

# AN OVERVIEW OF AI AND ML STRATEGIES FOR ORGANIZATION ARRANGEMENT

## Abstract

Artificial Intelligence(AI), computerized reasoning, network arranging, and the association between these ideas are talked about in everyday terms. To produce new expectations, AI models endeavor to take advantage of the crucial connections and examples in your information. Organizations are increasingly relying on AI (Artificial Intelligence) and ML (Machine Learning) strategies to streamline operations, improve decision-making, and spur innovation. These tactics entail the application of cutting-edge technologies to data analysis, insight extraction, and process automation. An overview of AI and ML organizational strategies is provided in this chapter. Adopting artificial intelligence (AI) and machine learning (ML) technology has become crucial for enterprises looking to improve operational effectiveness, decision-making procedures, and overall competitiveness in the modern digital landscape. This study seeks to present an overview of the uses, advantages, difficulties, and factors to be taken into account when integrating AI and ML in organizational contexts. The chapter begins by clarifying the underlying ideas of AI and ML, outlining their differences, and emphasizing their beneficial interaction. The applications of these technologies are then demonstrated, including natural language processing, process automation, predictive analytics, and recommendation systems. Real-world examples from a variety of industries highlight how AI and ML have the power to disrupt conventional business procedures. In addition to the many advantages, implementation issues with AI and ML are addressed. The possibility for bias, data privacy, and ethical considerations are crucial issues that call for careful management. In-depth discussion of options for overcoming these obstacles is provided in

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the article, including explainable AI and responsible data governance. The article also examines the organizational requirements for a successful integration of AI and ML. This includes cultivating cross-functional collaboration, upskilling people, and creating a data-driven culture. Additionally, frameworks for analyzing the ROI of AI and ML activities are offered strategically, assisting businesses in determining the worth of their investments and defending them. This report emphasizes the value of AI and ML as transformational tools in organizational evolution in its conclusion. Organizations may use AI and ML to enhance decision-making, streamline processes, and open up new doors for innovation and growth in the digital era by understanding the intricacies, potential applications, obstacles, and implementation requirements.

**Keywords:** Machine learning, artificial intelligence, innovation, ROI.

## I. INTRODUCTION

Our lives presently rely intensely upon innovation. Consistently, it continues to develop. It will keep on being vital to us later on and will show changes. Individuals have more charming existences when innovation is subsequently exceptional. Individuals are utilized in this industry to save this solace. Characterizing the innovation representing things to come is one more name for man-made reasoning, which is a mechanical capacity. It is comprised of the words "counterfeit," which is utilized to portray human-made duplicates of regular things, and "insight," which alludes to the limit with regards to understanding and thought, instead of being normally happening. In spite of the fact that it is a well known misguided judgment, the possibility of man-made reasoning isn't a framework. Frameworks currently incorporate computerized reasoning. As a rule, man-made reasoning is the investigation of human perspectives and the production of fake orders that are practically identical to these cycles; all in all, we can portray PCs as having the ability to do human exercises. It empowers machines to handle testing issues in a way similar to people. Actually utilizes PCs to take care of issues that call for knowledge and thinking. AI is a computerized reasoning application that empowers the framework to naturally gain from encounters and create. It permits the machine to advance unreservedly without programming and consistent control. For certain improvements in man-made consciousness, AI has progressed. The underlying advancement included showing PCs how to advance and how to complete any possible undertaking whenever it was understood that giving the data required achieving the errands. The advancement of the Web positions as the second-greatest development. The improvement of the Web opened up a formerly unfathomable potential for the putting away of data. The machines could now get to the information that was beforehand inaccessible to them inferable from stockpiling limitations. It is presently more successful to educate PCs to think for themselves rather of depending on them to perform assignments because of the development in how much information they can deal with. By empowering PCs to learn, AI calculations go about as their minds, making them more intelligent. Characterization empowers enormous errands to be finished in various exercises connected with the investigation of the assessed demonstrating and the examination of information. Customary openness to new information and encounters of these calculations. The presentation of educational information, for example, models, direct insight, headings, and perceptions to search for designs in the information, denotes the start of the growing experience. New info information is added to the AI calculation to confirm that it is working appropriately. The outcomes and assessment are then confirmed. By taking care of the PC more information, one can initiate the calculations that lead to "learning" and upgrade the result. The calculation is over and again retrained until the expected result is found in the event that the gauge isn't what was expected. Thus, the AI calculation can ceaselessly learn all alone and produce the best reaction, which will continuously work on its exactness over the long run. After the calculation has completed its learning stage, it can apply the information to handle related issues in view of different information groups.

