

DATA-DRIVEN A-TYPE

Introduction Leveragingtechnologicaladvancements environmentalconcernsduetosubstantial Thisintegrationgoesbeyondtheirtraditional applicationspromotessustainability and **Methodology** FLOU SS24 BC. Andrei Kazlouski In the Anthropoceneepoch, characterized is essential to transitioning to the post-An- energy consumption and resultant carbon utilitarian functions, incorporating them into reduces environmental impact. This thesis There search involves designing and impleby significant human impact on the environ- throp oceneera. Subsequent technologies footprint. This thesis discusses the challenges the social, economic, and environmental discusses various examples of heat reuse, menting UDC susing artificial intelligence ment, we witness rapid technological ad- designed to mitigate and normalize envi- and opportunities of integrating data centers tapes try of smart cities. By blending data such as using waste heat for greenhouse to create sustainable and adaptable archivancementsandacompletedigitalization ronmentalimpactsarenecessarytopro-ofourworld. These changes have funda-gressivelyminimize the overall environment-bata Center Challenges

HUMAN

NON-HUMAN

cene Shift

management. Data centers are compared Urban Integration

mentallyalteredourlifestylesandinterac- talimpactthroughcontinuoustechnological Datacentersfacesignificantchallengesre- real-timedataprocessingandefficientman- cesses. These applications demonstrate the creteassembly, dataset finalization, dataset tions. Among themost pivotal structures for innovation. Innovations in renewable ener- lated to energy consumption, environmental agement of urban operations. potential for data centers to contribute to samples representation, and robotic system ourdigitalexistencearedatacenters, which gy, sustainable agriculture, and ecological impact, and then eed for advanced cooling **Decentralized Data Networks and** urban sustainability and energy efficiency. configuration. The shift from modularity to AI havetraditionallyoperated at the fringes of restoration are pivotal infacilitating this tran-systems. Sustainable practices and innova-**Edge Computing** Integrating UDCs with urban farming infra-and the learning process of machine learning the systems. human-centricspaces. Asourrelianceon sition. The development of digital technolo- tive cooling methods are essential to ad- Decentralized datanetworks distributes tor- structure offers numerous benefits, includ- ingmodels are also explored. This approach digitalinfrastructuregrows, these centers gies and the Internet of Things (IoT) further dress these issues. The cooling systems em- age and processing across multiple nodes, ing a continuous supply of fresh produce ensures that UDCs are designed to meet curhavebecomecentraltomanagingandpro- enablesmore efficient resource manage- ployed indata centers include conventional enhancing data accessibility, redundancy, throughout the year and a significant re- renttechnological demands and anticipate cessing the vastamounts of datanecessary formodernurbanoperations. This thesises-plores the evolution of an ewarchitectural plores the evolution of an ew typology, the urban data center-termed processing the vast amounts of data nec- floor cooling. Each method has its advan- ing processes data closer to its source, re- The integration of UDCs into urban land- concept represents a paradigm shift in the 'Data-DrivenA-Type'—throughtheinnova- essaryformodernurbanoperations. These tagesandlimitations interms of energy effi- ducinglatency and bandwidthus age, which scapes should include public spaces, green design and implementation of urban data tiveuseofartificialintelligence(AI), affirm- facilities, which stand devoid of human ciencyandenvironmentalimpact. This the- iscrucial forreal-time applications likeau- spaces, and recreational facilities. These centers. By integrating advanced compuingtheincreasingmultimodalityandcom- presence, have become central to functions sisexplores these cooling methods in detail to nomous vehicles and smarttraffic systems. multifunctional spaces contribute to the unit of the ingtooptimizedataflowandenhancesys- ogies.DesigningUDCswithflexibilityand framework for further developing cooper-

