatory, despite it currently being opt-in.

Although there seems to be support for the bill or rights (BOR), still around 2 in 5 think it will affect their approach to ML deployment and development by slowing the process down. In terms of other negative impacts, almost 2 in 5 think the BOR will make the ML deployment and development process more difficult and over a third (35%) think it will make the process more expensive.

There are positive impacts too, however, as almost 2 in 5 (38%) think the BOR will make the ML deployment and development process safer, and a similar percentage (37%) think it will reduce the possibility of privacy violations. Finally, over a third (35%) think the BOR will reduce the frequency of unsafe or ineffective ML systems.

What's Next?

Machine learning can deliver outsized business value but the process of developing ML is complex, with many dependencies and potential pitfalls. ML initiatives and techniques are experiencing extrapolated growth and becoming more accessible across multiple industries. But practitioners are still managing friction in the form of challenges related to infrastructure, reproducibility, and people & budget resources.

One of the ways to reduce this friction is implementing an MLOps solution. Companies like Ancestry, Uber, and Etsy rely on Comet to increase scalability, support productivity, reproducibility, and collaboration.

ML provides virtually limitless opportunity to deliver business value. ML practitioners who embrace new tools and techniques, even on limited budgets, will accelerate model development and get to the good part faster: realizing value for their customers, teams, and companies.

About Comet

Comet provides an MLOps platform that data scientists and machine learning teams use to manage, optimize, and accelerate the development process across the entire ML lifecycle, from training runs to production. Comet's platform is trusted by over 450 enterprise, startup and academic organizations, including the teams at Affirm, Ancestry, Cepsa, Etsy, Uber and Zappos. Founded in 2017, Comet is headquartered in New York, N.Y., with a remote workforce in 11 countries. Comet is free for individuals and academic teams. Startup and enterprise licensing are available.

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