

A Systematic Literature Review on Urban Climate Informatics

Protik Bose Pranto¹, Waqar Hassan Khan¹, Ariane Middel^{1,2}
¹School of Computing and Augmented Intelligence (SCAI), Arizona State University, United States
²School of Arts, Media and Engineering (AME), Arizona State University, United States

Introduction

- The field of **Urban Climate Informatics (UCI)** is an emerging interdisciplinary research area that **bridges computer science and urban climate research** [1]
- UCI uses **advanced computational methods** to analyze data from sensors, satellites, and IoT devices for **urban climate solutions**
- UCI explores the **intersection** between **urban climate and computer science**
- UCI aims to understand **how computer science techniques**—like machine learning, artificial intelligence, GIS, and cloud computing—are being used to **tackle urban climate challenges**

Our Goals

Explore
Trends

Identify how computational methods like AI, GIS, and IoT advance urban climate research

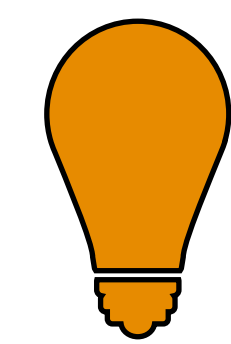
Address
Gaps

Highlight challenges like data integration, scalable algorithms, and equitable access

Shape the
Future

Recommend solutions to enhance sustainability and resilience through UCI advancements

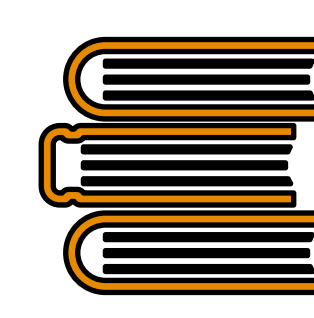
Methodology



We identified **18 urban climate keywords** and **22 computer science keywords**



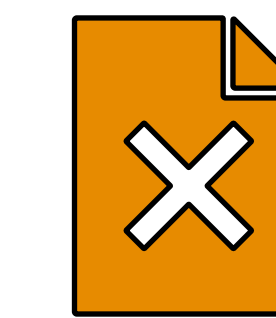
used these **keywords** to **search for literature** in **Scopus**, a widely used scientific database



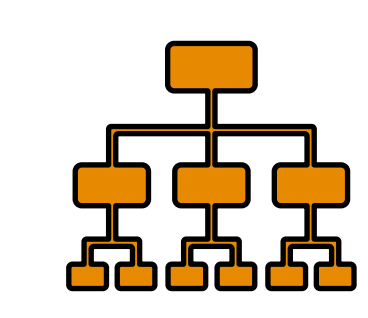
Found **8591 papers** published **between 2015 and 2024**



Removal of duplicates and irrelevant paper types (like "Editorials," "Books," "Letters," or "Retracted" papers)

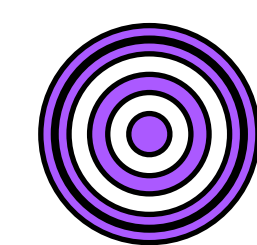


Papers with **highly similar abstracts and titles** (95% + cosine similarity) were **excluded** from the list

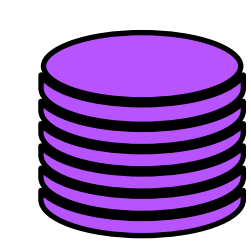


The remaining papers were **classified into five categories** based on the **"pillars"** or cornerstones of UCI

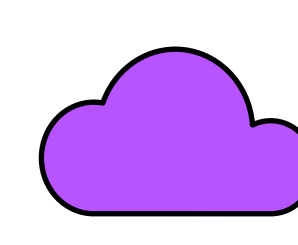
Cornerstones of Urban Climate Informatics



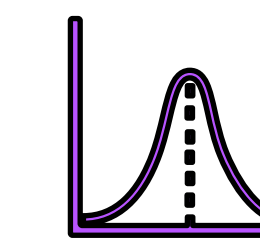
Advances in Sensing



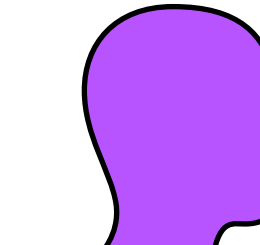
Novel Data Sources



Advances in Digital Infrastructure



Advances in Analytical Algorithms and Platforms



Practical Applications and Engagement



Preliminary Findings and Work in Progress

- We identified a new cornerstone, 'Practical Applications and Engagement,' alongside the existing cornerstones
- An important gap seems to be the integration of GIS and computational simulations to model urban heat islands, air pollution, and microclimatic variations
- More recent studies used crowd-sourced data and social media to complement traditional climate datasets
- Review of eligible papers is ongoing; further analysis will include a keyword analysis, network analysis, thematic mapping, and gap analysis using the BibliometriX package

Significance

- The analysis will provide a comprehensive understanding of how advances in computer science shape urban climate research
- Highlights the importance of interdisciplinary approaches in tackling challenges like urban heat, air pollution, flooding, and related public health issues
- Identifies trends and gaps to guide future research and practical applications in UCI