Research Question:

"How do developers perceive AI? Is the popularity of AI (Artificial Intelligence) having a significant impact on the way developers work, or is it just hype?"

Data Acquisition:

Data Source: The data is taken from Stack Overflow Annual Developer Survey 2023
https://insights.stackoverflow.com/survey

Developers from all across the world participate in the Stack Overflow Developer survey, which is conducted online every year. The survey is hosted on the Stack Overflow website and is open to all Stack Overflow users. The survey is self-reported, which means that respondents are asked to provide information about their own experiences and knowledge. This can be a limitation of the dataset, as there is always the possibility that some respondents may have exaggerated their experience or knowledge. However, the survey is also a valuable source of information about the developer community, as it allows researchers to collect data from a large and diverse group of developers.

With millions of registered users, Stack Overflow is one of the biggest community sites for developers. It is a widely used forum where programmers ask and respond to queries on coding, software development, and technologies. The platform draws developers from a range of industries, backgrounds, and degrees of experience, making it a perfect place to gather diverse and accurate information about the developer community.

About 90,000 developers responded to a series of questions about how they use AI technology in their work, and their results are included in the dataset from the Stack Overflow Annual Developer Survey 2023. This dataset is expected to include insightful information about how developers perceive AI, how AI technologies may or may not affect their work processes, and other topics associated with the adoption of AI and its effects.

This dataset seems to be a useful tool for researchers examining if the growing interest in AI is actually changing how developers work or if it is just marketing hype. It allows us to analyse the attitudes, experiences, and behaviours of a large and diverse developer community, giving us a better understanding of the real-world implications of AI in the development process.

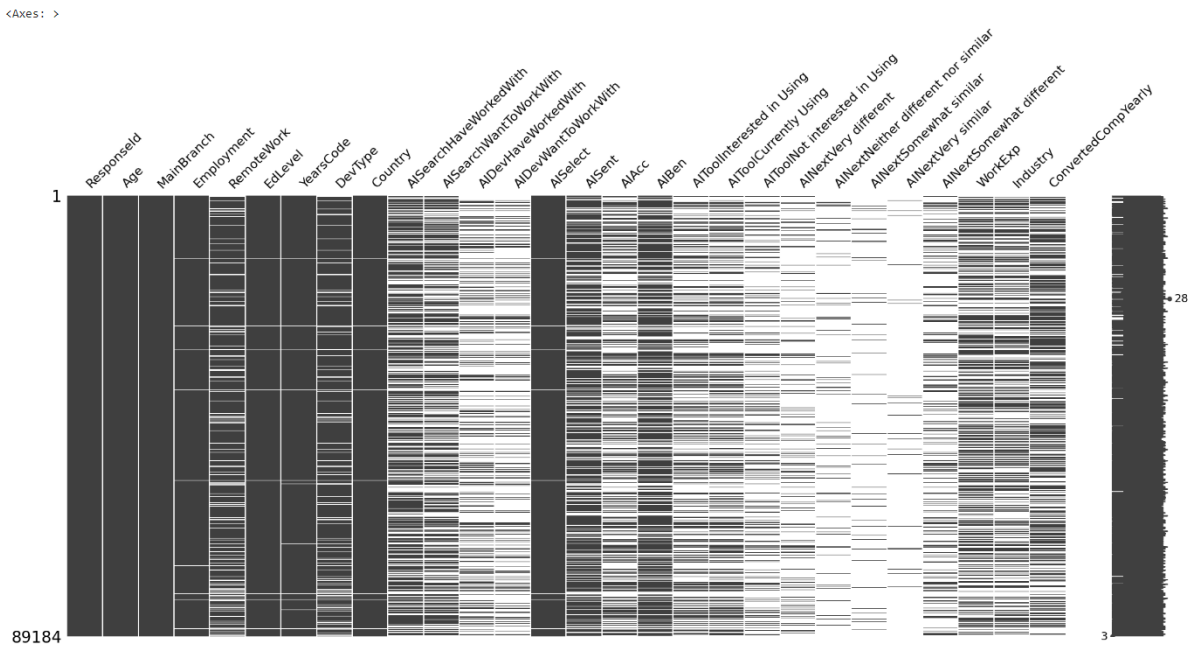
Data Preparation:

Understanding datasets:

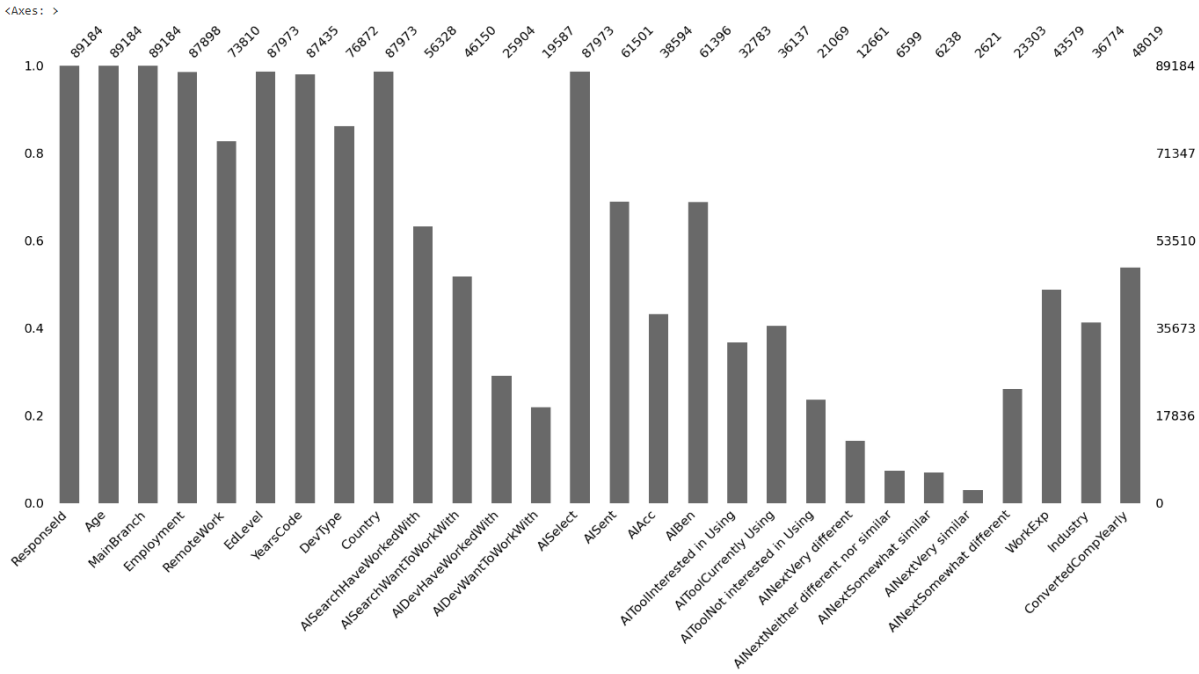
The data includes a wide range of details about developers, including their training, employment, career, use of technology, adoption of AI, usage of Stack Overflow, and more. The information appears to be extensive and is meant to help researchers better understand the preferences, experiences, and viewpoints of developers in various spheres of their professional lives.

The dataset includes data on the following significant aspects:
Information about a person's demographics, including their age, nationality, and main currency.
Information about the developer's present employment situation, job responsibilities, years of professional coding experience, greatest degree of education attained, and coding methods.
Information about the many technologies used by developers, including databases, cloud platforms, web frameworks, developer tools, and programming languages.
Information regarding how developers use Stack Overflow, such as how frequently they visit, their account status, whether they participate in Q&As, and whether they are active in the community.
Artificial Intelligence (AI) Usage and Sentiment: Data on the use of AI tools by developers, their views on the adoption of AI, and the advantages and trust placed in AI products.
Data acquired from the Professional Developer Series survey, which tries to comprehend the variables affecting developers' productivity and learning possibilities.

Now, we use the python pandas library for data preparation.
<u>Dealing with missing values:</u>
Our Goal is to research AI so we only use these columns which are related to AI. I have filtered the dataset and kept only the columns relevant to AI (Artificial Intelligence) for research. The “columns_to_keep” list contains the column names I want to retain, and the “filtered_survey_data” DataFrame is the result of this filtering.
After That We use the missingno library's msno.matrix() method to generate a matrix plot that reveals missing values in our dataset.

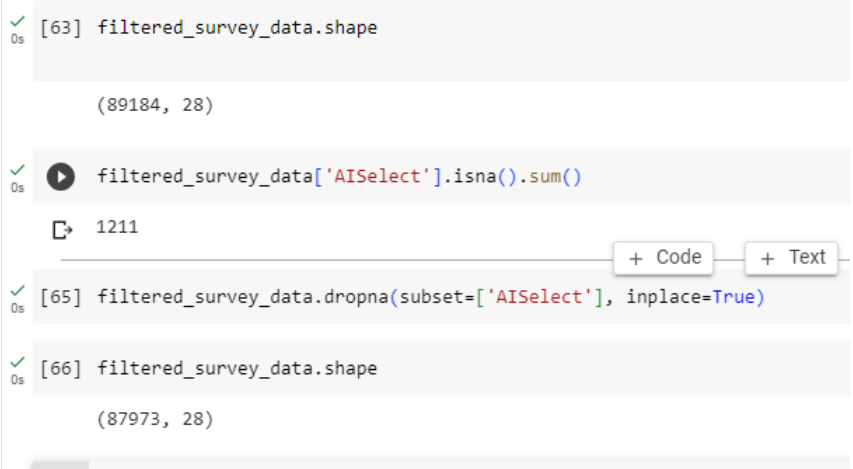


We may use the bar plot to see how the dataset's missing values are distributed. With this knowledge, we may determine which columns have a significant number of missing data.



We assume that A lot of columns have missing values for example 'AISearchHaveWorkedWith', 'AISearchWantToWorkWith', 'AIDevHaveWorkedWith', 'AIDevWantToWorkWith', 'AISent', 'AIAcc' and so on. However, our primary concern is the ‘AISelect’ column, which asks

developers whether they currently use AI tools in their development process. If this column has missing values, it will significantly impact our results. Therefore, we will delete 1211 rows that have missing values in the 'AISelect' column.



