III International Scientific Symposium “Intelligent Solutions” (IntSol-2023), September 27-28, 2023

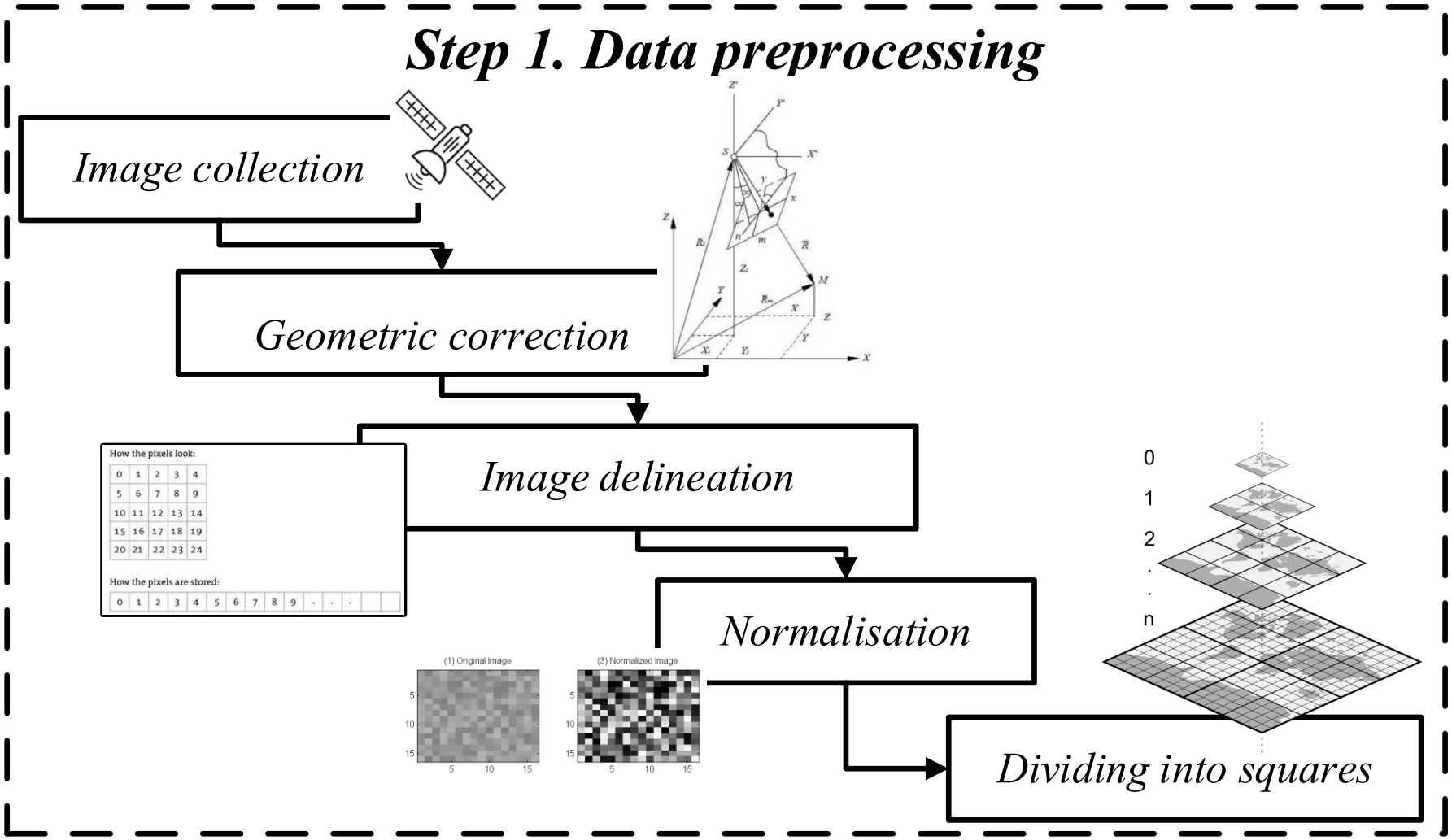
Intelligent Method for Counting Cars from Satellite Images

Ruslan Savchyshyn[1], Khrystyna Lipianina-Honcharenko[2] , Oleksandr Osolinskyi[2] and Komar Myroslav[2]

