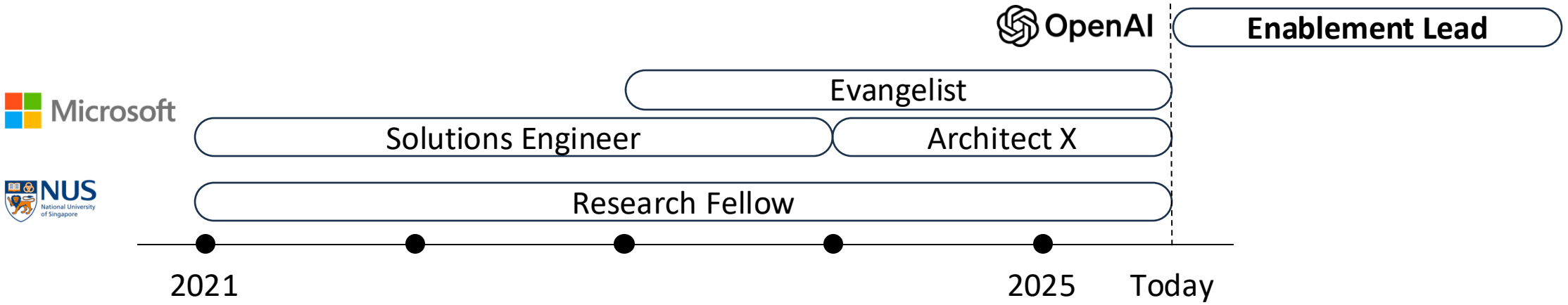
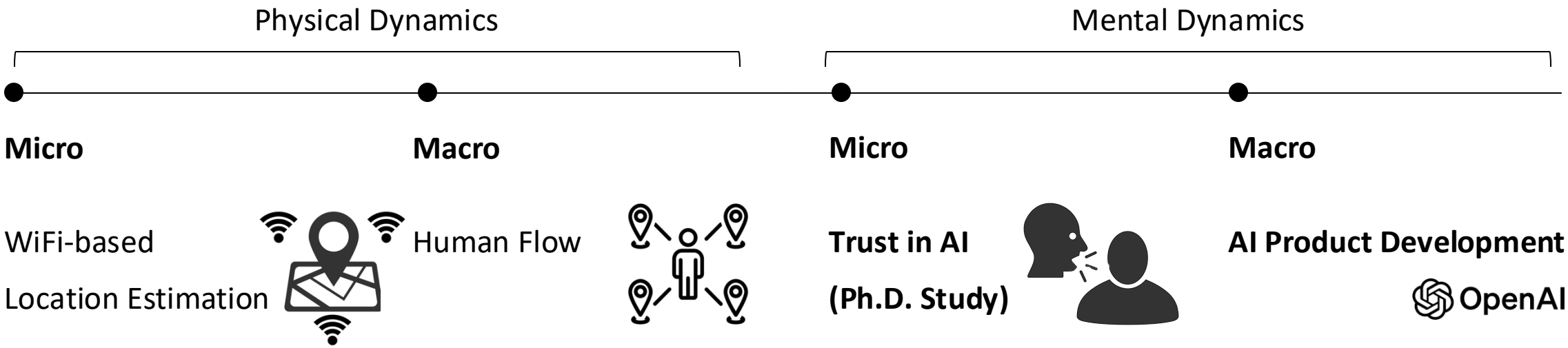
Kohei Yamamoto

Enablement Lead @ OpenAI | Ph.D. Student (Cognitive Informatics)

Work



Research (Human Dynamics)



