POI misplacement detection in multiply digitised routes

Wumpus World

Validating POI 295: A Geospatial Challenge

- **Manual validation** of **POIs** is slow and error-prone.
- There's a need for an **automated, scalable, and intelligent** backend that can find:
  - 1. **Non existent** POIs
  - 2. Incorrect **location**
  - 3. Not **multiply digitized**
  - 4. Rule **exception**

Methodology

Hay diferentes tipos de mapas, entre los más populares se encuentran los siguientes:
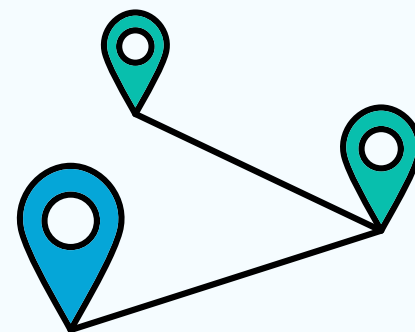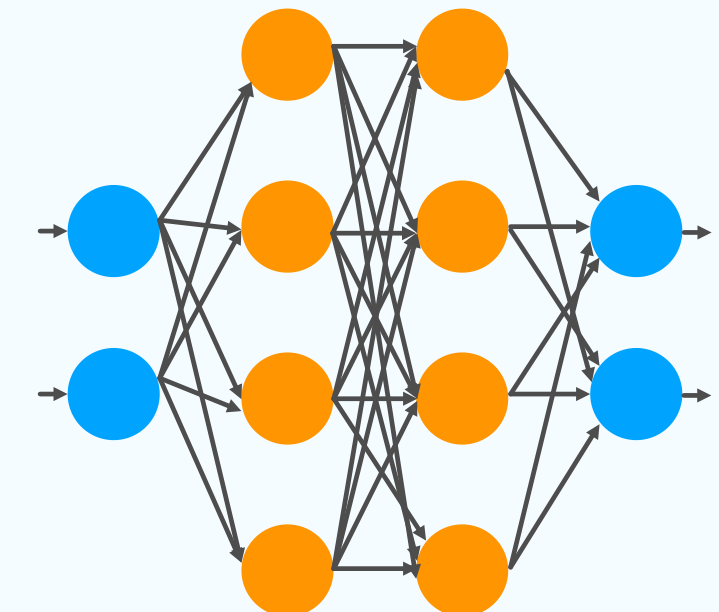
GEOSPATIAL DATA EXTRACTION HANDLING

MANUAL LABELLING

GEOMETRIC CALCULATIONS

CNN COSNTRUCTION AND TRAINING

Deep Learning Engine

- **Manual** labelling:
  - 0 for empty **area** of interests
  - 1 for AOI with **POI**
- Two Convolutional Neural Networks (**CNN**)
  - Trained on **satellite images** from **HERE API**
  - Ridges and sidewalks **analysis**
- **Automized** process from data extraction through **prediction**
- Validation accuracies: 0.84, 0.82

User interface

POI Data Analysis

Search by ID or name...

Total POIs	Non-existent	Wrong Location	Invalid Location	Rule Exception
113	11	60	0	42

All POIs | Non-existent | Wrong Location | Invalid Location | Rule Exception

ID ▲	Name	Status	Latitude	Longitude	Distance
800027356	PARDIÑOS	Wrong Location	-99.163411	19.344598	N/A
800027877	PEMEX	Rule Exception	19.360183	-99.171514	N/A
800028105	KFC-COPILCO	Rule Exception	19.343802	-99.181320	N/A
800032144	SCOTIABANK	Rule Exception	19.343818	-99.181316	N/A
800035174	LA MICHOACANA	Wrong Location	-99.181726	19.341890	N/A
800037899	EL TAJIN	POI Non-existent	19.344412	-99.163010	N/A
800038836	PEMEX	POI Non-existent	19.343720	-99.157183	N/A
998745662	STARBUCKS-MIGUEL ANGEL QUEVED...	Wrong Location	-99.165223	19.344701	N/A
1023860935	SCOTIABANK	Rule Exception	19.343818	-99.181316	N/A
1023863165	CITIBANAMEX	Wrong Location	-99.182789	19.338095	N/A

Showing 1-10 of 113 POIs

Previous | 1 | 2 | 3 | 4 | 5 | Next
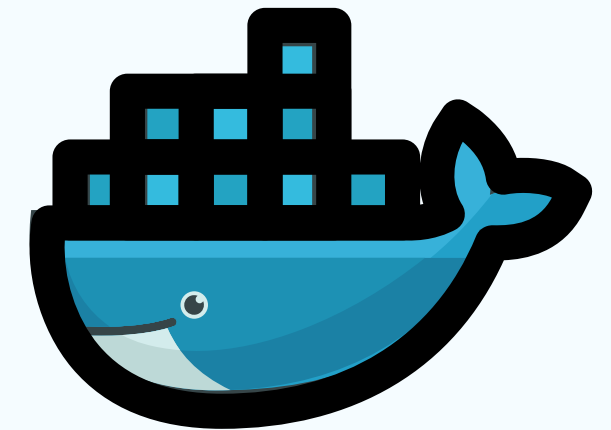
Application and Scalability