We specify a set of columns, columns_to_check, and then remove any rows from the filtered_survey_data DataFrame that have no values for any of these columns. Another dealing with missing values is drop rows by threshold. First, we set a threshold for the number of missing values allowed in a row. This threshold is calculated as 1.3 times the average number of columns in our DataFrame. This means that we will allow up to 1.3 times the average number of columns to be missing in a row before we drop the row.

Finally, we drop any rows from the filtered_survey_data DataFrame where the number of missing values is greater than the threshold.

<u>Transformation datasets:</u>
Some columns in the datasets have multiple values in a single cell. For instance, the column AIAcc asks respondents to rate how much they trust the accuracy of the results produced by AI tools when used in their development workflow. consists of numerous values in a row and five distinct values. We divided the data in each cell, separated them into categories, and made a new column for each category to handle this. We use the same process for 'AISearchHaveWorkedWith', 'AISearchWantToWorkWith', 'AIDevHaveWorkedWith', 'AIDevWantToWorkWith', 'AIToolInterested in Using', and 'AIToolCurrently Using'.

After thorough data preparation and applying the necessary transformations, our final dataset is now in a well-structured and cleaned state. It has 96 columns and 85,263 rows and contains useful data on developers and how they utilise AI technologies. Throughout the process, we have rectified missing values, transformed essential columns, as well as checked data integrity.

We will save this dataset to a CSV file called "filtered_survey_results_data.csv" so that it can be easily seen and used for additional analysis.

We have now finished the process of preparing our data and ready to move on to the data visualisation stage, where we may visually examine trends, patterns, and correlations in the data in order to find the answer to our research question.

```
[120] filtered_survey_data.shape

      (85263, 96)

[122] file_path = 'filtered_survey_results_data.csv'

      filtered_survey_data.to_csv(file_path, index=False)

      print("Dataset saved to 'filtered_survey_results_data.csv' successfully.")

      Dataset saved to 'filtered_survey_results_data.csv' successfully.
```

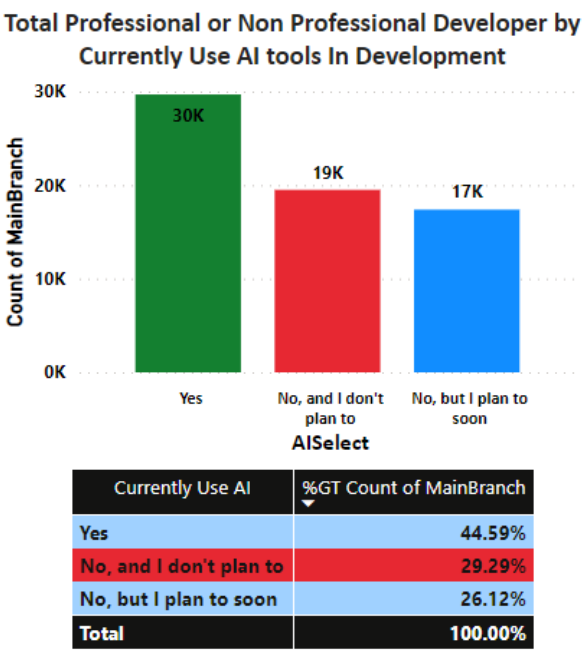
Exploratory Data Analysis and Visualisation:

Artificial intelligence (AI) is rapidly becoming a mainstream tool for software development. We see from the below report chart that 72% of developers are using or planning to use AI tools in their development process. This high adoption rate demonstrates that AI is not just a hype but has become a tangible and practical asset in the industry.

Currently Use AI	%GT Count of MainBranch
Yes	45.76%
No, and I don't plan to	27.67%
No, but I plan to soon	26.57%
Total	100.00%

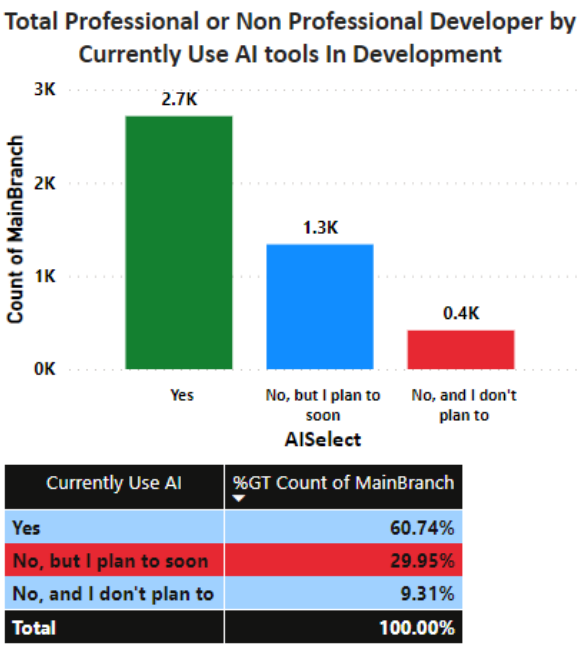
Figure 1: Currently Use AI Percentage

Interestingly, there is a notable difference in the adoption of AI tools between professional developers and learners. We discovered that non-professionals (learners) use AI technologies more frequently than professionals.This suggests that learners are more likely to adopt AI technologies to improve their learning abilities.