## II. DATA INTEGRATION AND GATHERING

A critical component of contemporary business operations and decision-making is the collection of data from multiple sources within a company. Gathering, integrating, and organizing data from various sources, including databases, sensors, customer interactions, and more, are all part of this process. The many sources are broken down below, along with why it's crucial to gather information from them:

- 1. Databases:** Structured data is frequently kept in databases by businesses. This can consist of data on customers, sales, inventories, financial transactions, and more. Organizations can learn more about their past performance, spot trends, and decide on future initiatives by obtaining and evaluating this data.
- 2. IoT Sensors and IoT Devices:** collect real-time data from a variety of sources, including industrial, transportation, and environmental monitoring systems. These data can reveal information on the condition of the equipment, usage trends, energy usage, and more. Based on this information, organizations may enhance efficiency, estimate maintenance requirements, and optimize operations.
- 3. Customer Interactions:** Whether through sales, customer service, or social media, interactions with customers produce useful data. This covers consumer preferences, comments, purchasing patterns, and sentiment analysis. Organizations may personalize marketing campaigns, improve customer experiences, and create products that more effectively address customer demands by evaluating this data.
- 4. Social Media:** Social media sites offer a lot of information about user demographics, engagement, mood, and brand mentions. Organizations can assess public perception, follow trends, and modify their marketing strategy by analyzing social media data.
- 5. Market Research:** Outside sources including industry studies, market research reports, and competition analysis also provide useful information. Organizations can use this information to better analyze market trends, spot new possibilities, and hone their competitive strategy.
- 6. Supply Chain and Logistics:** Organizations may optimize inventory levels, shorten lead times, and boost supply chain efficiency by using data from shipping, warehousing, and distribution activities in the supply chain and logistics.
- 7. Financial Information:** Financial information, such as revenue, costs, and profitability, is crucial for determining how financially sound a company is. This information aids in cost management and investment decision-making as well as budgeting and financial forecasts.
- 8. Employee Performance:** Information on an employee's performance, attendance, and training can be used to manage talent, determine training requirements, and assess workforce productivity.

### III. MAKING OPPURTUNITIES KNOWN

Without a doubt, AI and ML may add significant value to a variety of organizational functions. Here are some applications for AI and ML that can be used to add value:

- 1. Operating Effectiveness:** Automate repetitive processes by using AI-powered bots and robotic process automation (RPA), which will save time and minimize human error. Util-

ize machine learning algorithms for predictive maintenance to create the best maintenance schedules and avoid unscheduled downtime.

2. **Customer Encounters:** Implement AI-driven recommendation systems to provide clients with individualized product recommendations, marketing campaigns, and content. Integrate AI-powered chatbots or virtual assistants to offer real-time customer service and respond to frequently asked inquiries.
3. **Advanced Analytics:** Apply AI and ML to evaluate huge datasets and derive useful insights, facilitating departmental decision-making based on data. Fraud detection are useful to improve security and risk management, use machine learning models to identify fraudulent behavior and transactions.
4. **Quality Assurance:** Implement computer vision techniques for automatic flaw detection during the manufacturing process to ensure higher levels of quality. Use machine learning (ML) to find abnormalities in data or processes that could point to problems with quality or irregularity.
5. **Talent Acquisition:** Use AI to speed up the hiring process by screening resumes, matching candidates with job profiles, and more. Employ sentiment analysis and feedback analysis to determine the level of employee happiness and engagement.
6. **Sales and Marketing:** Lead Scoring: Use machine learning to score and rank leads according to how likely they are to convert, increasing the effectiveness of the sales team. Utilize AI to attribute sales and conversions to the most efficient marketing channels in order to maximize your marketing budget.
7. **Medical Services:** Use artificial intelligence (AI) in medical imaging to make precise diagnoses and give individualized treatment advice. Drug Discovery: To examine molecular structures and anticipate prospective drug candidates more effectively, use machine learning.
8. **Energy Administration:** Implement AI algorithms to reduce expenses and the environmental impact of energy use in commercial and industrial activities. ML can be used to forecast the output of renewable energy, improving grid management and stability.
9. **Monetary Services:** Risk evaluation: Apply AI to credit scoring and risk evaluation to enhance lending decisions and lower default rates. Utilize machine learning to create trading strategies based on current market conditions and past performance using algorithmic trading.

It's important to keep in mind that the key to successfully integrating AI and ML solutions is to thoroughly examine the unique demands, accessible data, and existing procedures of your firm. Begin with small-scale efforts, evaluate their results, then progressively move on to bigger ones as you gain knowledge and expertise.

#### IV. SPECIFYING GOALS

Clearly establishing goals and objectives is essential when putting AI (Artificial Intelligence) and ML (Machine Learning) methods into practice. These goals aid in concentrating efforts and resources and guarantee that the implementation procedure is in line with the larger business plan. The following are some typical goals for applying AI and ML techniques:

- 1. Cost Cutting and Increased Effectiveness:** Automate laborious and repetitive operations using AI and ML to improve operational efficiency and lower personnel expenses. Utilize predictive analytics to improve cost-effectiveness overall by decreasing waste and maximizing resource allocation. Utilize AI-driven process optimization to accelerate cycle times and streamline workflows, saving you time and money.
- 2. Expansion of the Market and Revenue Growth:** Use AI and ML to mine massive datasets for insights that can help you better understand client preferences and behavior, allowing you to create marketing campaigns that are more precisely targeted. Create cross-selling and upselling systems powered by AI to raise the average transaction value. Predictive modeling can be used to spot emerging market trends and opportunities, facilitating proactive product creation and market growth.
- 3. Improved Strategic Planning and Decision-Making:** Use analytics powered by AI to deliver precise and timely insights for thoughtful decision-making. Improve strategic planning and risk management by using ML algorithms to examine historical data and find patterns. To increase the accuracy of anticipating market trends, demand swings, and financial performance, develop AI-based forecasting models.
- 4. Customer Experiences that are Personalized:** Increase client happiness and loyalty by utilizing AI and ML to produce personalized suggestions, tailored product offerings, and personalized content. Use AI-powered chatbots and virtual assistants to improve customer support and engagement while offering round-the-clock assistance.
- 5. Innovation in Products and Services:** Analyze client feedback and usage trends using ML algorithms to spot potential for product improvements and innovations. Utilize AI in research and development to hasten the identification of fresh approaches and upgrades.
- 6. Fraud Detection and Risk Management:** Utilize AI-based anomaly detection technologies to find out-of-the-ordinary transactional trends, lowering the chance of fraud and monetary loss. Improve loan decisions by using ML algorithms to evaluate credit risk and foresee probable defaults.
- 7. Operating Excellence and Improving Quality:** Reduce downtime and increase the dependability of machinery and equipment by implementing AI and ML for predictive maintenance. Implement quality control procedures with the aid of AI-powered image analysis and identification.
- 8. Productivity and Satisfaction Among Employees:** Automate basic administrative activities using AI tools to free up staff time for more strategic and innovative aspects of their jobs. Give staff members AI-driven insights to aid in decision-making for tasks.

- 9. Regulatory Conformity:** Utilize AI tools to track compliance with rules and to automatically alert you to any problems.

Any corporation can design its AI and ML strategies to address particular needs, track progress, and ultimately produce measurable results that are in line with its business goals by precisely outlining these objectives.

## V. SELECTING AI AND ML METHODS

Depending on the objectives of the organization and the data's features, choose the best AI and ML techniques. Natural language processing (NLP), computer vision, reinforcement learning, supervised learning, and others are examples of common techniques.

- 1. Supervised Learning:** To train a model to produce predictions or classifications based on fresh, unused data, use labeled data. Common algorithms include neural networks, support vector machines, decision trees, and linear regression. Use cases include sales forecasting, customer churn analysis, credit risk evaluation, and picture classification.
- 2. Unsupervised Learning:** Without specific direction, analyze unlabeled data to find patterns. Clustering (K-Means, Hierarchical Clustering), Dimensionality Reduction (PCA, t-SNE), and Anomaly Detection are examples of common techniques. Use examples include text data topic modeling, fraud detection, and customer segmentation.
- 3. Reinforcement Learning:** To optimize rewards in a situation, teach agents to make a series of decisions. Common algorithms include Proximal Policy Optimization (PPO), Deep Q Networks (DQN), and Q-Learning. Use examples include autonomous systems, robotics control, and game playing (such as AlphaGo).
- 4. Natural Language Processing:** Analyze and edit text or audio data that is in a human language. Tokenization, NER, sentiment analysis, language translation, and text generation are techniques. Use examples include text summarization, sentiment analysis, language translation, and chatbots.
- 5. Computer Vision:** Processing and visual analysis of video or image data. Techniques include facial recognition, object detection in images, image segmentation, and image classification. Use examples include autonomous vehicles, medical image analysis, and object recognition and tracking.
- 6. Time Series Analysis:** Analyze data items gathered over time to draw conclusions or spot trends. Prophet, LSTM (Long Short-Term Memory), and ARIMA are techniques. Use examples include predicting stock prices, the weather, and energy usage.
- 7. Transfer Learning:** Improve performance on a similar task with little data by using a model that has already been trained on one task. Cases of Use employing pre-trained picture classifiers for particular domains to fine-tune a language model that has already been trained for specific NLP tasks.

8. **Ensemble Methods:** To enhance overall performance and generalization, combine numerous models. Bagging (Random Forest), boosting (AdaBoost, Gradient Boosting), and stacking are three techniques. Regression, classification, and strengthening model robustness are use cases.
9. **Generative Adversarial Networks (GANs):** Produce fresh data samples that resemble the training set. Use examples include data augmentation, style transfer, and image creation.

Keep in mind that the technique you choose should be compatible with the objectives your business has, as well as the data, computing power, and subject-matter expertise accessible to you. Starting with simpler methods and eventually moving on to more complicated ones as necessary is frequently beneficial. Additionally, identifying the right strategy for your particular challenge requires experimentation and ongoing refinement.

## VI. DATA LABELLING AND ANNOTATION

Undoubtedly, especially in supervised learning scenarios, data labeling and annotation are essential phases in the training of machine learning models. In these procedures, the raw data is given precise and relevant labels or annotations, allowing the model to discover the patterns and connections necessary for classification or prediction. The main components of data labeling and annotation are broken down as follows:

### 1. First, Prepare Your Data

- **Selection:** Pick a dataset that is pertinent to your issue and supports the goals of your model.
- **Cleaning:** Make sure the data is clear of mistakes, duplicates, and discrepancies that could fool the model.
- **Normalization:** To make data easier for the model to grasp, normalize it into a standardized format.