From CDMX to the World: A Scalable POI Validation System
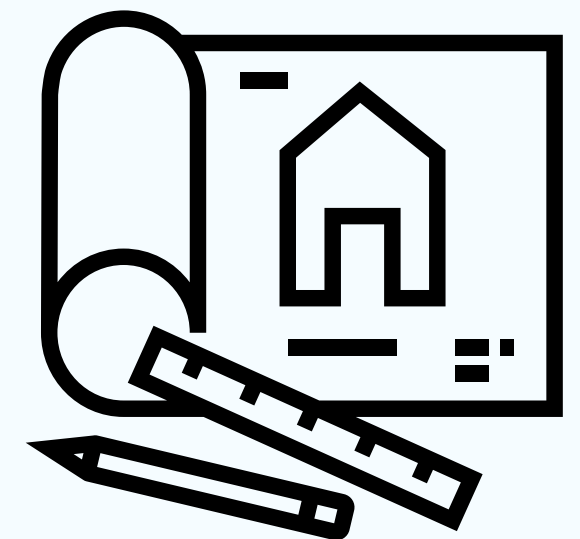
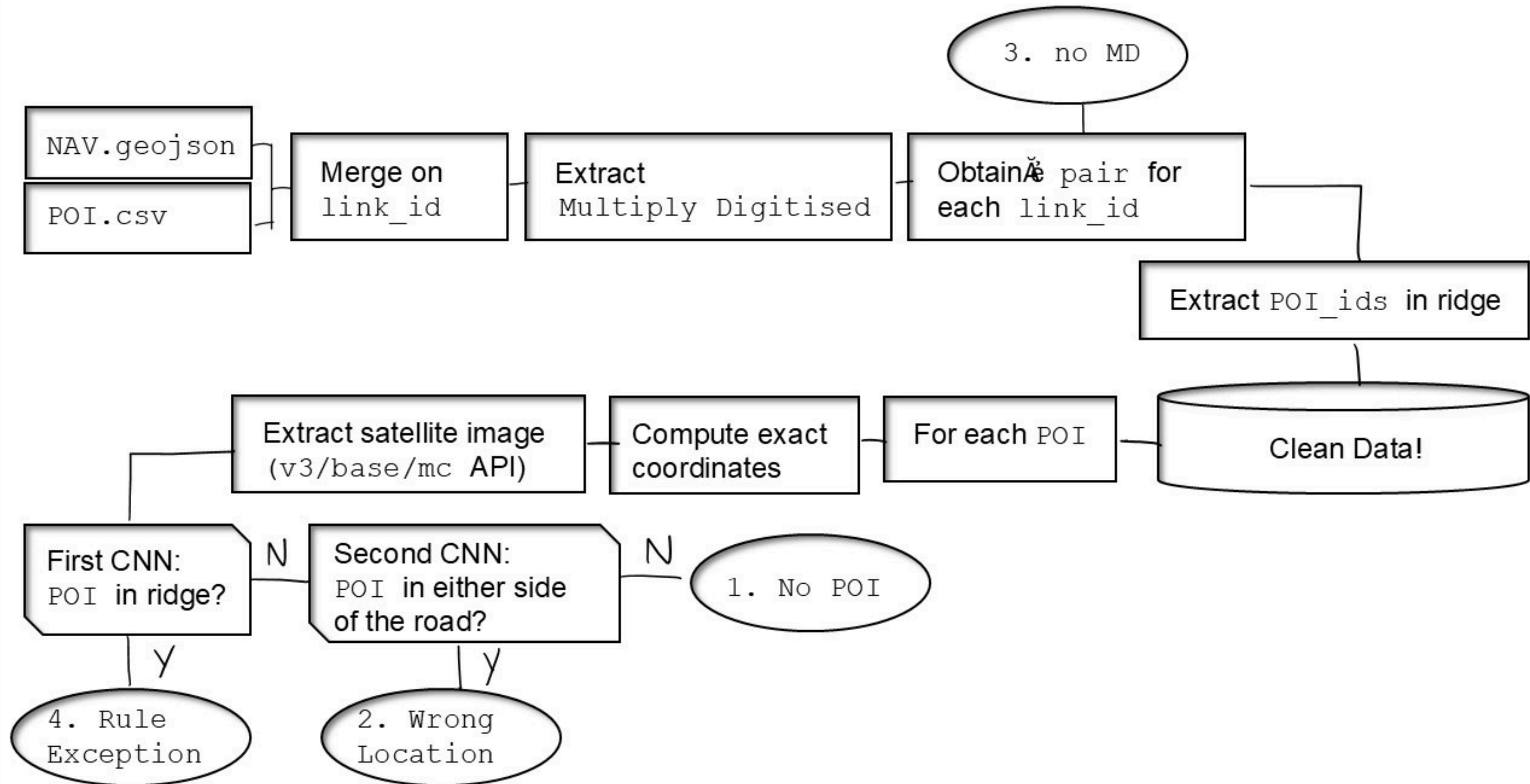🏙️ TESTED WITH MEXICO CITY (CDMX) DATA

