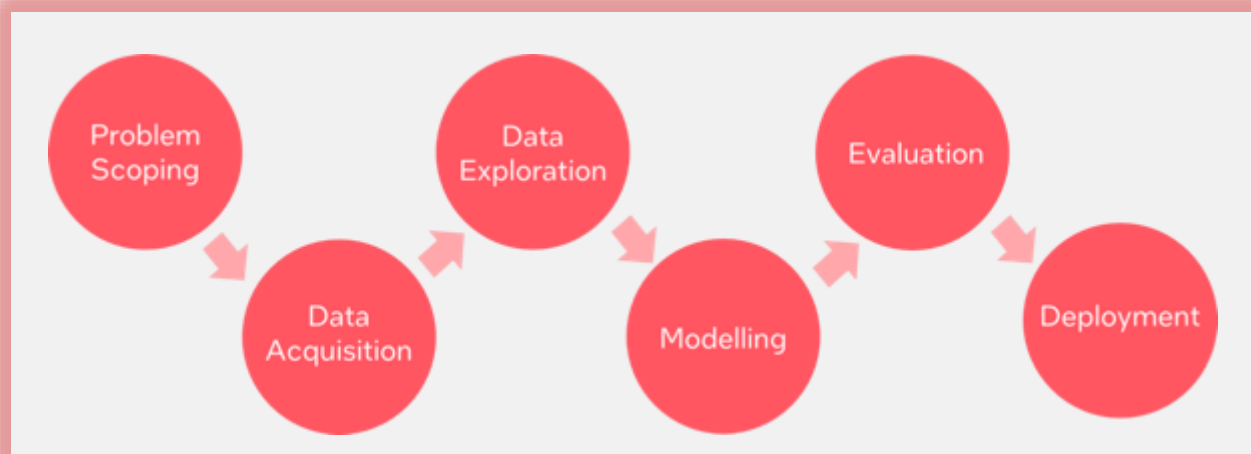## 1.1: AI Project Cycle

Let's revisit the concept of the AI Project Cycle.

Introduction

Let us assume that you have to make a greeting card for your mother as it is her birthday. You are very excited about it and have thought of many ideas to execute the same. Let us look at some of the steps which you might take to accomplish this task:

1. Look for some cool greeting card ideas from different sources. You might go online and check out some videos or you may ask someone who knows about it.
2. After finalising the design, you would make a list of things that are required to make this card.
3. You will check if you have the material with you or not. If not, you could go and get all the items required, ready for use.
4. Once you have everything with you, you will start making the card.
5. If you make a mistake in the card somewhere which cannot be rectified, you will discard it and start remaking it.
6. Once the greeting card is made, you will gift it to your mother.

These steps show how we plan to execute the tasks around us. Consciously or subconsciously our mind makes up plans for every task which we have to accomplish which is why things become clearer in our mind. Similarly, if we have to develop an AI project, the AI Project Cycle provides us with an appropriate framework which can lead us towards the goal. The AI project cycle is the cyclical process followed to complete an AI project. The AI Project Cycle mainly has 6 stages:

Starting with Problem Scoping, you set the goal for your AI project by stating the problem which you wish to solve with it. Under problem scoping, we look at various parameters which affect the problem we wish to solve so that the picture becomes clearer.
To proceed,

● You need to acquire data which will become the base of your project as it will help you understand what the parameters that are related to problem scoping are.

● You go for data acquisition by collecting data from various reliable and authentic sources. Since the data you collect would be in large quantities, you can try to give it a visual image of different types of representations like graphs, databases, flow charts, maps, etc. This makes it easier for you to interpret the patterns which your acquired data follows.

● After exploring the patterns, you can decide upon the type of model you would build to achieve the goal. For this, you can research online and select various models which give a suitable output.

● You can test the selected models and figure out which is the most efficient one.

● The most efficient model is now the base of your AI project and you can develop your algorithm around it.

● Once the modelling is complete, you now need to test your model on some newly fetched data. The results will help you in evaluating your model and improving it.

● Finally, after evaluation, the deployment stage is crucial for ensuring the successful integration and operation of AI solutions in real-world environments, enabling them to deliver value and impact to users and stakeholders.

