

Towards AI-Based Data Analytics for Environmental Monitoring

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1 Introducing AI and Environmental Monitoring

Artificial Intelligence (AI) can revolutionize environmental monitoring by enabling rapid data analysis and automated report generation. This technology can be instrumental in responding to environmental disasters, offering timely insights to experts and decision-makers.

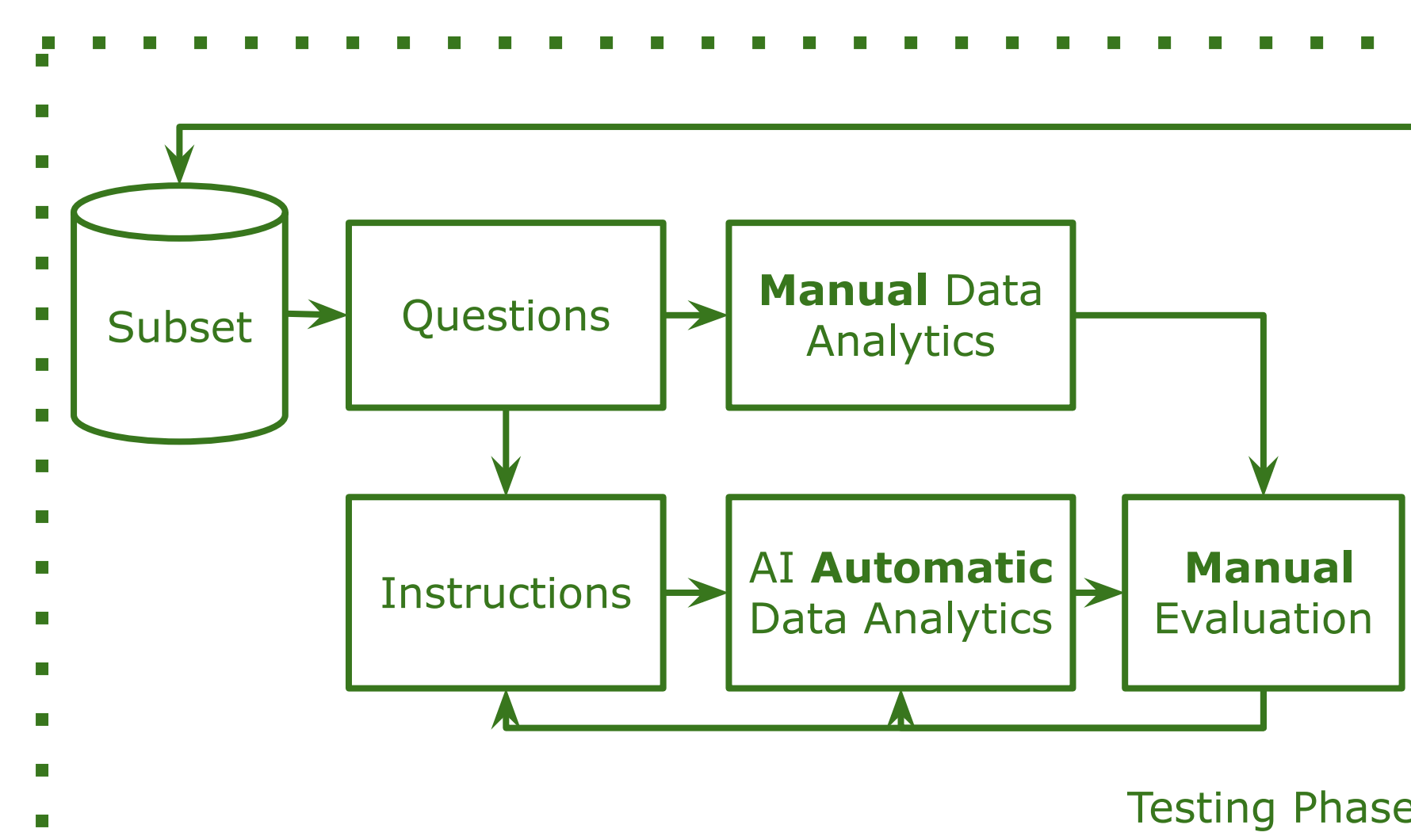


Our objective is to **help decision makers understand environmental data** and make responsible and concrete choices in the environmental context.