### 2. Marking

- **Manual Labeling:** After reviewing data instances, human annotators give the proper labels in accordance with specified categories.
- **Annotation tools:** Use specialist tools or software for efficient and precise labeling by using annotation tools. These instruments could be text highlighters, drawers for bounding boxes, etc.
- **Quality Control:** Take steps to assure correctness and uniformity across diverse annotators. Regular discussions and reviews can support maintaining labeling quality.

### 3. Types of Annotations

- **Classification** is the process of giving data examples labels based on a predetermined set of categories. Like classifying emails as "spam" or "not spam." Assigning continuous values to data instances is **Regression**. Predicting housing costs, for instance, utilizing factors like square footage, location, etc. Bounding boxes are used to enclose



items in photos so that models can be trained to locate them. Labeling specific pixels or areas of a picture with labels is known as **Segmentation**, used in processes like semantic segmentation, in which each pixel is identified as a component of a certain item.

4. **Expertise and Recommendations:** Annotators need to be well-versed on the assignment's requirements and labeling standards. Consistent labeling and less ambiguity are benefits of clear instructions.
5. **An Iterative Procedure:** Iterative data labeling is possible, comprising numerous iterations of model training and annotation. As the model gets better, it might spot patterns that weren't there before and assist hone the labeling procedure.
6. **Inconsistent Data:** If one class has noticeably fewer samples than the others, address the sample imbalance. This problem can be reduced by using methods like oversampling, undersampling, or creating synthetic data.
7. **Active Education:** In some circumstances, the model itself can recommend which data instances are best for labeling, maximizing the annotation effort.
8. **Privacy and Morality:** Especially if the data contains sensitive information, be careful of privacy issues. Data should be pseudonymized or anonymized as needed. To guarantee that the annotation process respects cultural, social, and legal standards, adhere to ethical criteria.

Keep in mind that the effectiveness of your machine learning model is directly impacted by the quality of your labeled data. Effective data labeling and annotation require time and effort, but the results are more accurate and robust models that can make informed predictions or classifications.

## VII. MODEL CREATION AND SELECTION

Implement your preferred algorithms using a good machine learning framework (such as TensorFlow, PyTorch, or Scikit-learn). Separate the training data even further into target labels ( $y$ ) and input features ( $X$ ). Set up the model of choice, then train it using the training set of data. To identify overfitting or underfitting, keep an eye on the model's performance on the validation set.

1. Describe the issue and Clearly state the issue that machine learning is intended to tackle. Define the objective, the kind of model you'll require (classification, regression, clustering, etc.), and the performance measures you'll employ.
2. **Data Preparation and Collection:** Compile the essential historical data for your issue. The data should be cleaned, preprocessed, and formatted appropriately. Deal with any missing values, outliers, or noise that can impair the performance of the model.

3. **Feature Engineering:** is the process of taking important features out of data so the model can better recognize patterns and correlations. This could entail deciding which features are pertinent, developing new features, and encoding categorical variables.
4. **Splitting your data** into training, validation, and test sets is a good idea. The validation set aids in hyperparameter tuning, the test set assesses the ultimate performance of the model, and the training set is utilized to train the model.
5. **Model Selection:** Pick the right algorithms for your situation. This depends on elements including the data's type, the relationships' intricacy, and the intended result. Create the **architecture** for the model you have selected. Choosing the quantity of layers, nodes, activation functions, and other pertinent elements falls under this category.
6. **Model Training:** Apply the training dataset to the model. Depending on the algorithm you choose, use frameworks like TensorFlow, PyTorch, scikit-learn, or others. The model picks up patterns and connections from the historical data during training.  
Tuning of the **hyperparameters:** Try out various hyperparameters to improve the performance of the model. Grid search, random search, or more sophisticated approaches like Bayesian optimization can be used for this.
7. **Validation and Evaluation:** Use the proper measures (accuracy, precision, recall, F1-score, etc.) to periodically assess the model's performance on the validation set. This aids in tracking the model's development and identifying overfitting.
8. **Model Refinement:** To increase the model's precision and generalizability, take required modifications to the model architecture, hyperparameters, and data pretreatment steps based on the validation findings.
9. **Testing and Deployment:** Once the model's performance on the validation set has pleased you, assess it on the test set to obtain a definitive assessment of its efficacy. Deploy the model to production if it satisfies your requirements. variables.
10. **Regular Updates and Maintenance:** Continue keeping an eye on how the model performs in the real world. Retrain the model periodically to adjust to shifting trends and keep accuracy as new data becomes available.
11. **Feedback Loop:** Gather user and stakeholder feedback. Utilize this criticism to further enhance the performance of the model.

Just keep in mind that the specifics will rely on your problem, data, and selected techniques and that this is only a high-level overview. Because machine learning is an iterative process, be ready to repeat these processes in order to hone and enhance your models over time.