1.2: Introduction to AI Domains

Artificial Intelligence becomes intelligent according to the training it gets. For training, the machine is fed with datasets. According to the applications for which the AI algorithm is being developed, the data fed into it changes. With respect to the type of data fed in the AI model, AI models can be broadly categorized into three domains:

Statistical Data

Statistical Data is a domain of AI related to data systems and processes, in which the system collects numerous data, maintains data sets and derives meaning/sense out of them.
The information extracted through statistical data can be used to make a decision about it.

Example of Statistical Data


Price Comparison Websites

These websites are being driven by lots and lots of data. If you have ever used these websites, you would know, the convenience of comparing the price of a product from multiple vendors in one place. PriceGrabber, PriceRunner, Junglee, Shopzilla, DealTime are some examples of price comparison websites. Nowadays, price comparison websites can be found in almost every domain such as technology, hospitality, automobiles, durables, apparel, etc.

Computer Vision

Computer Vision, abbreviated as CV, is a domain of AI that depicts the capability of a machine to get and analyse visual information and afterwards predict some decisions about it. The entire process involves image acquiring, screening, analysing, identifying and extracting information. This extensive processing helps computers to understand any visual content and act on it accordingly. In computer vision, Input to machines can be photographs, videos and pictures from thermal or infrared sensors, indicators and different sources.

Computer vision-related projects translate digital visual data into descriptions. This data is then turned into computer-readable language to aid the decision-making process. The main objective of this domain of AI is to teach machines to collect information from pixels.

Examples of Computer Vision
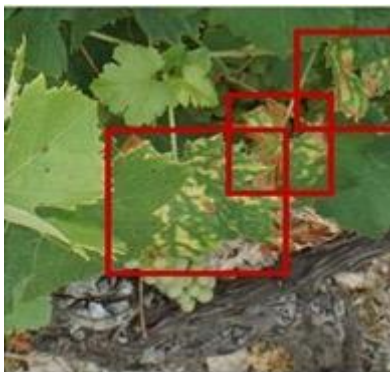
Agricultural Monitoring

Computer vision is employed in agriculture for crop monitoring, pest detection, and yield estimation. Drones with cameras capture aerial images of farmland, which are then analysed to assess crop health and optimize farming practices.

Surveillance Systems

Computer vision is used in surveillance systems to monitor public spaces, buildings, and borders. It can detect suspicious activities, track individuals or vehicles, and provide real-time alerts to security personnel.

Natural Language Processing

Natural Language Processing, abbreviated as NLP, is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language. Natural language refers to language that is spoken and written by people, and natural language processing (NLP) attempts to extract information from the spoken and written word using algorithms.
The ultimate objective of NLP is to read, decipher, understand, and make sense of human languages in a valuable manner.

Examples of Natural Language Processing

Email filters

Email filters are one of the most basic and initial applications of NLP online. It started with spam filters, uncovering certain words or phrases that signal a spam message.

Machine Translation

NLP is used in machine translation systems like Google Translate and Microsoft Translator to automatically translate text from one language to another. These systems analyze the structure and semantics of sentences in the source language and generate equivalent translations in the target language.
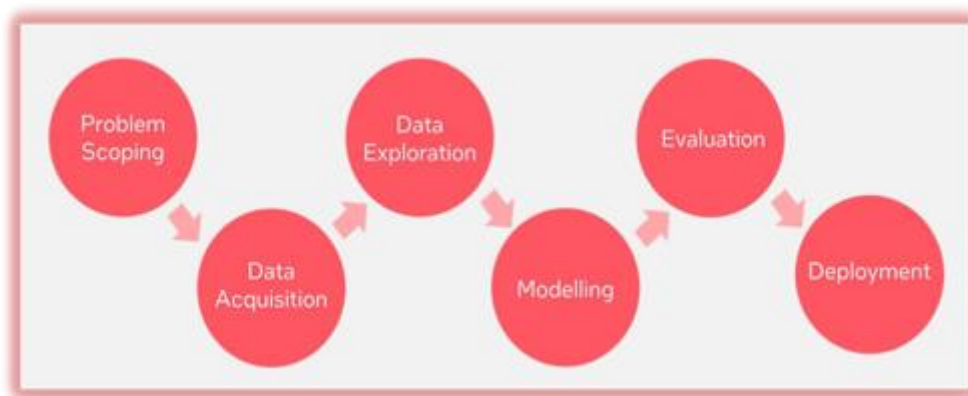
1.3: Ethical Frameworks for AI

Frameworks

Frameworks are a set of steps that help us in solving problems. It provides a step-by-step guide for solving problems in an organized manner. Moreover, frameworks offer a structured approach to problem-solving, ensuring that all relevant factors and considerations are taken into account. Additionally, they serve as a common language for communication and collaboration, facilitating the sharing of best practices and promoting consistency in problem- solving methodologies.
You may have used frameworks without knowing it! Can you think of one framework you have come across during your AI journey?