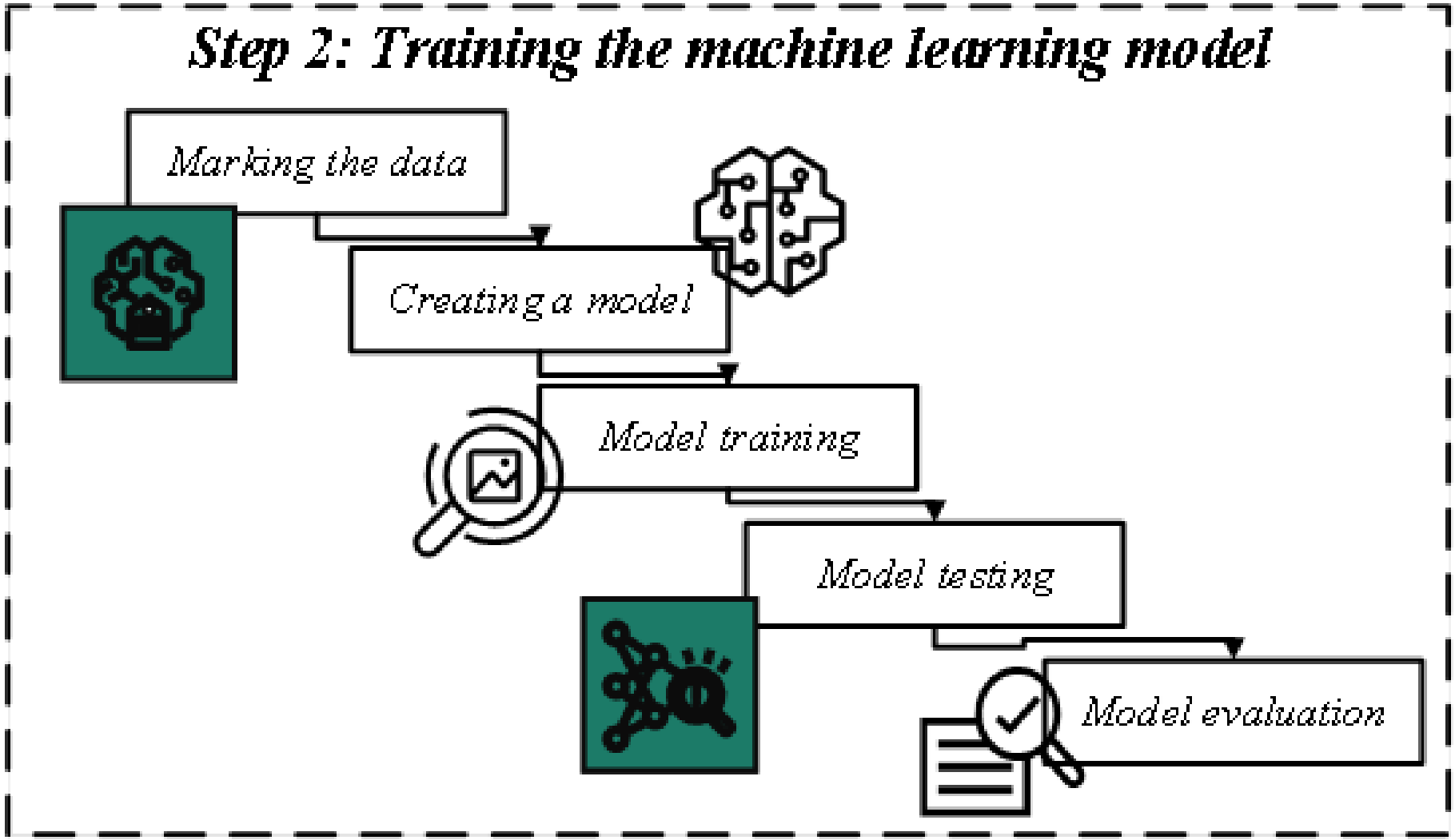
[1] MagneticOne Group, Taylor Draper Ln #115, Austin, TX 78759, 11211, USA