## VIII. TESTING AND VALIDATION

In the development of machine learning and artificial intelligence, testing and validation are essential processes. These procedures aid in ensuring that trained models are trust-

worthy, precise, and able to generalize well to fresh, unexplored data. A breakdown of the testing and validation procedure is provided below:

- 1. Training and Validation Split:** It's important to divide your dataset into two main subsets, the training set and the validation set, before you start testing and validating your models. The validation set is used to test model performance, fine-tune hyperparameters, and avoid overfitting while the training set is used to train the model.
- 2. Teaching the Model:** The training data are used to educate the model the relationships and patterns found in the data. Based on the input attributes and desired outcomes, the model develops the ability to predict outcomes. The objective is to reduce the discrepancy between the predicted values of the model and the actual target values.
- 3. Tuning The Hyperparameters:** A model's hyperparameters control how it learns and generalizes. They must be established before to training because they cannot be taught during it. To determine the ideal parameters that produce the best model performance, you can experiment with various hyperparameter values and configurations using the validation set.
- 4. Validation:** Using the validation set, you assess the model's performance after training it. By serving as a stand-in for unobserved data, the validation set enables you to assess how well the model generalizes to fresh, untested samples. Depending on the particular issue, common evaluation measures may include accuracy, precision, recall, F1 score, mean squared error, etc.
- 5. Iterative Approach:** An iterative approach is frequently used in validation. You may need to tweak the model architecture, increase the training data, or adjust the hyperparameters if the model's performance on the validation set is unsatisfactory. This procedure is repeated until the validation results show that the model is effective.
- 6. Comparing with Real World Scenarios:** When your model has demonstrated sufficient performance on the validation set, it is time to test it against real-world scenarios. In order to do this, a unique, unexplored dataset that the model has never seen before must be used. A model's ability to handle unexpected variations and generalize far beyond the training and validation data is ensured by testing against real-world events.
- 7. Performance Metrics on Test Data:** Similar to model validation, performance metrics on test data are used to assess how well the model performs. This step offers a final evaluation of how effectively the model is likely to function in practical applications. Using the test set more than often could result in overfitting to the data, therefore it's vital to keep that in mind.
- 8. Monitoring and Maintenance:** It's critical to continue tracking the model's effectiveness in real-world circumstances even after it has been deployed. Retraining and revalidation may be required if the model's performance deteriorates over time as a result of changes in the data distribution or other variables.

In conclusion, testing and validation are essential stages to guarantee that trained models are reliable, accurate, and capable of working well in practical settings. By addressing problems like overfitting, bias, and inadequate generalization, these phases eventually result in more trustworthy and efficient AI systems.

## IX. DEPLOYMENT

Machine learning model deployment strategies require careful consideration of a number of different aspects, including infrastructure, tools, scalability, latency, security, and cost. Deploying devices on-premises, in the cloud, or at the edge relies on the particular use case and specifications of your project. A step-by-step method for creating a deployment strategy is provided below:

- 1. Understand Needs:** Specify the needs for your project, taking into account the workloads, user base, data volume, and response times you anticipate. Your deployment choices will be guided by this information.
- 2. Deployment Alternatives:** Analyze the various deployment options:
  - **On-Premises:** Suitable for applications with stringent compliance and data security standards. Although it offers total control over infrastructure, it could need a sizable initial expenditure.
  - **Scalability, flexibility, and ease of management** are provided by cloud-based systems. ML models may be deployed using a variety of methods thanks to services like AWS, Azure, and GCP.
  - **Edge Devices:** Perfect for situations where intermittent connectivity or low latency are essential, such as with IoT devices or real-time applications.
- 3. Structure and Equipment:** Depending on the deployment option you choose, choose the required tools and infrastructure:
  - **On-Premises:** You will be responsible for configuring and maintaining your hardware and software stack, which includes servers, storage, networking, and container orchestration technologies like Kubernetes.
  - **Cloud-based:** For deploying and administering models, cloud providers provide managed services like AWS SageMaker, Azure Machine Learning, or Google AI Platform. They also offer resources for load balancing and auto-scaling.
- 4. Scalability:** Take into account the possibility of rising usage and data volume over time. Select a deployment strategy that enables simple scalability. Based on demand, cloud-based systems can scale automatically. Manual scaling may be necessary for on-premises configurations, however Kubernetes and other container orchestration solutions can be useful.
- 5. Latency:** Consider your application's latency requirements. Network latency may be introduced by cloud-based installations, but edge devices can offer low-latency inference.

6. **Security:** Implement effective security procedures to safeguard your models and data. Make sure that data is transmitted and stored in an encrypted form. Implement suitable mechanisms for authentication and permission for access control. Keep frameworks and software updated on a regular basis to resolve security flaws. Establish monitoring tools to look for any unexpected behaviour. Examine each deployment option's cost structure:
7. **Cost Analysis:** Operational costs for cloud-based deployments are based on use. On-premises systems entail higher upfront expenses but could end up saving money over time. Although they may have a physical cost, edge devices can reduce cloud usage expenses.
8. **Hybrid Strategies:** To maximize performance, security, and cost, think about hybrid solutions that integrate on-premises, cloud, and edge components.
9. **Testing and Optimization:** Thoroughly test your deployment method using realistic workloads before deploying to production. Performance, resource use, and financial efficiency should all be optimized.
10. **Maintenance and Monitoring:** Establish monitoring tools to keep tabs on model performance, resource usage, and any problems. Maintain and update your deployment frequently to keep it in line with changing requirements.

Remember that your project's unique qualities will determine the best deployment approach, so be ready to iterate and adjust as your application develops and evolves over time.