Ethical Frameworks

We know that ethics are a set of values or morals which help us separate right from wrong. Frameworks are step-by-step guidance on solving problems.

Hence, Ethical frameworks are frameworks which help us ensure that the choices we make do not cause unintended harm.
Furthermore, ethical frameworks provide a systematic approach to navigating complex moral dilemmas by considering various ethical principles and perspectives. By utilizing ethical frameworks, individuals and organizations can make well-informed decisions that align with their values and promote positive outcomes for all stakeholders involved.

Why do we need Ethical Frameworks for AI?

As we have seen how bias could result in unwanted outcomes in AI solutions. Think of thehiring algorithm which was biased against women applicants!

AI is essentially being used as a decision-making/ influencing tool. As such we need to ensure that AI makes morally acceptable recommendations

Ethical frameworks ensure that AI makes morally acceptable choices. If we use ethical frameworks while building our AI solutions, we can avoid unintended outcomes, even before they take place!

So far, we have understood why ethical frameworks are needed.Let's

try to guess what such a framework would be made of!

Activity: 1 My Goodness

Purpose: To understand how our decisions get influenced by our personal morals, values and ethics!

Say: "Carefully read the descriptions provided that help you decide on donating. Explore your decision-making ability."

Visit the website – https://www.my-goodness.net/

Take a quick look at the video to learn more about the game!

Players must make 10 decisions on how they would like to make a charitable donation. In most cases, players will receive details about the recipients. They will also be given information on the intended use of the money they are donating. In a few instances, this may be hidden from them, however they can choose to reveal it.

This activity aims to understand an individual's judgment. We are looking to discover potential biases within us!

Data is collected anonymously and with your consent.

If you wish to delve deeper and explore your own decision-making, click on "yes."

Would you like to help us better understand your judgement?

Yes   No

After clicking on "yes" you will be taken to a short survey.
After the survey has been filled, you will see interesting insights about your decisions

Did you discover any internal biases in your decisions?

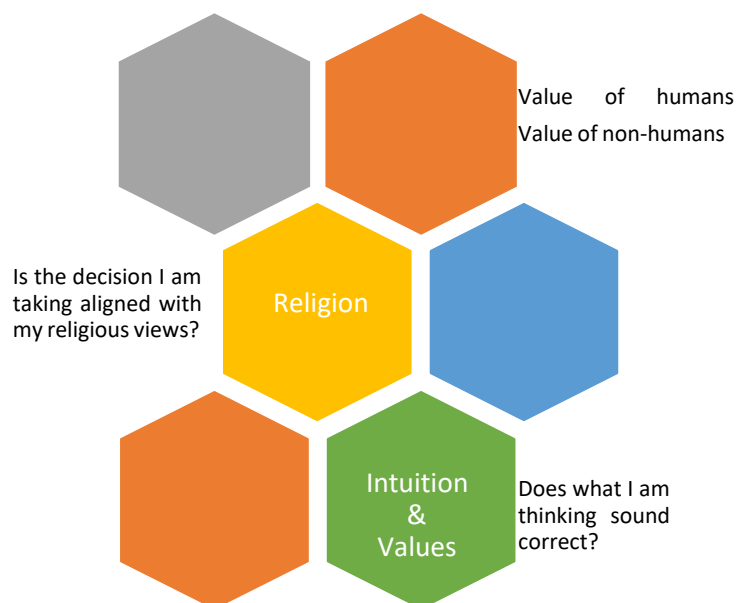Do you agree with the results shared by thegame?

Factors which could influence your decisions without you realizing it include

- Identity of the charity recipient.

- Location of the recipient.

