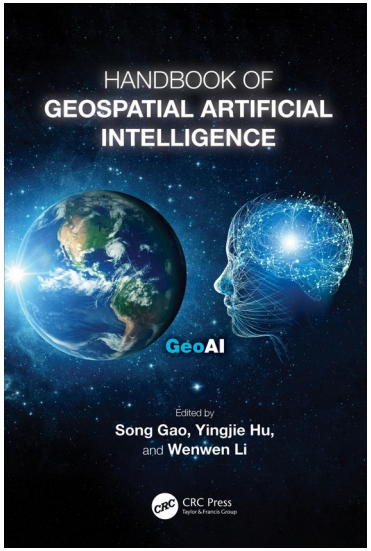
# EXPLAINABILITY IN GEOAI
# A CHAPTER OF THE BOOK: HANDBOOK OF GEOSPATIAL ARTIFICIAL INTELLIGENCE

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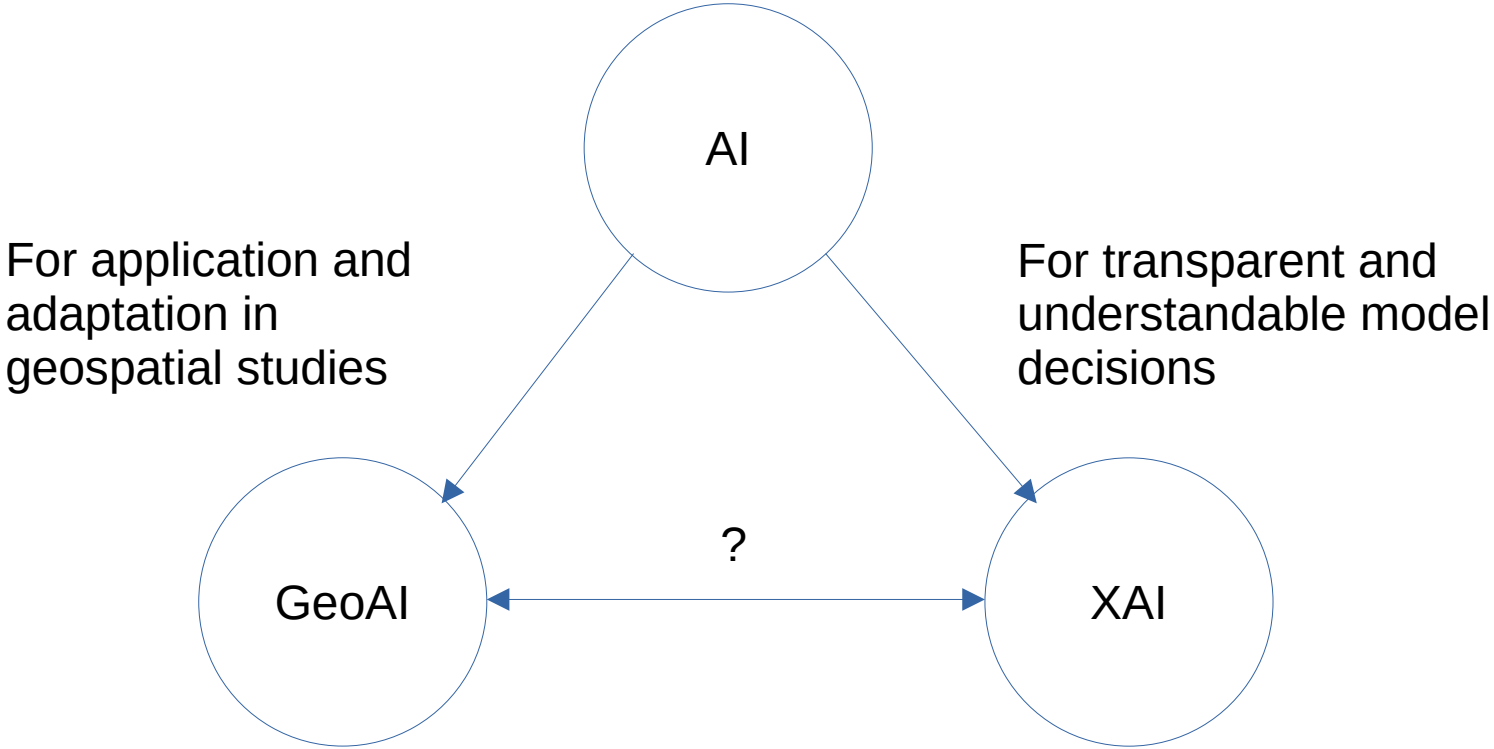
# AI, GeoAI, and Explainable AI