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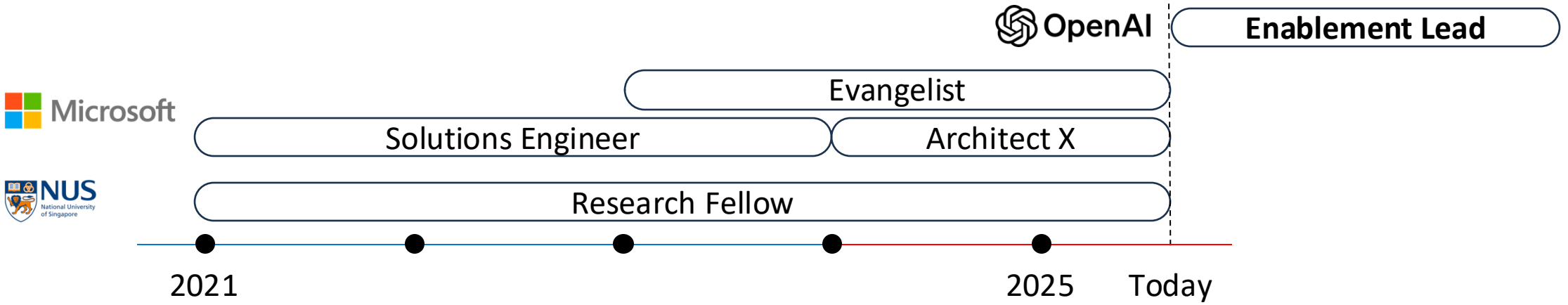
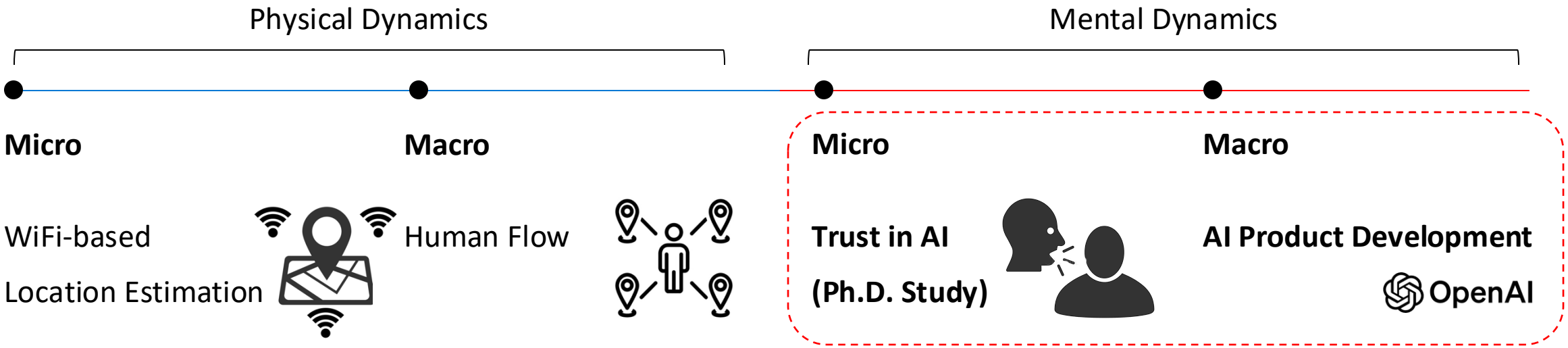


Research (Human Dynamics)



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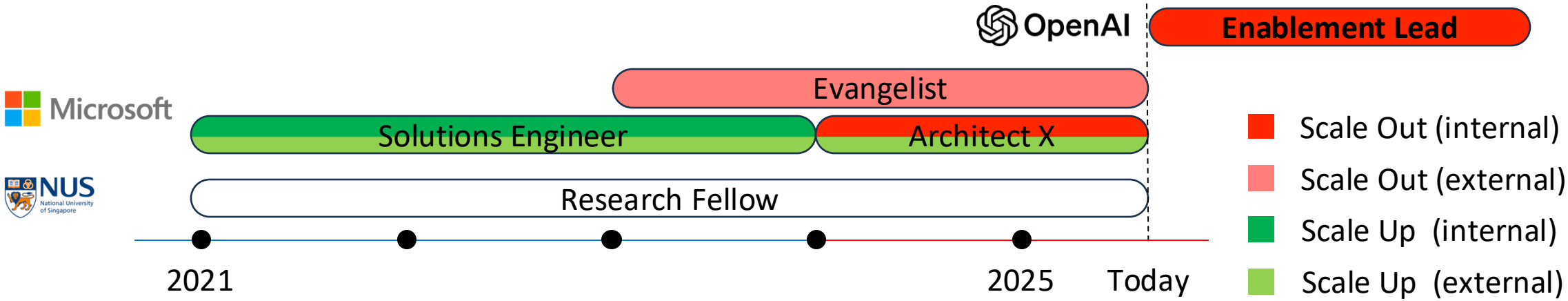