- Bias towards relatives.
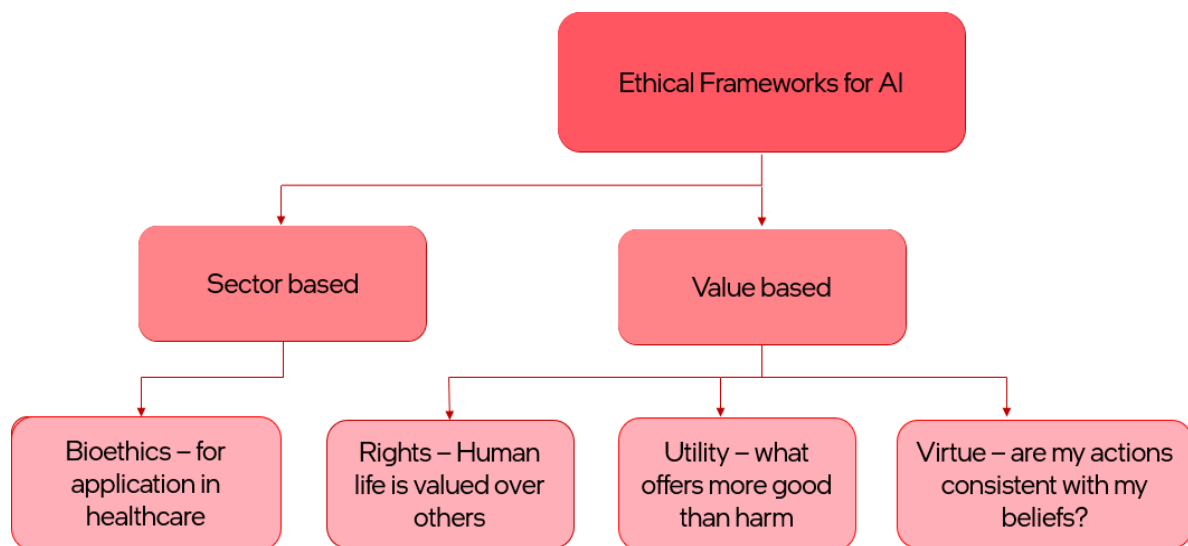
- Uncovering information available.

This is just an exercise to uncover our biases and thought processes behind making certain decisions. This will help us in producing a framework which can aid in making decisions which are ethically sounder.

Let's list at least **3 factors** which knowingly or unknowingly influence our decision-making.

Value of humans
Value of non-humans

Is the decision I am taking aligned with my religious views?

Religion

Intuition & Values

Does what I am thinking sound correct?

Types of Ethical Frameworks

The various types of ethical frameworks are classified as follows:

Let's delve into the classifications of ethical frameworks.

Ethical frameworks for AI can be categorized into **two main** types: sector-based and value-based frameworks.

1. Sector-based Frameworks:

These are frameworks tailored to specific sectors or industries. In the context of AI, one common sector-based framework is Bioethics, which focuses on ethical considerations in healthcare. It addresses issues such as patient privacy, data security, and the ethical use of AI in medical decision-making. Sector-based ethical frameworks may also apply to domains such as finance, education, transportation, agriculture, governance, and law enforcement.

2. Value-based Frameworks:

Value-based frameworks focus on fundamental ethical principles and values guiding decision-making. It reflects the different moral philosophies that inform ethical reasoning. Value-based frameworks are concerned with assessing the moral worth of actions and guiding ethical behaviour. They can be further classified into three categories:

i. Rights-based: Prioritizes the protection of human rights and dignity, valuing human life over other considerations. It emphasizes the importance of respecting individual autonomy, dignity, and freedoms. In the context of AI, this could involve ensuring that AI systems do not violate human rights or discriminate against certain groups.

ii. Utility-based: Evaluates actions based on the principle of maximizing utility or overall good, aiming to achieve outcomes that offer the greatest benefit and minimize harm. It seeks to

maximize overall utility or benefit for the greatest number of people. In AI, this might involve weighing the potential benefits of AI applications against the risks they pose to society, such as job displacement or privacy concerns.

iii. Virtue-based: This framework focuses on the character and intentions of the individuals involved in decision-making. It asks whether the actions of individuals or organizations align with virtuous principles such as honesty, compassion, and integrity. In the context of AI, virtue ethics could involve considering whether developers, users, and regulators uphold ethical values throughout the AI lifecycle.

These classifications provide a structured approach for addressing ethical concerns in AI development and deployment, ensuring that considerations relevant to specific sectors and fundamental ethical values are adequately addressed.

Let's explore a popular framework which is used in the healthcare industry.