# Benefits of Explainable AI

- Explain the decisions of trained AI models
  - Expected decision
  - Unexpected decision
- Gain an understanding of the specific task and domain
  - e.g., the game of Go
- Guide to improve the model
  - Train data
  - Training process

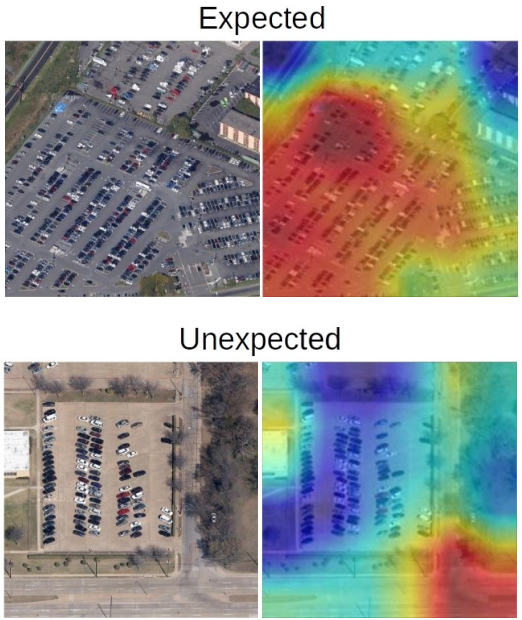
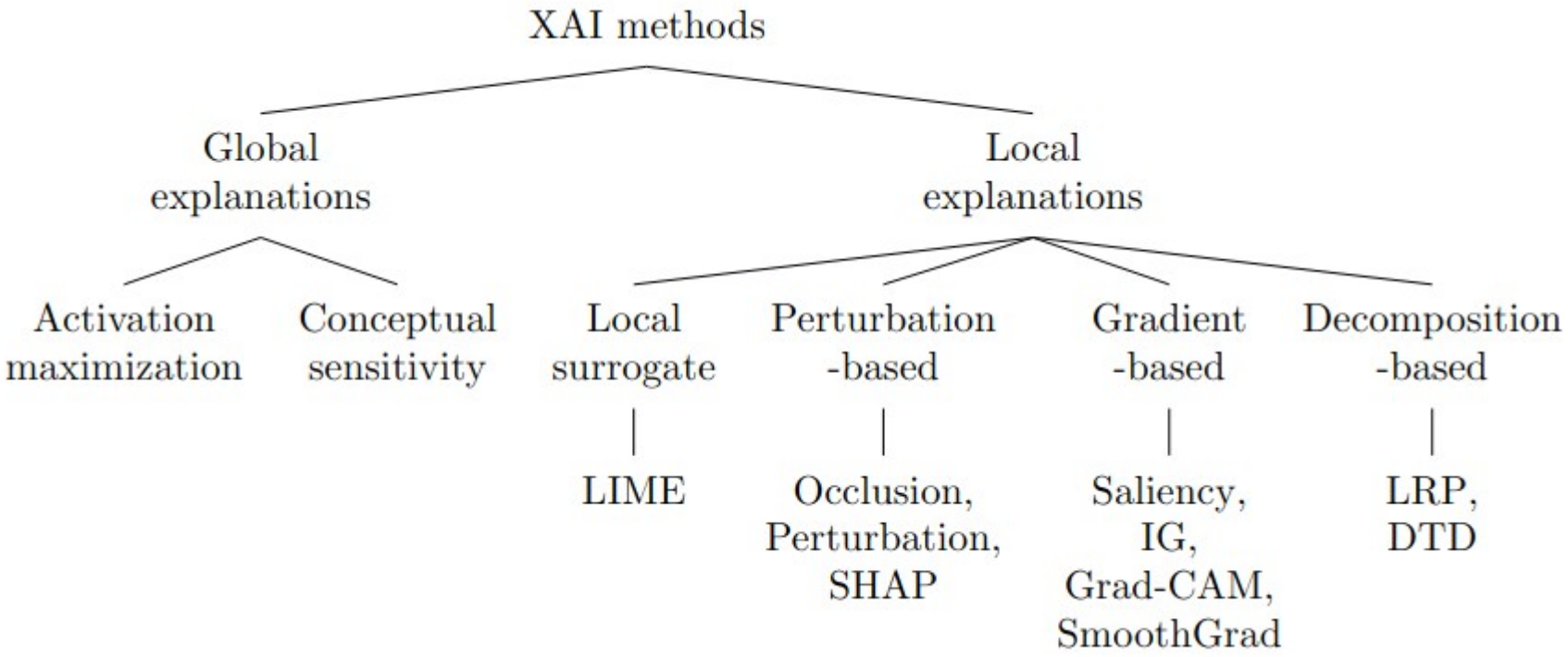