[2] West Ukrainian National University, 11 Lvivska St, Ternopil, 46009, Ukraine

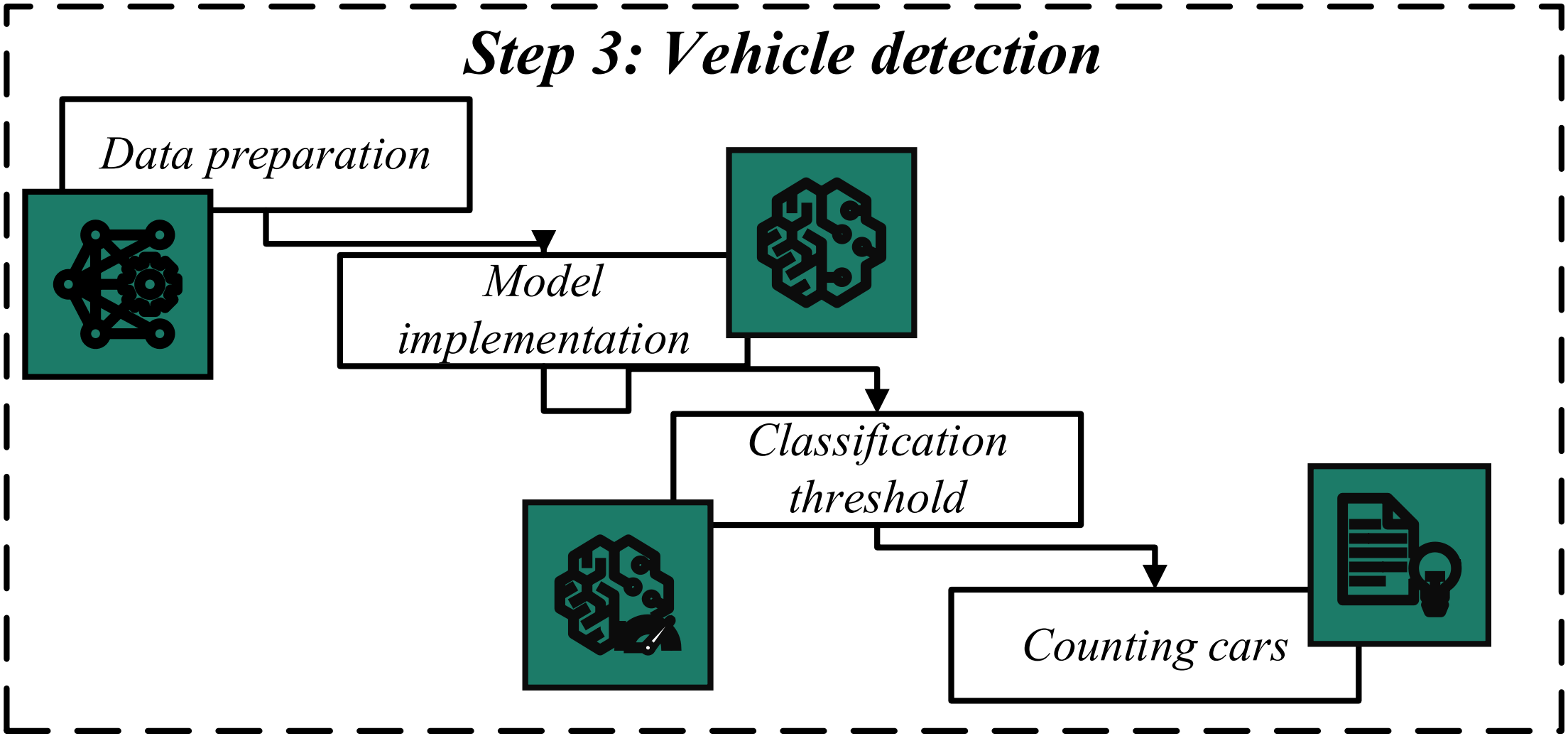
Data preprocessing