Bioethics

Bioethics is an ethical framework used in healthcare and life sciences. It deals with ethical issues related to health, medicine, and biological sciences, ensuring that AI applications in healthcare adhere to ethical standards and considerations.

Principles of bioethics:

- Respect for Autonomy.

- Do not harm.

- Ensure maximum benefit for all.

- Give justice.

• "**Non-maleficence**" refers to the ethical principle of avoiding causing harm or negative consequences. It emphasizes the obligation to minimize harm as much as possible and prioritize actions that prevent harm to individuals, communities, or the environment.

• "**Maleficence**" refers to the concept of intentionally causing harm or wrongdoing.

• "**Beneficence**" refers to the ethical principle of promoting and maximizing the well-being and welfare of individuals and society. It emphasizes taking actions that produce positive outcomes and contribute to the overall good, ensuring that the greatest benefit is achieved for all stakeholders involved.

Let's look at a case study and see the impact of the application of an AI ethical framework on the end outcome.

Case Study

A company aimed to support hospitals in optimizing patient care by creating an AI algorithm designed to identify individuals at high risk. The objective was to provide healthcare providers with valuable insights to allocate resources effectively and ensure those most in need receive appropriate attention. However, potential unintended consequences lead to some problems in the model, such as the algorithm inadvertently exacerbating existing biases or inaccuracies in the data, potentially leading to misclassification of patients or overlooking critical cases. Addressing concerns about the algorithm's accuracy and reliability becomes paramount, as any flaws in its designor training data could compromise patient care and outcomes

The problem it caused:

Patients from the Western region of a particular area, who were categorized at the same risk level by the algorithm, generally exhibited more severe health conditions compared to patients from other regions.

Why the problem happened:

- The algorithm utilized was trained on healthcare expense data as a measure for health metrics rather than actual physical illness.

- This algorithm was created in the United States where less money is spent on western region patient healthcare than other ethnic patient healthcare.

This meant the algorithm

We can use principles of the Bioethics framework to ensure an ethical AI solution.

The **four principles** of bioethics can be used to ensure an ethical AI solution for the healthcare problem.

i. Respect for autonomy: Enabling users to be fully aware of decision-making. E.g., users of an AI algorithm should know how it functions.

- The data that models were trained on, and used to make decisions, should be reproducible and accessible to the patients.

- In the event of performance concerns, model predictions and data labels should be released.

ii. Do not harm: Harm to anyone (be it human or non–human) must be avoided at all costs. If no choice is available path of least harm must be always chosen.

- Promote well-being, minimize harm, and ensure that benefits and harms are distributed among stakeholders in a just manner.

- The AI algorithm must be trained on data sets that equitably reduce harm for all, not just harm for some groups.

- In this instance, patients from other regions excluding western part who were less ill would receive more intensive care from doctors than patients who actuallyrequire help.

- This algorithm, if implemented, would actively harm patients belong to western region by inappropriately recommending healthcare resource allocation.

iii. Maximum benefit: Not only should we avoid harm our actions must focus on providing the maximum benefit possible.

- The solution should be held to clinical practice standards, not merely technological ethics standards.

- It should go beyond nonmaleficence and strive for beneficence.

- Considering the example, we discussed, the AI algorithm should not only avoid causing harm to patients from the western region but also provide benefits to these patients, as well as patients from other regions and of all races.

- Is there a better data set for training that reflects the healthcare needs and outcomes of patients of all races?

- The data we use for training must be unbiased.

iv. Justice: All benefits and burdens of a particular choice must be distributed in a justified manner across people irrespective of their background.

- Solution development requires concerted and in-depth knowledge of social structures at play that result in issues like racism and sexism (a few types of societal biases).

- The solution needs to be aware of social determinants of healthcare and actively work against those structures.

We saw that abiding by bioethical principles could have helped us to avoid the unintended consequences of the AI solution.