## X. MONITORING AND UPKEEPING

Constantly keep an eye on how deployed AI/ML models are doing in practical situations. Models may lose precision if data distribution and pattern changes over time. Retrain and update models frequently to make sure they continue to work. After they are put into use, AI/ML models need to be monitored and maintained in order to remain effective. Here is a more thorough explanation of the procedure:

1. **Real-Time Surveillance:** Utilize monitoring software to keep tabs on the performance of your deployed models in real time. Depending on the specifics of your application, this may include measures like accuracy, precision, recall, F1-score, and more. Set up notifications so that you'll be informed when specific performance thresholds are crossed. By doing so, you can take care of problems as they come up fast.
2. **Detecting Data Drift:** Keep an eye on how the data are distributed as it comes in to spot any changes or shifts. Data drift can happen as a result of modifications in user behavior, outside variables, or other environmental changes. To detect data drift, use statistical methods or machine learning algorithms. These methods can assist you in determining whether the incoming data significantly differs from the data used to train the model.

3. **Track the Evolution:** of your model's performance over time by using this tool. Keep a history of the model performance metrics .To find trends and probable degradation, compare the model's original performance to the current performance.
4. **Retraining and Updating Models:** As model performance degrades and data drift is identified, you might want to retrain your models. Amass enough new information to produce a training dataset that accurately reflects the current distribution of data. Update the model with the new data while keeping the original model's expertise by employing techniques like transfer learning or fine-tuning.
5. **Version Control:** Keep your models' and related code's versions under control. Keeping track of modifications to the model, codebase, and configuration settings over time is made possible by this.
6. **Experiments and A/B Testing:** Before sending new model iterations into production, conduct A/B testing on them. This enables you to assess how well the new version performs in comparison to the previous one. Test out several algorithms, hyperparameters and features to make sure you're using the ideal setup for your issue.
7. **Feedback Cycle:** Obtain user and stakeholder input on the effectiveness of the model that has been adopted. This input might assist you in finding problems that automatic monitoring might not pick up right away.
8. **Adaptive Techniques:** Think about using adaptive techniques that instantly modify model parameters in response to shifting circumstances. A group of models, for instance, could be activated or deactivated in response to specific circumstances.
9. **Documentation:** Keep complete records of the monitoring and maintenance procedures, including the tactics you used, the choices you made, and any difficulties you had.
10. **Ongoing Education:** Keep abreast with the most recent developments in AI/ML monitoring and maintenance research and best practices. New methods may develop to increase the resilience of deployed models as the area develops.

You may make sure your AI/ML models are useful to users in the dynamic real-world contexts they operate in by putting these methods into practice.

## XI. ETHICAL CONCERNS AND BIAS MITIGATION

Address ethical issues with regard to bias, fairness, openness, and privacy. To ensure equitable results, put in place tools to spot and reduce biases in the data and models. It is imperative to address ethical issues with prejudice, fairness, transparency, and privacy in AI systems in order to ensure that these technologies are utilized ethically and do not reinforce current inequities or damage people. Here is a thorough outline of factors to take into account and prevention techniques for bias:

## 1. Ethical Challenges and Concerns

- **Bias:** AI systems that are biased may treat some groups of people unfairly or produce incorrect findings, which would serve to reinforce discrimination.
- **Fairness:** Preventing both explicit and covert types of prejudice, fairness requires that the AI system produce comparable results for various groups.
- **Transparency:** AI systems ought to be clear and easy to grasp so that users may understand how decisions are made.
- **Privacy:** It's crucial to safeguard user information and uphold privacy in order to avoid misuse or unauthorized access.

## 2. Techniques for Recognizing and Reducing Biases

- **Preprocessing of Data:** Examine and examine training data for possible biases, taking into account both overt and covert biases. To avoid underrepresentation, balance the representation of various demographic groups in the training data.
- **Measurement of Bias:** Implement measures, such as disproportionate impact, equal opportunity, and demographic parity, to statistically examine biases in AI algorithms. Monitor and assess the model's performance frequently across multiple groups to spot any inconsistencies.
- **Fairness of the Algorithm:** Use learning methods that explicitly take fairness restrictions into account when training models. To ensure egalitarian results and prevent reverse discrimination, modify the model's predictions.
- **Transparency and Explainability:** Create models that explain their choices so that people may comprehend the thinking behind the results. Create interpretable explanations by using strategies such as LIME (Local Interpretable Model-Agnostic Explanations) and SHAP (SHapley Additive exPlanations).
- **Consistent Auditing:** Even after implementation, continuously audit and assess the AI system's performance for biases. To improve the system and correct any biases that may have emerged, take into account user input and in-person observations.
- **Loop for User Feedback:** Establish ways for users to report prejudice or unfair results, and work quickly to address these problems. Engage different user groups to gain understanding and viewpoints on any biases.
- **Protection of Privacy:** To ensure that personal information is not disclosed, use effective data anonymization techniques.