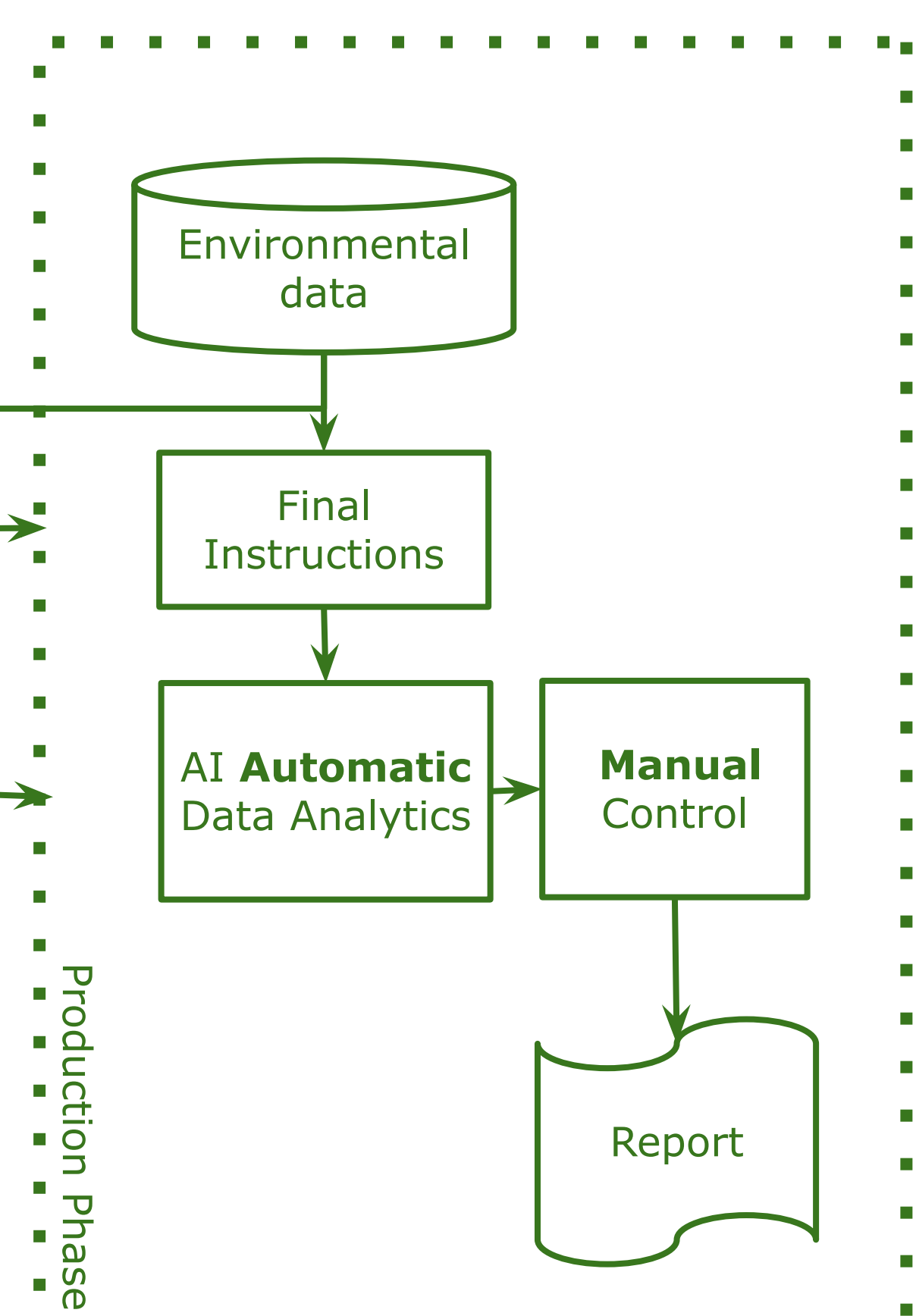
2 The Proposed AI-Driven System

Our system integrates manual supervision by environmental experts with AI-powered analytics. The process involves a two-phase approach: **testing** and **production**.