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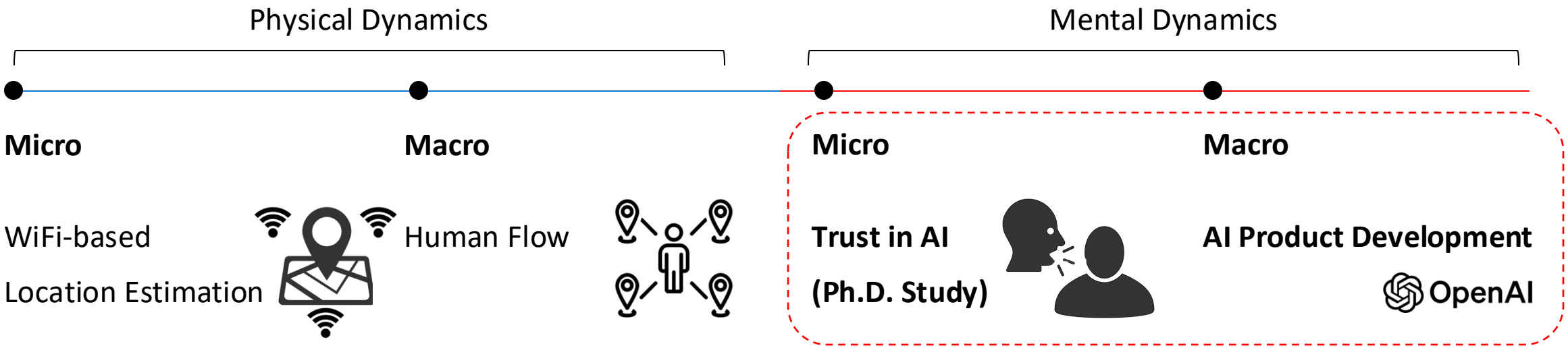


Research co-published from Microsoft, Sun Yat-Sen University, & NUS in Journal of Location-Based Services

Microsoft Research

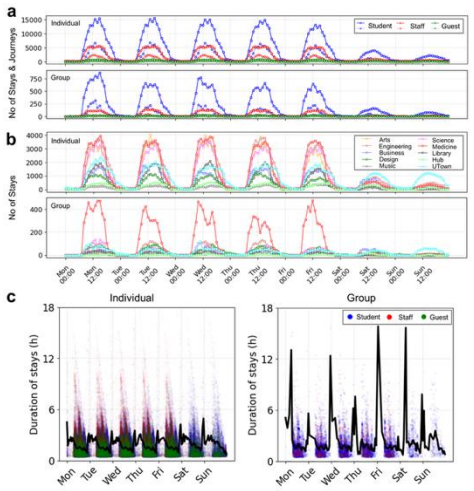
Juxtaposing Individual and Group Mobility from Sparse WiFi Signatures with Cloud-Assisted Computing ~ Transforming Juxtaposed Mobility Framework into Cloud-Native Solution ~

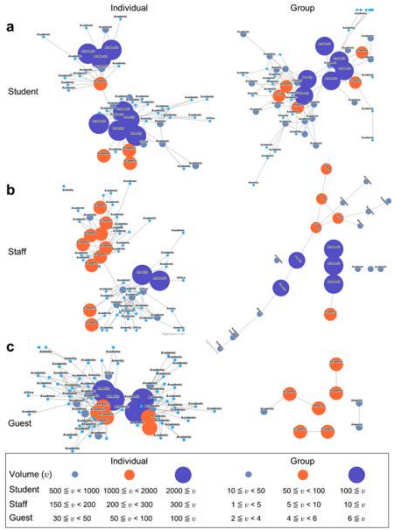
Kohei Yamamoto (Microsoft), Zhou Guo (Sun Yat-sen University), Chen-Chieh Feng (NUS; National University of Singapore)

Proposed a **juxtaposed analysis framework** on human mobility. Spatiotemporal patterns of individuals and groups from WiFi connections are investigated while **compressing the computation time to about 6%** of the conventional cost using a cloud. Results **published** in Journal of Location-Based Services.