Test Yourself:

1. What is the purpose of defining the problem statement during the Problem Scoping stage in an AI project cycle?
A) To collect data
B) To understand the aim and objective of the project
C) To train the model
D) To process data

2. In what ways can AI models be categorized based on the type of data fed into them?
A) Two domains
B) Four domains
C) Three domains
D) Five domains

3. In Statistical Data, what is the primary function of the system in relation to data?
A) Generating large datasets
B) Analyzing data to extract insights
C) Converting data into images
D) Distributing data across networks

4. What is the main goal of Computer Vision projects?
A) Translating audio data into visual descriptions
B) Converting digital data into analogue signals
C) Teaching machines to understand textual information
D) Converting digital visual data into computer-readable language

5. What is the primary focus of NLP?
A) Analyzing computer languages
B) Interacting between computers and humans using artificial language
C) Dealing with the interaction between computers and humans using natural language
D) Enhancing human-to-human communication

6. What do frameworks provide in the context of problem-solving?
A) Random solutions
B) Step-by-step guidance
C) Legal advice
D) Ethical justifications

7. How are Ethical Frameworks for AI categorized?
A) Into legal and illegal frameworks
B) Into sector-based and value-based frameworks
C) Into historical and contemporary frameworks
D) Into theoretical and practical frameworks

8. What is the central focus of virtue-based value-based frameworks?
A) Maximizing utility
B) Protecting human rights
C) Aligning actions with ethical principles and beliefs
D) Ensuring compliance with legal regulations

9. Which of the following best describes rights-based value-based frameworks?
A) Prioritizing human rights and dignity, valuing human life over other considerations
B) Evaluating actions based on maximizing overall good and minimizing harm
C) Centering on the character of the decision-maker and the alignment of actions with personal or societal virtues
D) Focusing on achieving outcomes that offer the greatest benefit

10. What is the primary domain of application for Bioethics?
A) Agriculture
B) Healthcare and life sciences
C) Information technology
D) Environmental conservation

11. Assertion: Ethics provide guidance in distinguishing right from wrong.

Reasoning: Ethics consist of a set of values and morals that aid individuals in making moral judgments and decisions.

A) Both Assertion and Reasoning are true, and Reasoning is the correct explanation of the Assertion.

B) Assertion is true, but Reasoning is false.

C) Both Assertion and Reasoning are true, but Reasoning is not the correct explanation of the Assertion.

D) Assertion is false, but Reasoning is true.

12. Assertion: Value-based frameworks in ethics provide guidance by focusing on fundamental ethical principles and values.

Reasoning: These frameworks reflect different moral philosophies guiding ethical reasoningand are concerned with assessing the moral worth of actions.

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Reflection Time:

1. Outline the main steps in the AI Project Cycle briefly.

2. What roles does computer vision play in agricultural monitoring systems?

3. Mention the factors which knowingly or unknowingly influence our decision-making.

4. What is the necessity for Ethical Frameworks in AI development?

5. Mention the key characteristics of sector-based frameworks.

6. What do you mean by Bioethics?

7. What is Natural Language Processing? Explain any two real-life applications of NLP.

8. How do value-based frameworks contribute to ethical decision-making by emphasizing fundamental principles and values?

Case-Based Questions

1. Case Scenario:

In a corporate setting, a multinational company is facing scrutiny over its environmental practices, particularly regarding the disposal of industrial waste. The company has historically prioritized profit maximization and cost-cutting measures, leading to practices that result in environmental harm and negative impacts on local communities. As public awareness and concern about environmental sustainability grow, stakeholders, including investors, customers, and advocacy groups, are calling for the company to adopt more responsible and sustainable business practices.

Question:

Drawing from the case presented, analyze the ethical considerations surrounding the company's environmental practices through the lens of value-based frameworks in ethics.

2. Case Scenario:
In a rural farming community, a group of small-scale farmers is faced with a dilemma regarding the use of pesticides on their crops. The farmers have traditionally relied on chemical

pesticides to control pests and maximize crop yields. However, concerns have been raised about the potential environmental and health impacts of pesticide use, including soil contamination, water pollution, and adverse effects on human health. Additionally, neighboring communities and environmental advocacy groups have expressed opposition to the widespread use of pesticides, citing ecological damage and risks to biodiversity.

Question:
Using the case provided, examine the ethical considerations surrounding pesticide use in the agricultural sector, applying ethical frameworks to analyze the competing interests and values at stake.

Unit–1: Revisiting AI Project Cycle & Ethical Frameworks

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Ans:1. Value of humans Value of non-humans
        2. religious views
        3. Intuition & Values

4. What is the necessity for Ethical Frameworks in AI development?
Ans:AI is essentially being used as a decision-making/ influencing tool. As such we need to ensure that AI makes morally acceptable recommendations .
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