1 - AI is trained using environmental data in the **testing** phase.



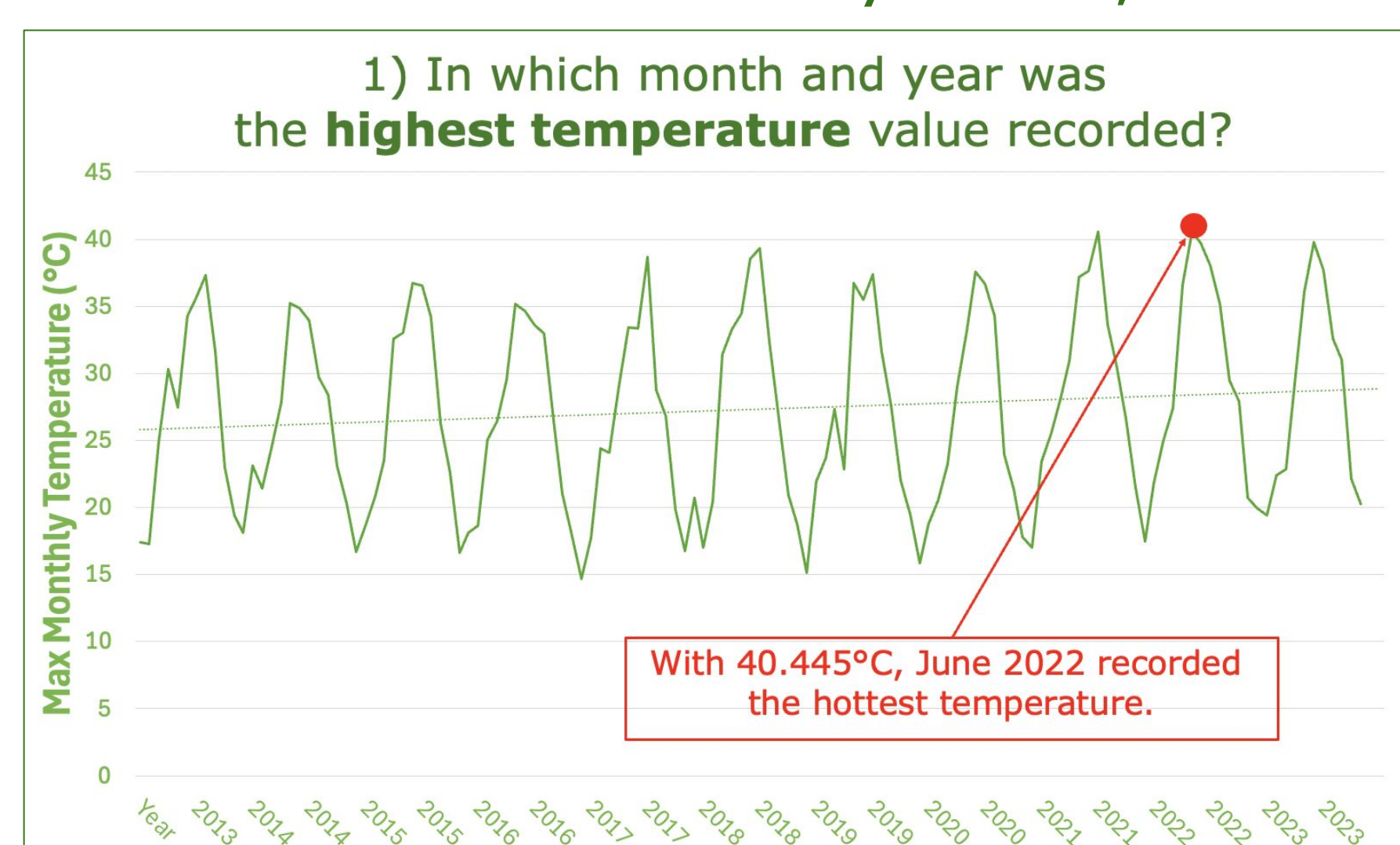
2- AI operates independently during the **production** phase.