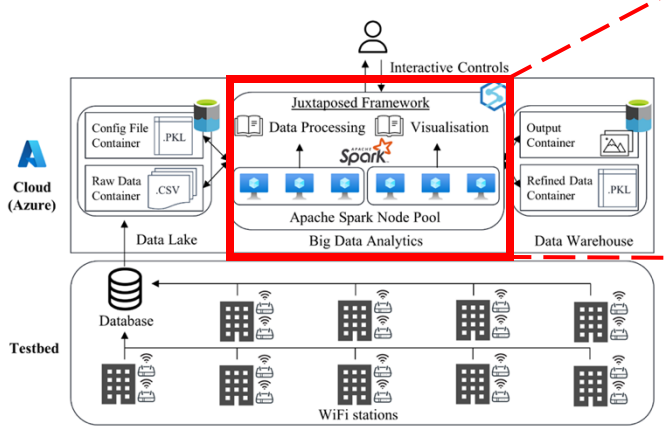
Challenge

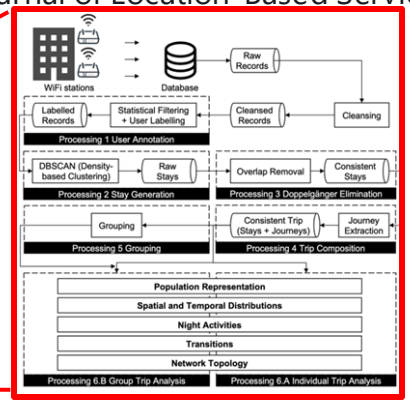
- Increased focus on **human mobility** after COVID-19 pandemic.
- Empirical **juxtaposed analysis** of individual and group mobility is still scarce.
- Testing the framework using WiFi histories spans **several days**
  - Heterogeneity between **individuals and groups**?
  - Variations among **different attributes**?
  - **Computation optimisation** on cloud-assisted infrastructure





Solution





- **High-performance** computing using Spark Cluster-based distributed infrastructure.
- **Rapid conversion in about 1 week** using GitHub Copilot to fit PySpark.

Agility | Scalability | Performance

Benefit

- Implemented **scalably** on a big data platform
- Compressed cost spanning 2-3 days to **2-3 hours**
- Investigating 100M records from 46K people on **NUS** campus, proved **the validity of juxtaposed framework** in a **real-world** scenario.
- Suggested the **practicality** of cloud architecture
- **Published** in **Journal of Location-Based Services**

User Voice

"It proposes a novel framework utilising Wi-Fi and Geo-spatial technology to analyse both individual and group mobility dynamics, offering valuable insights into human behaviour and mobility patterns with practical applications."

Guo Zhou
Associate Professor, Sun Yat-Sen University

"The Azure-based geospatial framework greatly improved our ability to make sense of human mobility dynamics by offering a computationally efficient means to analyse massive amount of Wi-Fi data."

Chen-Chieh Feng
Associate Professor, NUS

Yamamoto, K., Zhou, G., and Feng, C. 2024. Juxtaposing individual and group mobility from sparse Wi-Fi signatures with cloud-assisted computing: a case study for a multidisciplinary university campus, Journal of Location Based Services, 18(2), 205–236. DOI: 10.1080/17489725.2024.2330922

Research co-published from Microsoft & NUS at IEEE

Microsoft Research

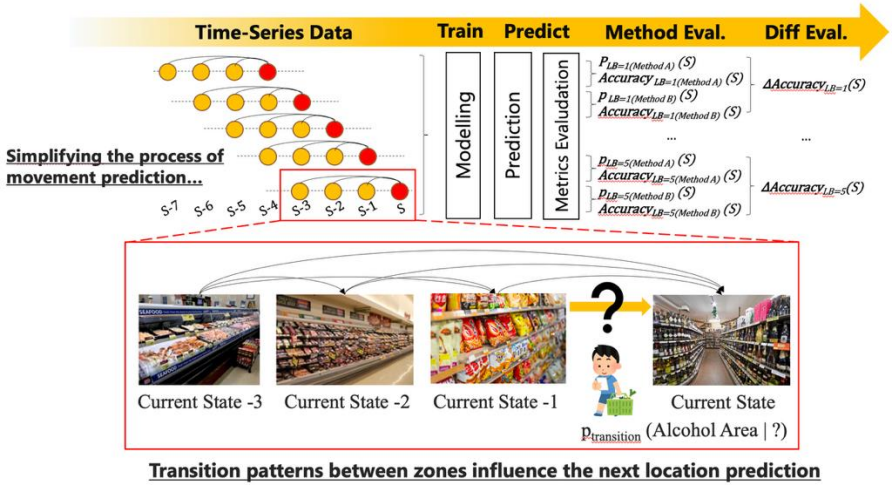
Analytical Framework in Cloud-Native Environments for Auto-Modelling Sparse Human Mobility Considering Memory of Past Contexts ~ Transforming ML Framework into Cloud-Native Solution ~

Kohei Yamamoto (Microsoft), Joie Lim (NUS; National University of Singapore), Filip Biljecki (NUS), Rudi Stouffs (NUS)

Approximately **60 times more efficient** in total computation time for machine learning parameter sets.
Swiftly executed hypothesis validation in academic institutions using **cloud-native architecture**, leading to **paper acceptance and presentation at IEEE**.
Submitted to an international journal of cloud.