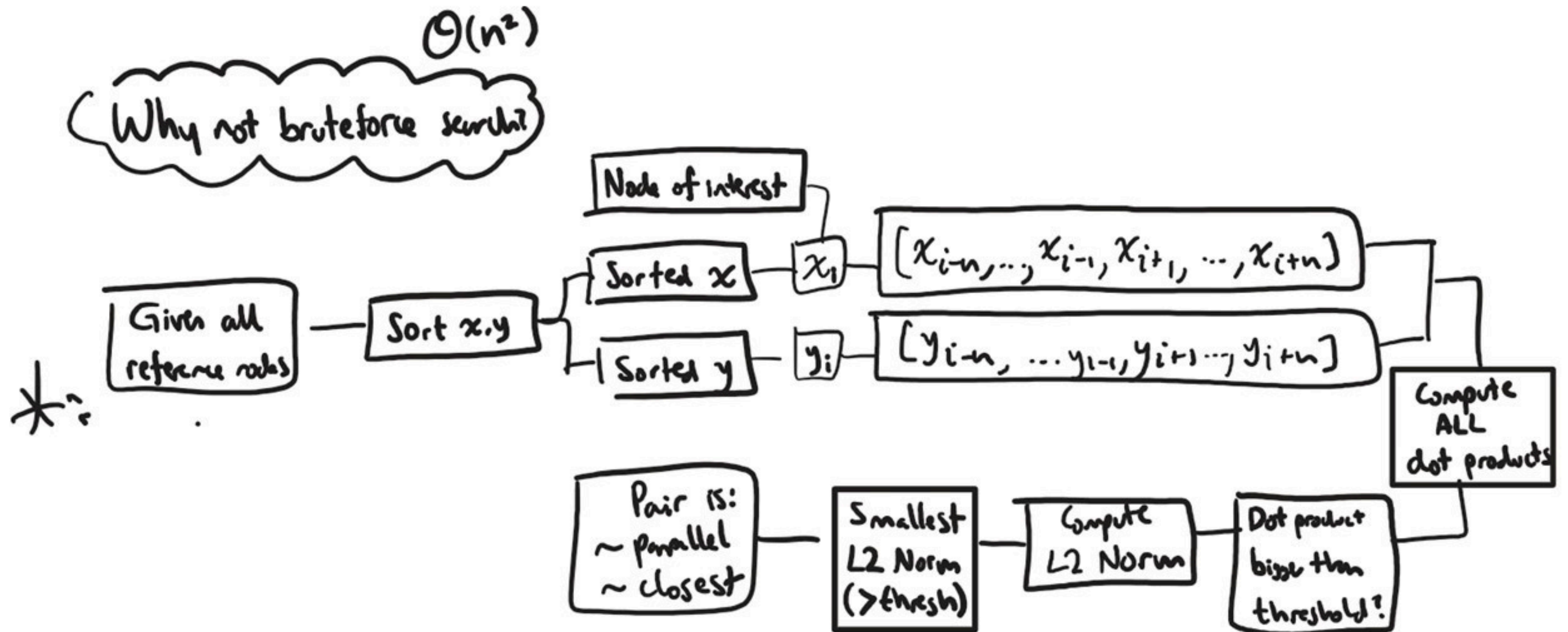🐳 CONTAINERIZED DEPLOYMENT

🌐 GLOBALLY SCALABLE ARCHITECTURE

🧠 REUSABLE MODEL ARCHITECTURE

Appendix: diagrams

Appendix: diagrams

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Given 2 pairs of nodes (2 link id's)

$V_1 = ((x_1' - x_1), (y_1' - y_2))$
$V_2 = ((x_2' - x_2), (y_2' - y_2))$

$y_{v_1} = y_{v_2}$?

$\xrightarrow{N}$ $y_{v_1} < y_{v_2}$ $\xrightarrow{Y}$ Ridge $V_1 = L$, Ridge $V_2 = R$

$\downarrow N$

Ridge $V_1 = R$, Ridge $V_2 = L$

$\downarrow Y$

Ridge $V_1 = L$, Ridge $V_2 = R$ $\xleftarrow{N}$ $x_{v_1} < x_{v_2}$

$\downarrow Y$

Ridge $V_1 = R$, Ridge $V_2 = L$

Appendix: diagrams

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Manual image labelling → 0: No POI in ridge / 1: POI in ridge → Validation set / training set

Satellite Image (RGB) — Convolution 32 3×3 kers — Max Pool 2×2 — Convolution 64 3×3 kers — Max Pool 2×2 — Convolution 128 3×3 kers — Max Pool 2×2 — flatten 128·16·16 — Linear 64 — RELU — Linear 1 — Sigmoid — output!