3 Case Study on Temperature Data

We analyzed the historical series of temperature data recorded in the decade 2013-2023 from the AL007 station of the **Micro Meteorological Network** (RMM) managed by ARPA Lazio.

We asked three **questions** to our data. First, we answered to them manually. Next, we used AI.



2) What was the **hottest month** for each year?

The answer is based on the average temperature.

Year	Hottest Month
2013	July
2014	August
2015	July
2016	July
2017	August
2018	July
2019	August
2020	August
2021	July
2022	July
2023	July

3) What is the **percentage increase** in temperature over the decade 2013-2023?

Year	Average Value	Increase in °C	Increase %
2013	16.636	1.197	0.0720
2023	17.833		

Instrumentation	Model
Ultrasonic Anemometer	USA1 Scientific
Rain Gauge (Pluviometer)	VRG 101
Thermohygrometer	HMP 45AC
Radiometer	CNR1

Spin the wheel to know how AI answered to the questions...

- Start by securing all the tabs together to the right.
- Turn the knob clockwise.
- To move to the following question:
 - Turn the knob clockwise
 - Remove the paperclip
- Move the question you already answered counterclockwise
- Secure it at the bottom
- Secure the remaining questions together on the right
- Turn the knob clockwise.

The AI Wheel

The questions are translated into instructions for the AI model.

At the end of the analysis, the expert compares AI results with their own and, if issues are found, adjusts the AI instructions.

This process repeats until the AI provides correct answers.

Download the poster, the code, and more



4 Future of AI and Environment

Our preliminary experiments demonstrated that although the AI model could not answer all the questions correctly, preliminary results are encouraging. As a future work, we plan to improve the testing phase and also implement the production phase of the project.

Question 2

Round 0

AI Analysis

The hottest month for each year based on the maximum monthly temperature is:

Year	Hottest Month
2013	August
2014	June
2015	July
2020	July

Round 1

Instructions

Consider the average monthly temperature.

Year

Hottest Month

2013

June

2014

July

2015

July

2016

July

2017

July

2018

July

2019

June

2020

June

2021

June

2022

June

2023

June

Round 0

Instructions

Consider {context} where:

- Year is the year
- Month is the month
- Mean is the average monthly temperature
- Max is the maximum monthly temperature
- Min is the minimum monthly temperature
- Mode is the most frequent monthly temperature value

Answer the following question: {question 2}

Question 2

Question 3

Round 0

AI Answer

To calculate the percentage increase in temperature over the decade 2013-2023, we would typically take the average of the mean temperatures for each year, then calculate the percentage increase from 2013 to 2023. [...]

Round 1

Instructions

I have many datasets from 2013 to 2023. [Instructions as in Round 0]. Answer the following question considering all the data from 2013 to 2023: {question 3}

AI Analysis

As in Round 0

Improvement

We provided only the years 2013 and 2023 as an input to the system, which calculated the percentage increase correctly.

Go to the following question...

Round 0

Instructions

Consider {context} where:

- Year is the year
- Month is the month
- Mean is the average monthly temperature
- Max is the maximum monthly temperature
- Min is the minimum monthly temperature
- Mode is the most frequent monthly temperature value

Answer the following question: {question 3}

Question 3

Question 1

Round 0

AI Analysis

The highest temperature value was recorded in July 2020 with a maximum monthly temperature of 37.553.

Manual Analysis

June 2022 with 40.445°C

Discussion

AI considered only 2013, 2014, 2015, and 2020.

Round 1

Instructions

Consider all the data from 2013 to 2023. [Instructions as in Round 0]. Answer the following question considering all the data from 2013 to 2023: {question 1}

AI Analysis

July 2022

Round 0

Instructions

Consider {context} where:

- Year is the year
- Month is the month
- Mean is the average monthly temperature
- Max is the maximum monthly temperature
- Min is the minimum monthly temperature
- Mode is the most frequent monthly temperature value

Answer the following question: {question}

Question 1