Currently Use AI	%GT Count of MainBranch
Yes	44.59%
No, and I don't plan to	29.29%
No, but I plan to soon	26.12%
Total	100.00%

Figure 2: Developers by Profession



Currently Use AI	%GT Count of MainBranch
Yes	60.74%
No, but I plan to soon	29.95%
No, and I don't plan to	9.31%
Total	100.00%

Figure 3: Non-professionals(Learners)

An impressive 32% of developers agreed that AI tools contribute to increased productivity during the development phase.
Approximately 25% of developers acknowledged that AI tools bring greater efficiency and speed up learning to their development workflows.
The findings from the below donut charts demonstrate the significant benefits that AI tools provide to developers in the software development domain. We discovered that a considerable percentage of developers acknowledge AI tools positive contributions in increasing productivity, enhancing efficiency, and accelerating learning.

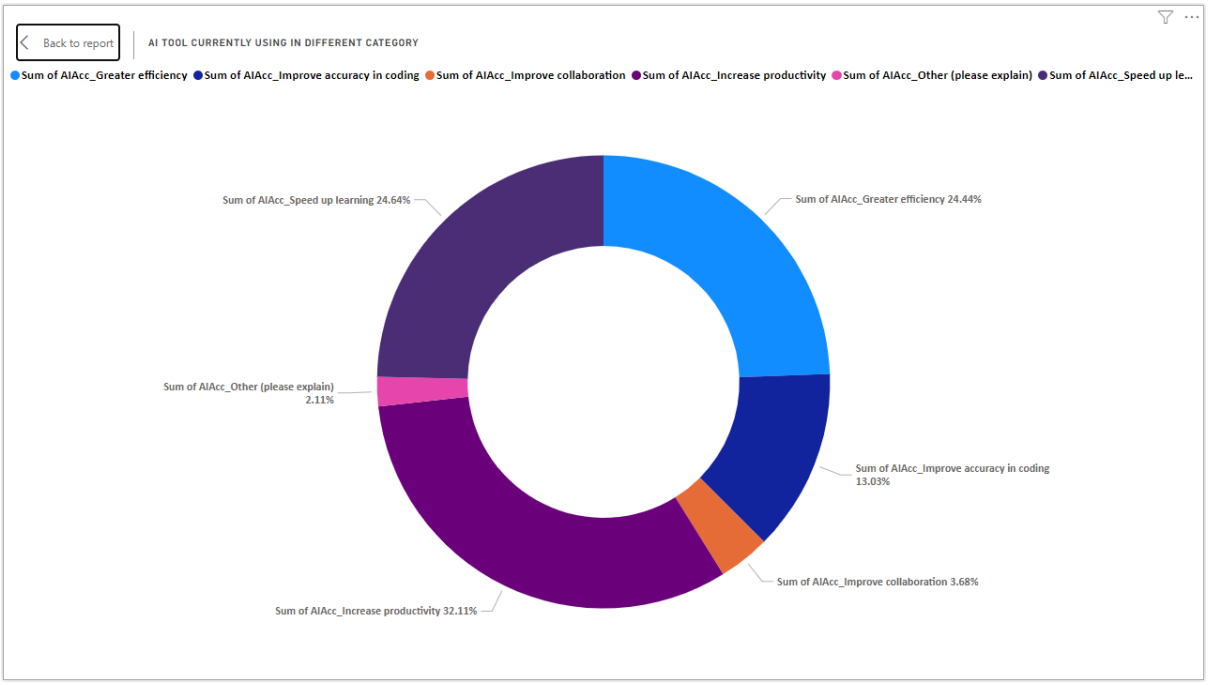


Figure 4: Currently using AI tool Benefits

Responses from about 60000 people, providing valuable insights into How favourable their stance is on using AI tools in the development workflow.
Half of the total respondents (50%) strongly believed that AI tools were favourable. Furthermore, 28% of developers found AI tools to be very favourable. These respondents displayed a high level of enthusiasm for integrating AI technologies, emphasising the significant advantages they perceived in doing so. A minor proportion of developers, below 10%, expressed some level of unfavorability towards AI tools.

The results of the pie chart show that developers generally have a positive attitude about using AI tools into their development workflow. A sizable portion of respondents had a favourable opinion of AI technologies, realising their potential to increase software development productivity and efficiency.

The industry's increasing acceptability and readiness to adopt AI technologies is highlighted by the strong favorability and enthusiasm demonstrated by half of the respondents. AI technologies are increasingly being viewed by developers as significant resources that can supplement their skill sets and speed up their development workflows.

The vast majority's positive response suggests a change in the software development landscape, even though a small minority of respondents expressed some degree of unfavorability. Developers will probably discover even more compelling reasons to integrate AI technology into their workflows as AI tools continue to grow and handle potential issues, encouraging innovation and advancement in the software development industry.