Training the machine learning model



Vehicle detection



Emissions analysis and forecasting

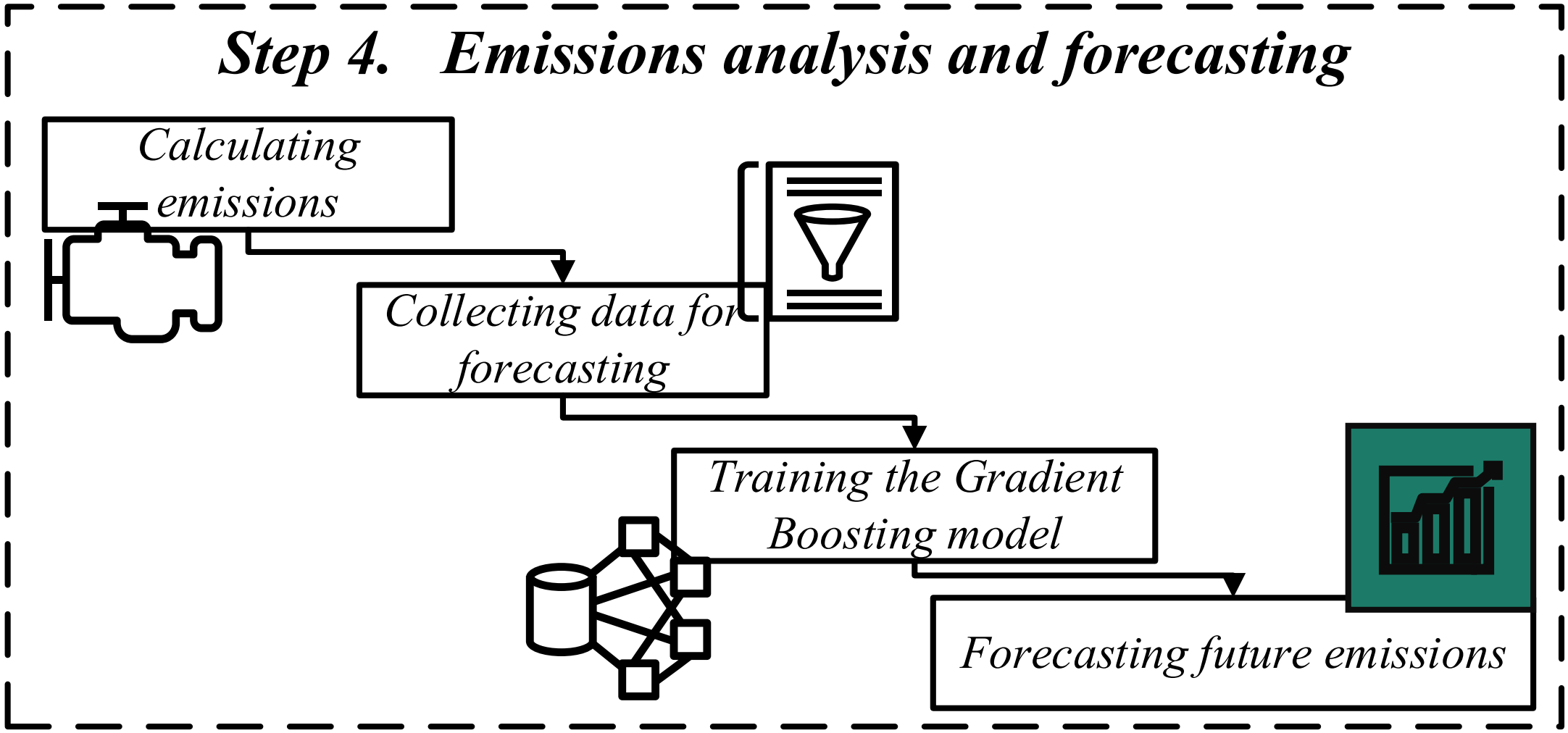
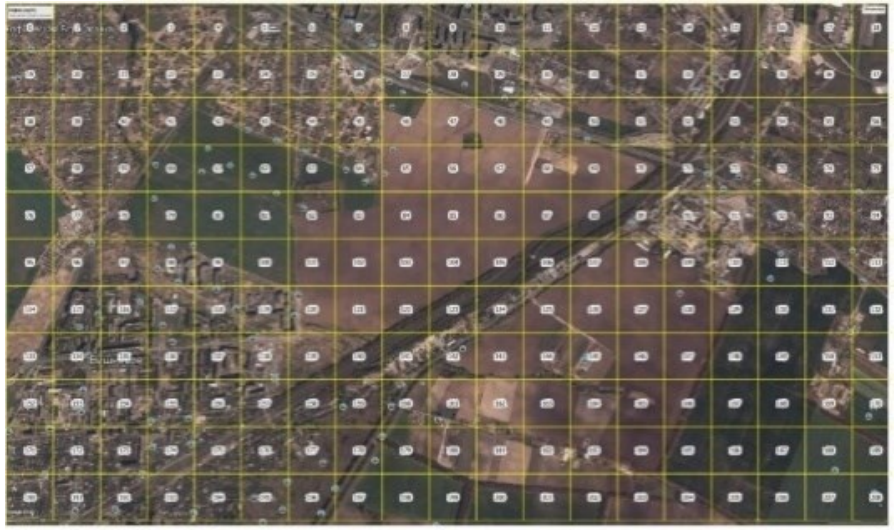