Figure: An example of XAI results. The RS images are classified as a parking lot

# Explainable AI methods



# Case #1: explain models for rainfall-runoff prediction

- Task: train a model for rainfall-runoff prediction in Germany and explain the model decisions
- Trained model: long short-term memory (LSTM) based model
- XAI method: layer-wise relevance propagation (LRP) (Arras et al. 2017, Bach et al. 2015)


Figure: Relevance score for each input feature contained in the digital elevation map (DEM), soil map (BÜK), hydrogeological map (HÜK), and land cover map (CLC).


Arras, L., et al., 2017. Explaining recurrent neural network predictions in sentiment analysis. In: Proceedings of the EMNLP'17 Workshop on Computational Approaches to Subjectivity, Sentiment & Social Media Analysis. 159–168.

Bach, S., et al., 2015. On pixel-wise explanations for non-linear classifier decisions by layer-wise relevance propagation. PloS ONE, 10 (7), e0130140.

# Case #2: knowledge discovery for taxi data analysis

- Task: discovery the knowledge on distinguishing the taxi OD data between weekdays and weekends/holidays in Beijing, China
- Method: train a model to classify the taxi OD data and discover the task-specific knowledge by using XAI method to explain the trained model (Cheng et al. 2021)

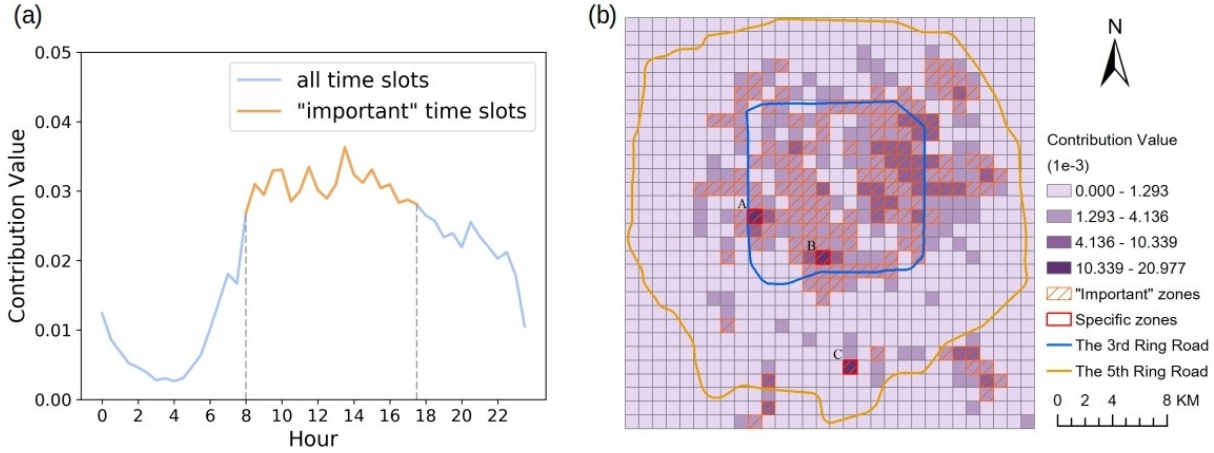



Figure: Normalized contribution value of each spatio-temporal unit in (a) temporal and (b) spatial dimensions.

Cheng, X., et al., 2021. A method to evaluate task-specific importance of spatio-temporal units based on explainable artificial intelligence. International Journal of Geographical Information Science, 35 (10), 2002–2025.

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