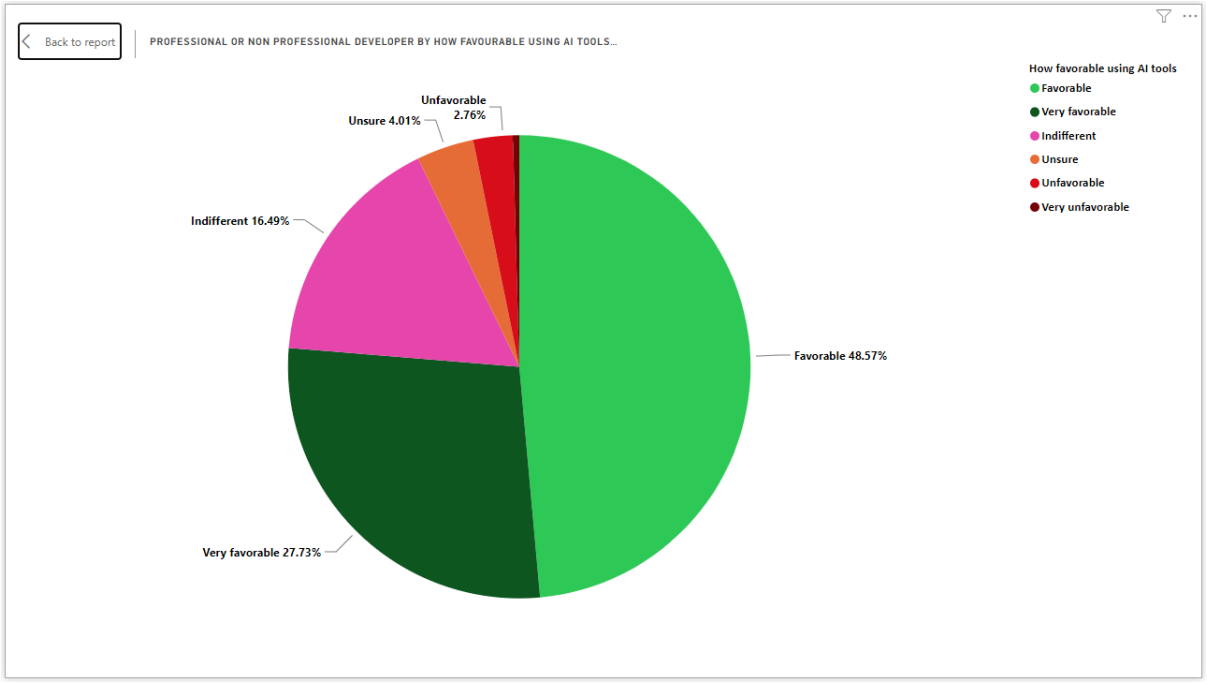


Figure 5: How favourable using AI tools

The vast majority of developers have faith in the accuracy of current AI tools. Compared to just a few years ago, when just a small portion of engineers trusted AI tools, this is an immense receive.
The level of trust between professional and hobbyist developers do not differ significantly. Above 24,000 developers somewhat trust the accuracy of AI tools. This means that they believe that AI tools are generally accurate, but they may have some concerns about their accuracy in certain situations. However, 2000 people highly trust the accuracy.

19,000 developers neither trust nor distrust the accuracy of AI tools. This means that they are open to using AI tools, but they are not yet convinced of their accuracy. Only 13,000 developers somewhat distrust the accuracy of artificial intelligence (AI) methods. This indicates that while they are not entirely in favour of employing AI tools, they do have some reservations about their accuracy.Only 3,000 developers highly distrust the accuracy of AI tools. This means that they believe that AI tools are not accurate enough to be used in software development.
The below column charts clearly shown the results:

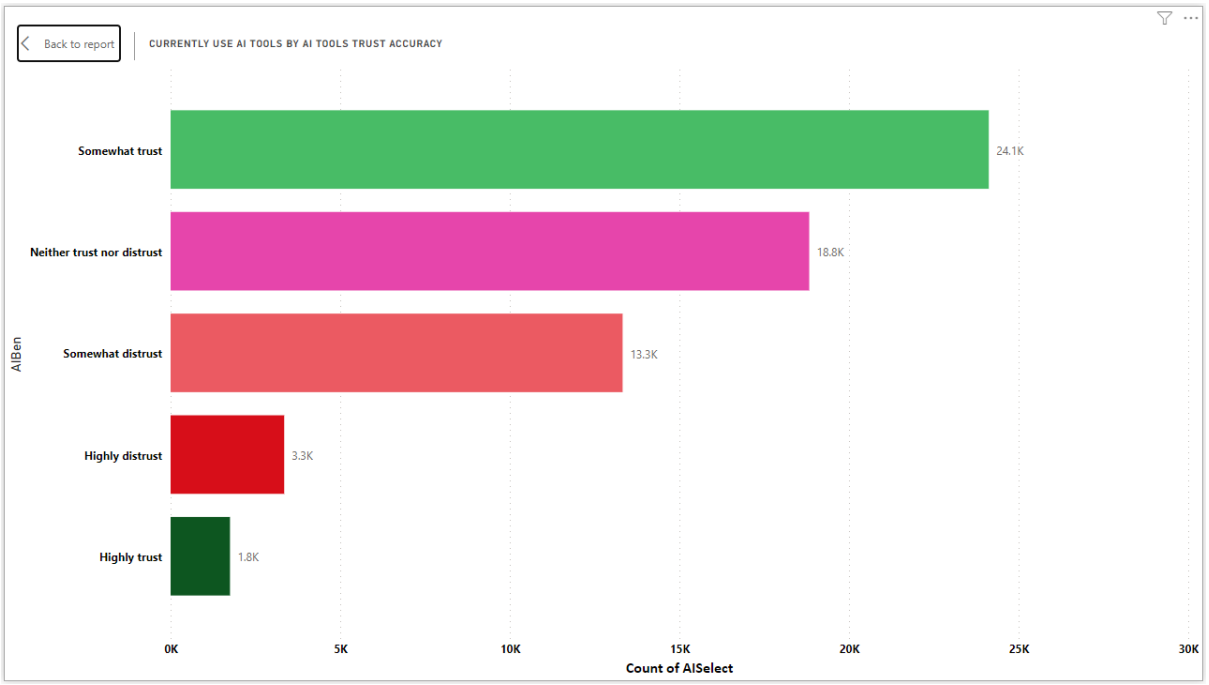


Figure 6: Trust accuracy of AI tools

ChatGPT emerged as the most popular choice among the AI tools evaluated, with a considerable above 65% (52000 people) of people who completed searches having prior experience working with it. The tool's widespread use demonstrates its effectiveness and attraction to users in a variety of fields.
Users were enthusiastic about Bing AI, with around 13,000 searches made on this AI tool. While ChatGPT maintains its dominance, the popularity of Bing AI indicates a rising appreciation for the features and capabilities provided by this platform.
With roughly 6,000 searches, Google Bird, and 8000 searches, WolframAlpha, another 2 AI applications, drew attention. While behind ChatGPT and Bing AI in terms of search volume, its presence in search queries implies that developers are actively investigating various AI tools on the market.

Below stacked bar chart give us a clear view:

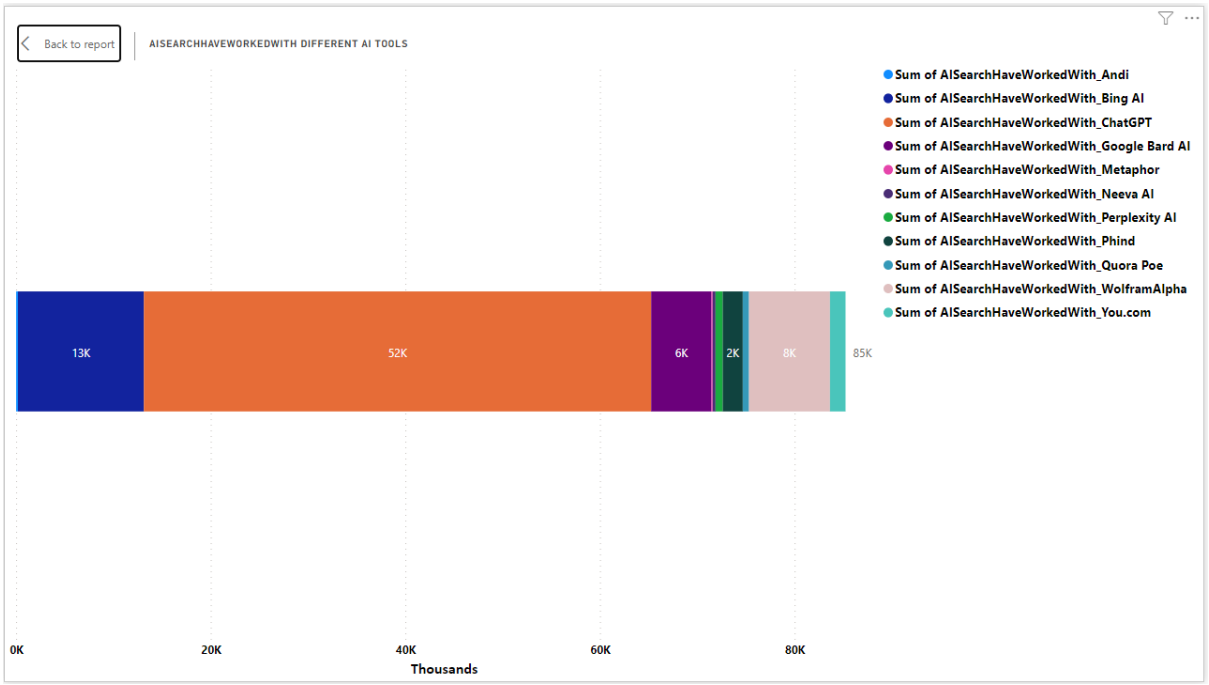


Figure 7: AI Tools Search have worked with

The adoption and use of AI tools varies among countries, affected by factors such as technological infrastructure, legislative climate, and professional awareness.
The United States has a high degree of AI tool usage, with 18014 respondents adopting AI tools in their development workflow.