Table I Average CO2 emission in Ternopil

Year	Numbers of cars	CO2 tones
2004	28579	71447,5
2005	28931	72327,5
2006	29821	74552,5
2007	33211	83027,5
2008	36601	73202
2009	39992	79984
2010	43382	86764
2011	45975	91950
2012	49379	98758
2013	57783	104009,4
2014	59186	106534,8
2015	62590	112662
2016	65893	98839,5
2017	67530	101295
2018	69405	104107,5
2019	70258	105387

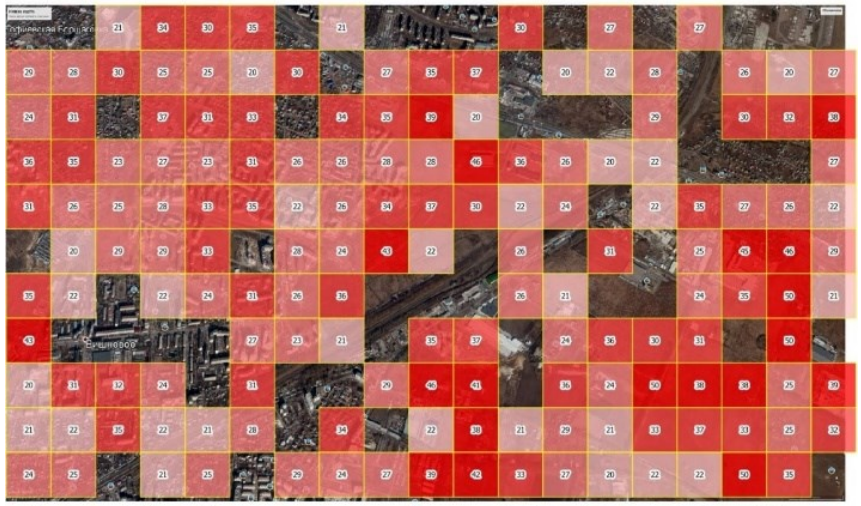
2019

imental Results

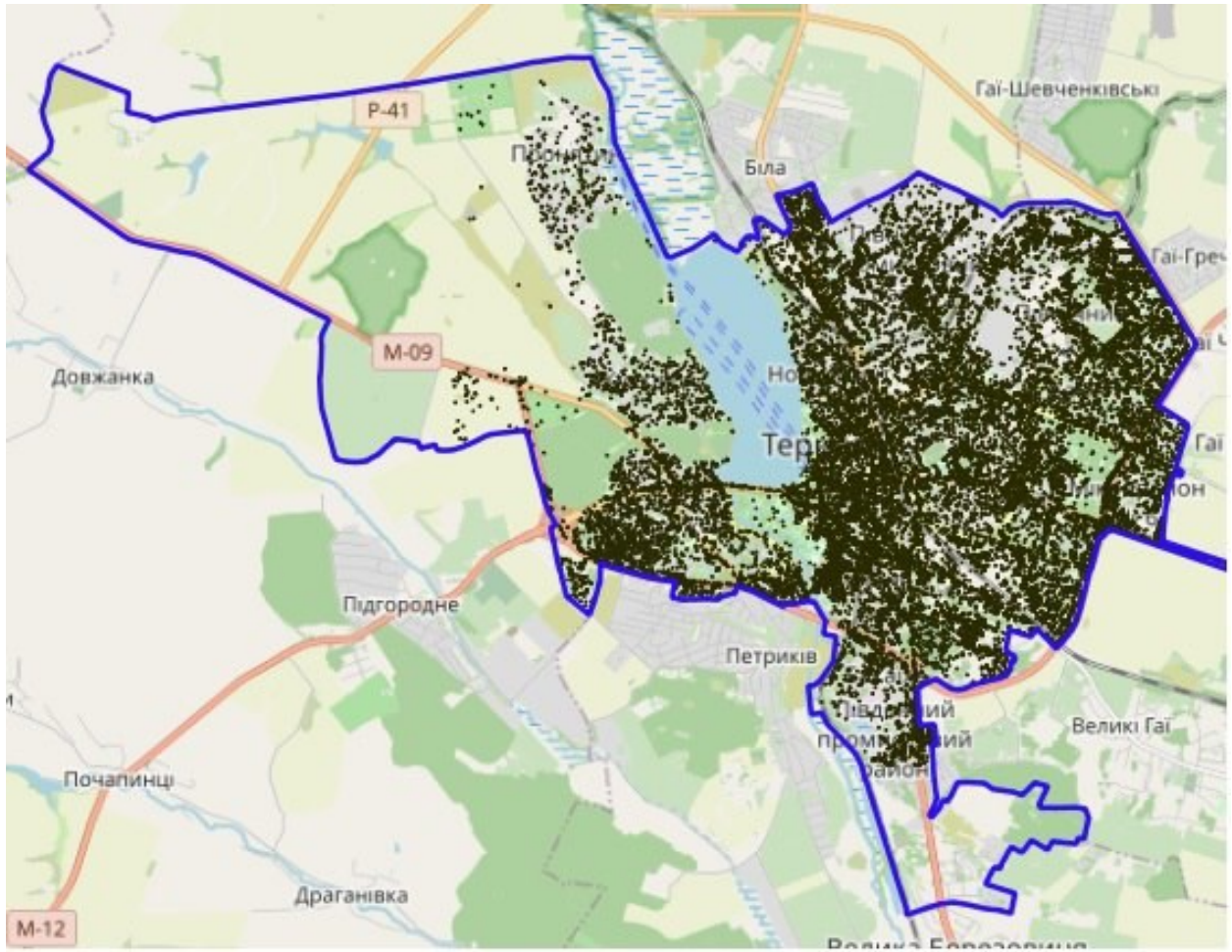


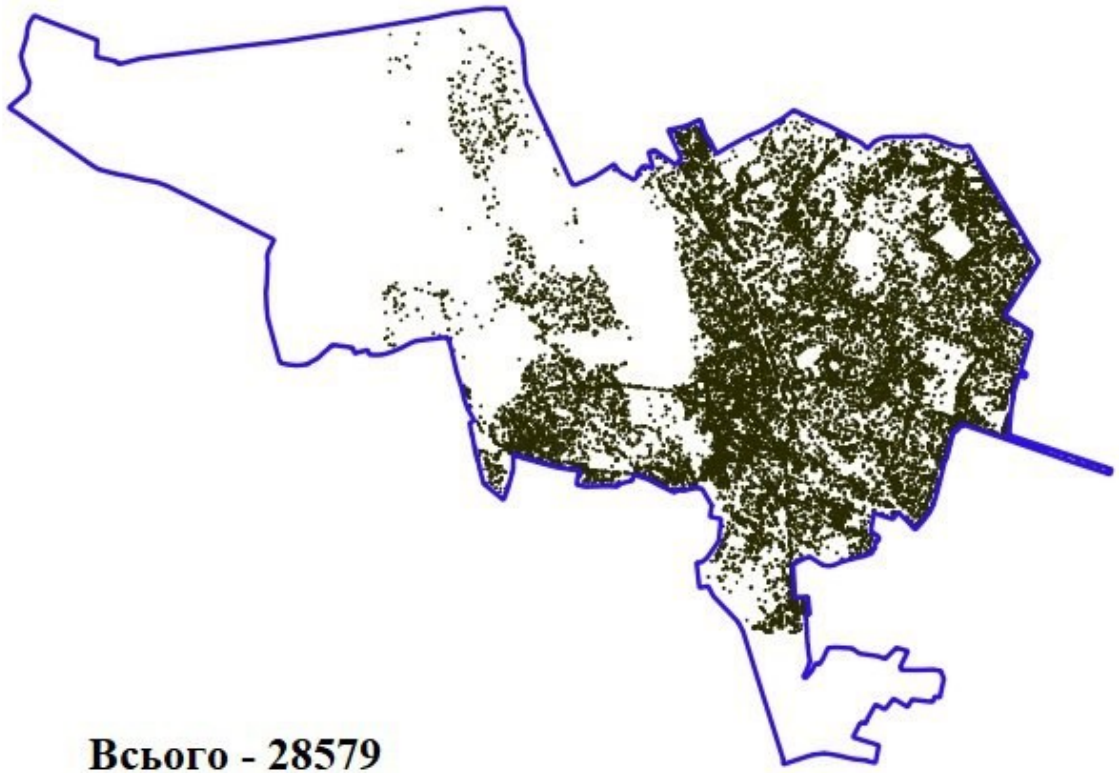
2004

2019