## 3. Moral Points to Bear in Mind

- **Design with Inclusion:** Engage diverse teams in the design and development process to reduce the likelihood of biases resulting from uniform viewpoints.
- **Impact Evaluation:** Before adopting AI systems, conduct ethical impact analyses to pinpoint potential biases and dangers.
- **Accurate Records:** For transparency, describe the development process, data sources, model architecture, and mitigation techniques.
- **Responsibility:** Make it clear who is responsible for keeping an eye on and eliminating bias, both inside development teams and across the business.

- **Ongoing Education:** To modify techniques over time, stay up to date on new best practices, research, and bias reduction technologies.

While addressing biases and ethical problems, incorporating these procedures and considerations can considerably aid in the development of AI systems that are more fair, transparent, and respectful of privacy. It's crucial to understand that bias mitigation is a continuous process that calls for vigilance and dedication to encouraging equitable outcomes.

## XII. CONSTANT IMPROVEMENT AND LEARNING

The fields of AI and ML are developing quickly. Keep up with the most recent discoveries and studies in the area. Encourage your AI/ML teams to adopt a culture of ongoing learning and development. Undoubtedly, in the realm of AI and machine learning, promoting a culture of continual learning and progress is crucial. Keeping up with the most recent developments and research is essential for keeping a competitive edge and creating high-quality solutions as these technologies evolve quickly. Here are some tactics to promote an environment of ongoing learning and development within AI/ML teams:

1. **Invest in Education and Training:** Give your teams the chance to attend workshops, conferences, and training courses. Encourage them to enroll in online courses or obtain specialized credentials. Their skills will be improved and they will stay current with the newest trends thanks to this investment in education.
2. **Regular Knowledge Sharing Sessions:** Organise routine internal knowledge sharing meetings where team members can present and talk about latest research articles, initiatives, or developments in AI/ML. This encourages teamwork and introduces members of the team to various ideas.
3. **Encourage Research and Innovation:** Give team members time to concentrate on their own research or innovation projects. In addition to keeping students interested, this encourages original thought and the investigation of cutting-edge concepts.
4. **Encourage Cross-Functional:** cooperation with experts in various fields, such as computer science, mathematics, neurology, and ethics. Cross-functional conversations can offer a variety of viewpoints and produce original ideas.
5. **Peer Evaluations and Feedback:** Create an environment where code, algorithms, and research articles are subjected to constructive peer evaluations. Regular feedback encourages knowledge exchange and helps identify areas for development.
6. **Competitions & Hackathons:** Host internal hackathons or take part in outside AI/ML competitions. These activities encourage team members to use their skills in real-world situations and pick up knowledge from their coworkers.
7. **Stay Current with Literature:** To stay up to date with the most recent developments, regularly read research papers, articles, and blogs from reliable sources. This can be ac-



complished by subscribing to influential organizations and scholars on websites like ArXiv and LinkedIn.

8. **Encourage team members** to prototype new ideas and try out new tools, methods, and frameworks. Making prototypes can aid in understanding the operation and potential uses of various technologies,
9. **Access to Resources:** Make sure your teams can access pertinent resources like books, online courses, journals, and software tools. Learning and staying current can be significantly impacted by having access to the appropriate materials
10. **Adapt to Ethical and Regulatory Changes:** Practitioners of AI/ML must be mindful of changing ethical and governmental requirements. Inform your team frequently of any changes to the legal and regulatory framework governing AI/ML applications.
11. **Celebrate Success:** Highlight and honor the accomplishments of your team members. This not only raises spirits but also fosters a sense of pride in one's work and drives one to want to learn more.

Keep in mind that lifelong learning is a journey, not a finish line. Your AI/ML teams will be more equipped to succeed in the constantly changing environment of AI and machine learning technologies if you promote a culture of inquiry, cooperation, and adaptability.

### XIII. ITERATION AND FEEDBACK LOOP

Obtain feedback from stakeholders and end users who interact with the AI systems through the feedback loop and iteration process. Utilize this feedback to iterate on the models, enhance their functionality, and resolve any problems that surface. Undoubtedly, a good feedback loop and iteration process are essential to the development and upkeep of AI systems. The typical flow of this procedure is as follows:

1. **Get Feedback:** Consistently get feedback from stakeholders and end users who engage with your AI system. Surveys, user interviews, support requests, and the observation of user interactions can all be used for this. To acquire a thorough understanding of the system's functioning, it's crucial to incorporate both technical and non-technical users.
2. **Analyzing the Feedback:** Carefully examine the feedback you've gathered. Determine trends, recurrent problems, and user recommendations. Sort customer feedback according to many criteria, such as usability, accuracy, dependability, and ethical considerations.
3. **Set Issues in Order of Importance:** Not all comments will be equally crucial. Sort the concerns according to their importance for the user experience, any associated risks, and compatibility with your project's objectives. You can better allocate your resources as a result.
4. **Iteration and Model Improvement:** Adjust your AI models as necessary in light of the prioritized feedback. This could entail improving algorithms, updating training material,

changing settings, or adding new features. Enhancing performance and addressing the issues found are the objectives.