plexity of architecture as a discipline. ranging from traffic management and pub- and examines how they can be optimized. This thesis explores the integration of decen- ban fabric, promoting public acceptance ciples, and the practical application of AI, AnthropocenetoPost-Anthropo- licsafetytoenergydistribution and waste for better performance and sustainability. tralized data networks and edge comput- and understanding of advanced technol- this research provides a comprehensive The Anthropocene era has led to signifi- to ancient libraries, highlighting their sig- Integrating data centers intour banenviron- tem resilience. By deploying local nodes scalability allows them to adapt to changing ation between architectural disciplines and cantenvironmental changes, necessitating nificance in storing and processing data ments iscrucial for the development of small disciplines and between and interview and cantenviron development of small disciplines and between a cantenviron development of small disciplines and between a cantenviron development of small disciplines and cantenviron mental changes, necessitating nificance in storing and processing data ments iscrucial for the development of small disciplines and between a cantenviron disciplines and between a cantenviron development of small disciplines and between a cantenviron disciplines and between a atransitiontoamoreharmoniousrelation- integral to modern life. They are becom- cities. Urbandatacenters (UDCs) should be data transmission distances, reduce latency, ments. By incorporating mixed-use elements shipwithnature. This thesis examines the shift ingcultural landmarks of the digital age, conceptualized as multifunctional spaces and improve application performance. such as public spaces, green spaces, and from the Anthropocene to the post-Anthro-symbolizing our shift into a fully digitalized that support various urban functions such Heat Reuse and Sustainability recreational facilities, UDCs can serve their pocenefrom the perspective of technolog-society. However, the rapid growth of the astraffic management, public safety, en-Reusing waste heat from data centers for primary technological functions while con-ical progress and its environmental impact. data center industry has led to significant ergy distribution, and waste management. urban farming, district heating, and other tributing to the urban environment.

Everystructurecreatedwillbeanalyzedtoextractthe

heightinformation of distributed modules. This infor-

mationisdistributedinagradientfromwhitetoblack,

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/ Structure

Foreachgeneratedlocation, it was decided

tousevariantEPWdatafromdifferentparts

oftheworldtoenlargethevarietyofthesam-

ples in the data set.

/ North Direction

Inordertoincreasethetotalamountofsam

plesinthedataset,Idecidedtocalculatethe

setofnorthanglevaluesforeachlocation.

 O'
 45'
 90'
 135'

 180'
 225'
 270'
 315'

/ Footprint

- Contraction of the second se

/ EPW

Twopre-trained, open-sourcemodelswere representation, datamodules and green modadapted to explore the interplay between AI ules ratio. This methodology culminates in the andarchitectureforthethesismethodology.Ini- developmentofatoolthatenablesarchitects tiallyfine-tunedandsubsequentlytrained with tosketchabuilding's footprint within a specific prepared datasets, these models were trans- context initially; the tool then generates a context initially the tool then generates a context in the tool then generates a context in the tool the t formedintoabespokearchitecturaltool. The responding map of building heights, which is processinvolvestwosequentialpix2pixmodels: utilizedtodefinetheinternalstructure.Thistool thefirstmodelprocessesthefootprintsketch- demonstratesthepracticalapplicationofades to generate a height map of the proposed structure, while the second model analyzes this height map to determine the building's structural efficiency.





ML MODEL TRAINING 2 PAIRED DATA SET 1**2** 11 15.0 . . 5 B. J ----C D L C D L

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robot transporter for assembly of the





voxelsdifferentiatedbyfunctionalorspatialusage. VoxelsA-v,B-v,C-v,D-v,andE-varedesignedfor direction, whilevoxelsA-h,B-h,C-h,D-h, and E-h serveforhorizontalassembly. VoxelFrepresents thedatacenterhardwaresystem.VoxelHisdesignedforurbanfarmsystems.VoxelGservesas anairtransportationunitfromthedatacenterto thegreenhouseorasaheat-accumulatingdevice forfurtherdistribution.VoxelIisacomplexunit thatfunctionsasthemainreinforcingunitofthe construction, with integrated pipes for electricity and water distribution.



model of the Tokyo urban area selectedfortheexperimentisimported as context for calculations and solar

envelope.





structure.

AI-basedoutputintheformoftwo-pix-

el images of the height map and the

Usersinputabuildingfootprintsketch, which can be done in any pixel-based graphicprogram, into a prepared map capture with defined building heights represented in a grayscale gradient based on the height.

Thecustomizedlibrarvisrepresented invarious