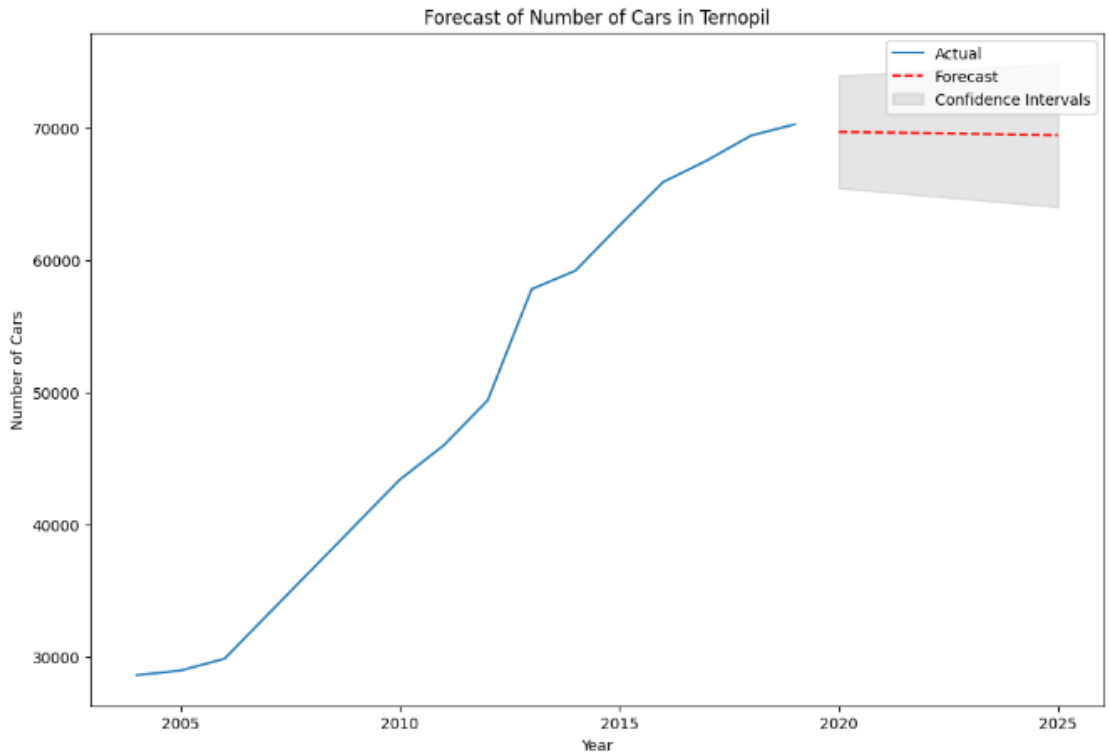


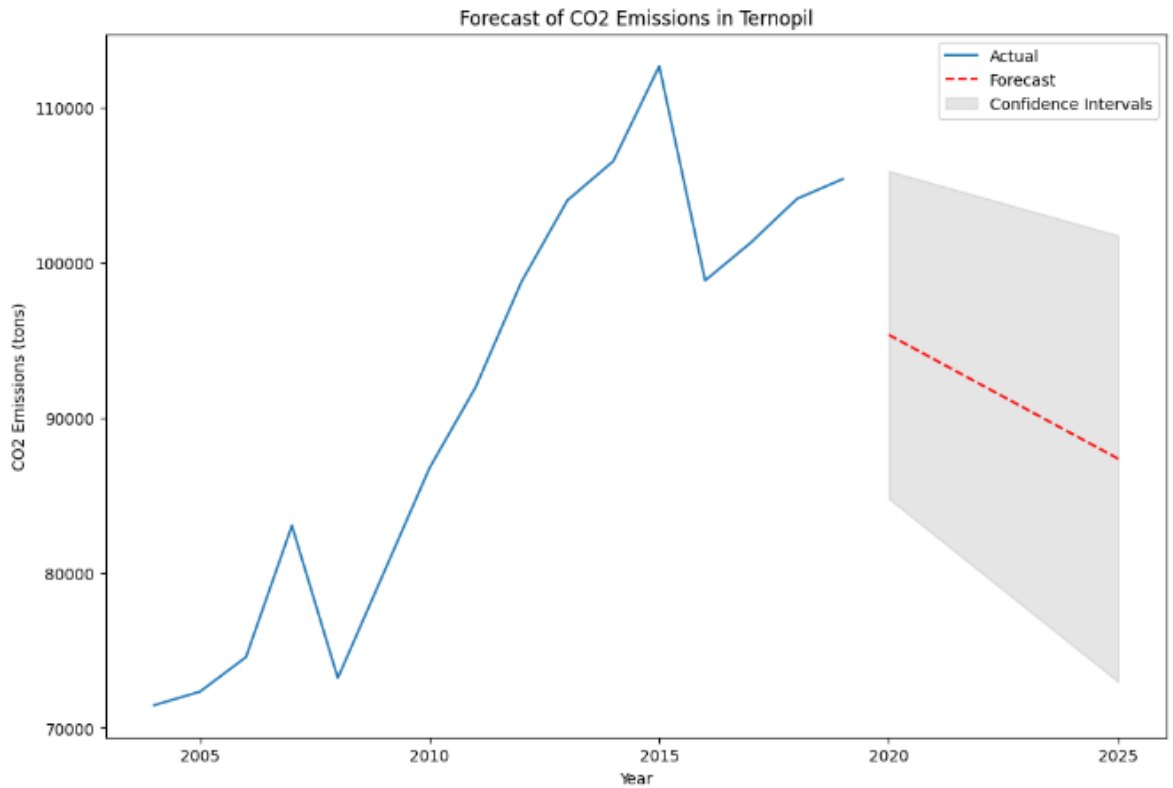
індекс змін (чим більше знаяення тим більше змін (незафарбовані - без змін))





Всього - 28579


Forecast of Number of Cars in Ternopil
Actual
Forecast
Confidence Intervals
Number of Cars
Year
70000
60000
50000
40000
30000
2005
2010
2015
2020
2025


Forecast of CO2 Emissions in Ternopil
Actual
Forecast
Confidence Intervals
CO2 Emissions (tons)
Year
110000
100000
90000
80000
70000
2005
2010
2015
2020
2025

Conclusions

- In this work, a method was developed that combines car detection in satellite images with car count and CO2 emissions forecasting. For this purpose, satellite images of the city of Ternopil from 2004 to 2019 were used, which were divided into quadrants for further analysis.
- In addition, the Gradient Boosting Regressor model based on time series analysis was used to forecast CO2 emissions. The actual and projected data show an increase in the number of cars and CO2 emissions in Ternopil. These predicted values show a stable trend to increase but with variations in different years. Thus, the developed method can be useful for car counting and forecasting emissions based on satellite images. This can be important for monitoring traffic flow, infrastructure planning, and developing environmental strategies to reduce the environmental impact of vehicles.
- Possible further research could include analysing the impact of traffic on air quality and developing emission reduction strategies, studying the impact of infrastructure on car traffic, and investigating the effectiveness of environmental policies in the city.

THANK YOU FOR YOUR ATTENTION!