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Country	Count of AISelect
United States of America	18014
Germany	7064
India	5468
United Kingdom of Great Britain and Northern Ireland	5333
Canada	3385
France	2831
Poland	2363
Netherlands	2297
Brazil	2001
Australia	1990
Spain	1803
Italy	1776
Sweden	1597
Switzerland	1115
Czech Republic	1039
Russian Federation	1027
Austria	1009
Israel	901
Turkey	865
Belgium	853
Ukraine	852
Denmark	833
Romania	813
Portugal	738
Norway	719
Finland	700
New Zealand	644
China	638
Greece	620
Mexico	592
Total	**85263**

Figure 8: AI Tools using countrywise

AI development tools have grown in popularity, with innovative platforms such as GitHub Copilot and SyncAI garnering a lot of attention from developers all over the world.
The great majority of developers regard AI development tools as powerful tools that boost their productivity and efficiency significantly. These technologies automate monotonous activities, provide intelligent code suggestions, and optimise development workflows, freeing up developers' time to work on more complicated and creative areas of their projects.
This below pie chart shows how much developer AI Dev Tools Has worked with

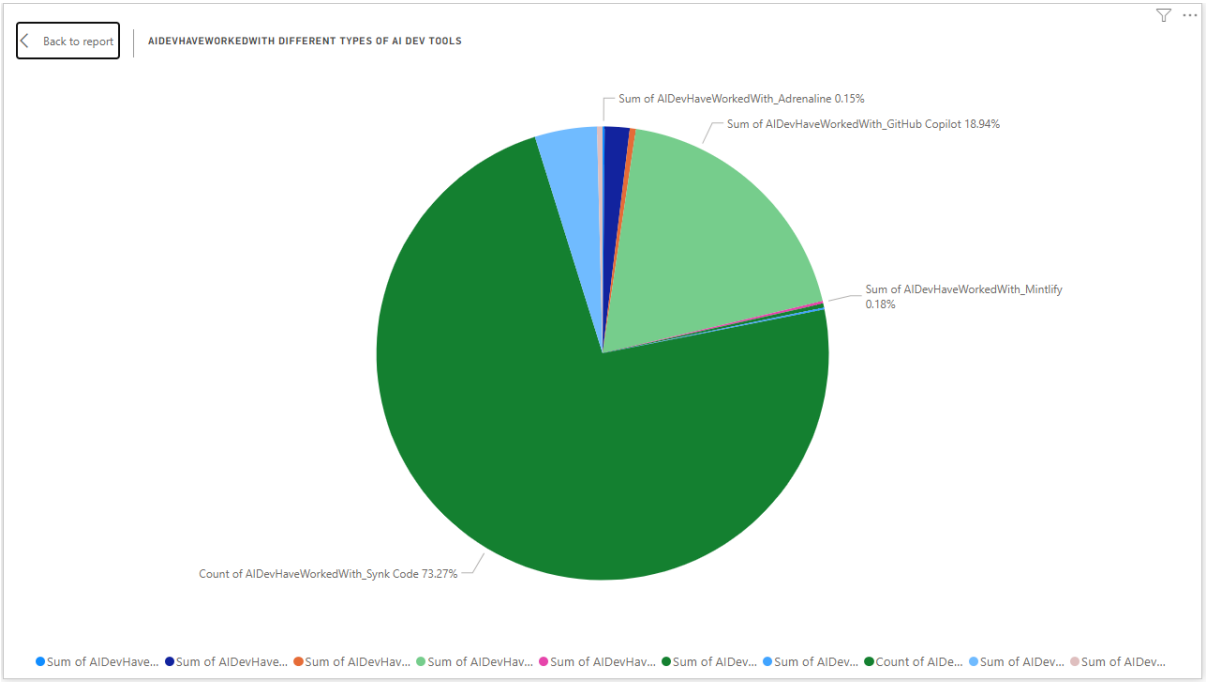

Figure 9: AI Dev Tools Search have worked with

Feedback:

After receiving feedback, I made significant improvements to the dashboard's colour selection and organisation. Initially, I experimented with a variety of colours for the donut charts, but based on the feedback, I realised the importance of creating a consistent and cohesive visual experience.

To fix this, I diligently chose a small palette of hues that went well together and suited the brand's aesthetic. The dashboard's bar charts, pie charts, and donut charts were all subsequently created using these colours in a consistent manner. This improved the overall aesthetic and gave it a more polished and professional aspect.

By applying the same colour scheme to the donut charts that was used for the other data visualisations, I achieved a seamless integration of information, making it easier for users to interpret and navigate the dashboard effectively.

As a result of these refinements, the donut charts now seamlessly blend with the overall design, creating a visually appealing and user-friendly experience. The limited and harmonious colour palette, along with the consistent organisation of dashboard views, has significantly enhanced the usability and aesthetic appeal of the dashboard.