5. **Release and Monitoring:** After making the necessary adjustments, release the revised AI system. The procedure doesn't, however, finish here. Continue to test the system in real-world situations to make sure the modifications are working as planned and to spot any unexpected problems that could appear.
6. **Maintain the Feedback Loop in Its Current State:** Repeat the analysis, prioritization, iteration, testing, and monitoring phases as needed, and regularly ask for new feedback. AI systems should change as user requirements and technology develop since they are not static.
7. **Transparency and Communication:** Inform end users and other stakeholders in a clear and concise manner about the improvements you're making and how their feedback is being applied to the system's improvement. This promotes trust and keeps everyone up to date on the system's development.

Keep in mind that the feedback loop is about more than just problem-solving. A chance to innovate and improve the AI system's capabilities based on user input and new trends is also presented. This cycle of continual improvement enables the development of AI systems that are both user-responsive and situation-adaptive.

#### XIV. MEASURING THE RETURN ON INVESTMENT(ROI)

Calculate the return on investment (ROI) attained by putting AI and ML strategies into practice. Indicators of the organization's critical performance, such as revenue, cost savings, customer happiness, and efficiency improvements, should be evaluated in light of these initiatives. Assessing the impact of these techniques on various key performance indicators (KPIs) across the organization is a necessary step in determining the return on investment (ROI) attained via the application of AI and ML strategies. Here is a step-by-step explanation on how to do this:

1. **Specify Goals and Metrics:** Specify the goals of your AI and ML strategy. Do you want to boost product suggestions, optimize supply chains, or improve customer service? Choose the appropriate metrics for each goal, such as higher revenue, lower costs, higher customer satisfaction ratings, faster reaction times, etc.
2. **Baseline Data Gathering:** Prior to putting AI and ML methods into practice, gather baseline data on the chosen KPIs. This will operate as a benchmark for assessing the effectiveness of your strategies.
3. **Put AI/ML Strategies into Practice:** Implement your AI and ML solutions in accordance with your predetermined goals. These tactics might include anything from chatbots and tailored recommendations to process automation and predictive analytics.

- 4. Post-implementation Data Collection:** After the AI/ML strategies are in place, carry on data collection using the same KPIs. Make sure to collect data over a sufficient timeframe to account for seasonal swings and transient fluctuations.
- 5. Isolate AI/ML Impact:** Distinguish AI/ML impact from other potential influences on KPIs. It can be difficult to credit changes to your strategy, but methods like A/B testing (if appropriate) or statistical modeling can help.
- 6. Calculate ROI:** Use the formula below to determine the ROI.
  - ROI is calculated as  $(\text{Initial Investment} - \text{Net Profit from AI/ML}) / \text{Initial Investment} * 100$ .
  - Net Profit from AI/ML: The total of all benefits (such as increased revenue and cost reductions) minus the costs (such as software development and employee training) related to implementing AI/ML.
  - Initial Investment: The sum of the development, hardware, software, and training expenditures for deploying AI/ML.
- 7. Iterate and Improve:** Measuring ROI is a continuous process. To maximize the impact of your AI/ML initiatives on KPIs, continuously evaluate and improve them.
- 8. Report and Interact:** Stakeholders should hear about your results and insights. The actions used to reach these results, the ROI attained, the influence on KPIs, and these are all clearly communicated.

Keep in mind that calculating ROI for AI and ML solutions can be challenging due to the interaction of several variables. It's essential to collect data carefully, attribute information correctly, and set reasonable expectations.

## XV. CONCLUSION

In 1959, research on numerical learning and model recognition in artificial intelligence gave rise to the field of computer science today known as machine learning. The creation of algorithms that can foresee data and learn as a structural function is the focus of a system known as machine learning. Instead of just following static program instructions, these algorithms work by building a model from sample entries to generate data-based estimations and judgments. Artificial intelligence and machine learning have altered life. The historical evidence supports the use of machine learning. Additionally, newly developed modeling algorithms now receive essential help from new data mining, curation, and management techniques. In summary, machine learning presents enormous potential for a carefree and problem-solving way of living that will eventually impact humankind. A new age of revolutionary possibilities has begun as a result of the incorporation of artificial intelligence (AI) and machine learning (ML) technology into companies. These innovations have generated efficiency, innovation, and competitive advantage across a variety of industries. As businesses continue to gather enormous amounts of data, AI and ML present unmatched opportunity to glean insightful information, automate procedures, improve decision-making, and forecast trends. The successful application of AI and ML within enterprises, however, necessitates rigorous planning, strategic alignment, and a dedication to addressing ethical issues. To estab-

lish and uphold trust among stakeholders, transparency, fairness, and accountability must be the three guiding principles of any AI and ML endeavor. Organizations must promote a culture of constant learning and adaptation as AI and ML technologies advance. In order to fully utilize these technologies and negotiate the evolving nature of the workplace, this entails making investments in the upskilling and reskilling of personnel. In order to achieve the best results and deal with difficult problems, cooperation between human experience and AI algorithms will be essential. In the end, the journey toward AI and ML integration is a process rather than a destination. Organizations that adopt these technologies with a distinct vision, a dedication to moral behavior, and a willingness to change will be better prepared to succeed in a world that is driven by data and becoming increasingly automated. Organizations can create new levels of innovation, efficiency, and value by utilizing the potential of AI and ML, paving the way for a better future for both their operations and the larger sectors they service.

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