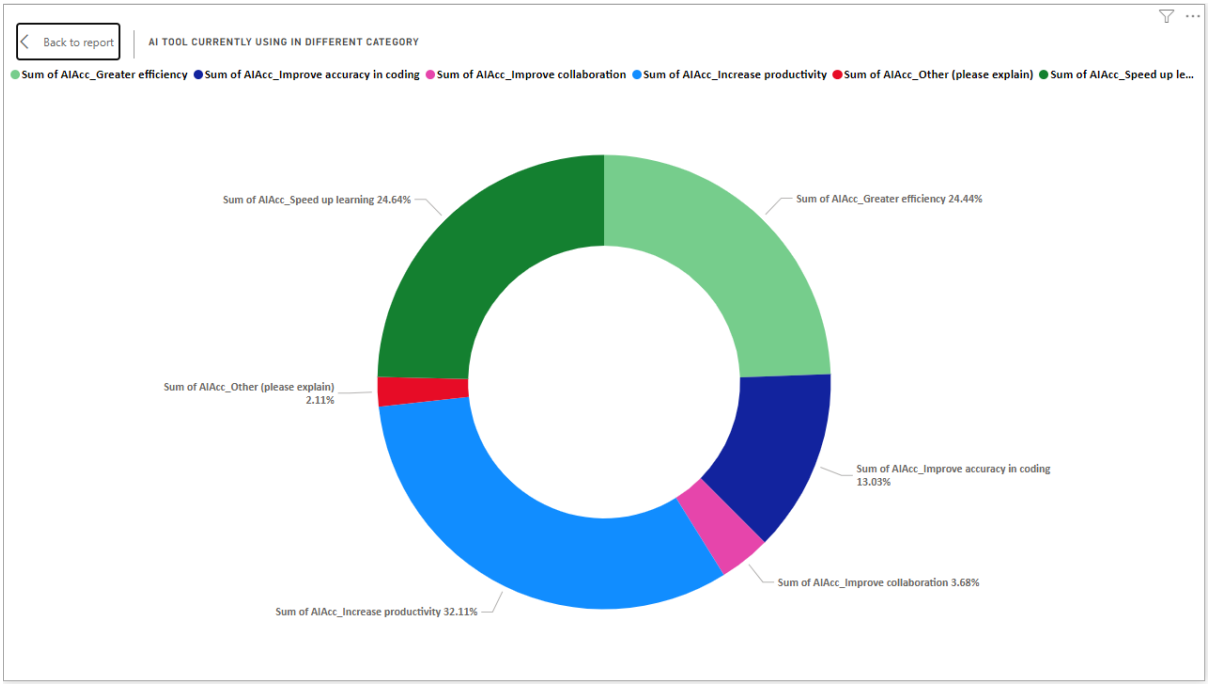

Figure 10: Changing colours Currently using AI tool Benefits

Conclusion:

We may draw a few conclusions regarding how developers perceive AI and its impact on their work based on our analysis of the Stack Overflow Annual Developer Survey 2023 data:

AI Adoption: The survey indicates that AI has become more than just hype in the developer community. Approximately 72% of developers are currently using or planning to use AI tools in their development process. This high adoption rate demonstrates that AI has become a tangible and practical asset in the industry.
Learners vs. Professionals: It's worth noting that non-professional developers (learners) use AI technologies at a higher rate than professionals. This implies that students are more inclined to use AI technologies to increase their learning abilities.
AI Tools Provide Significant Benefits: Developers recognize the significant benefits that AI tools provide, with 32% claiming that AI tools contribute to increased productivity during the development phase and approximately 25% claiming that AI tools bring greater efficiency and speed up learning in their development workflows.
Favorability Towards AI: The majority of developers (50%) are highly in favour of utilising AI tools in their development workflow, with another 28% expressing a very favourable opinion. This demonstrates a high level of enthusiasm for using AI technologies, as well as the huge benefits observed by developers.

Trust in AI Accuracy: The vast majority of developers believe that current AI technologies are accurate. This trust is a huge improvement from just a few years ago, when just a small percentage of engineers trusted AI tools.

Popular AI Tools: ChatGPT emerged as the most popular AI tool among those tested, with a significant number of developers previously working with it. Bing AI received attention as well, demonstrating a growing enthusiasm for its features.

Regional Differences: The adoption and usage of AI tools varies by country, with factors such as technological infrastructure and legislative climate influencing adoption and utilisation. The United States has a high level of AI tool utilisation, with many responders using AI tools into their development workflow.

AI Development Tools: AI development tools such as GitHub Copilot and SyncAI have grown in prominence as powerful tools that considerably improve productivity and efficiency in development workflows.

Finally, the results of the Stack Overflow research demonstrate that AI has become an essential aspect of the developer community, with the majority of developers actively utilising or considering AI technologies in their work. The widespread use of AI tools, as well as the good perception and faith in their accuracy, suggest that AI is having a significant impact on how developers work, rather than being just hype. As AI technology advances, it is expected to further disrupt the software development business, allowing engineers to be more productive and efficient.