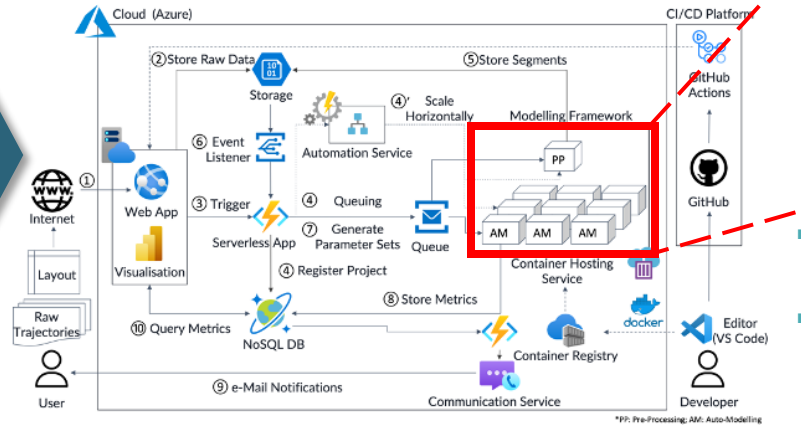
Challenge

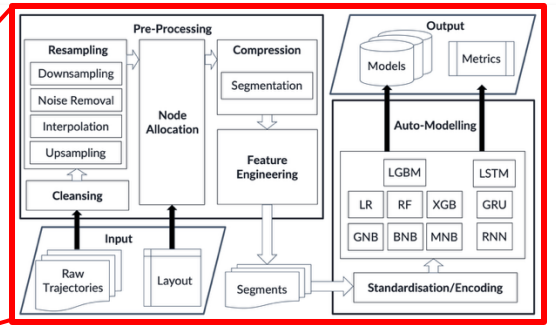
- Increased focus on **individual movement predictions** due to the COVID-19 pandemic.
- Approximately **one week or less of computational cost** for iterative hypothesis testing of nearly 10,000 parameter sets:
  - How much past information should be incorporated?
  - How much difference will there be among methods?
  - How much difference will there be in feature importance?



Transition patterns between zones influence the next location prediction

Solution



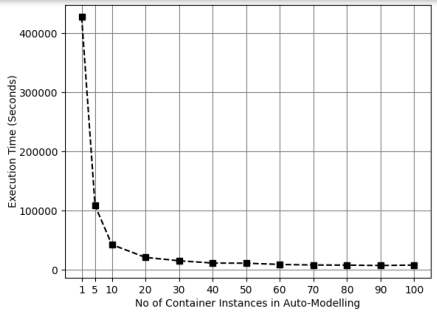


- **Containerised** modelling framework and **parallelised** executions.
- **Rapid implementation in about 1 month** using serverless applications (Functions) and GitHub Copilot.

Agility | Scalability | Reliability

Benefit

- Implemented **quickly and scalably** using PaaS.
- Compressed weekly computational costs to **1-2 hours**.
- Tested hypotheses using data from a supermarket within **Tsinghua University (China)**, **suggesting the practicality of the modelling framework and cloud architecture**.
- Academic **paper accepted at IEEE** & **presented in India**.
- Currently submitting to an **international journal in the field of cloud computing**.



User Voice

"Leveraging cloud technology in research and education enables the tackling of more computationally challenging tasks, leading to new opportunities."

Rudi Stouffs
Associate Professor & Assistant Dean, NUS

K. Yamamoto, J. Lim, F. Biljecki and R. Stouffs, "Analytical Framework in Cloud-Native Environments for Auto-Modelling Sparse Human Mobility Considering Memory of Past Contexts," 2023 13th International Conference on Cloud Computing, Data Science & Engineering, Noida, India, 2023, pp. 87-91.

Research co-published from Microsoft, Sun Yat-Sen University, & NUS in Journal of Location-Based Services

Microsoft

学術研究

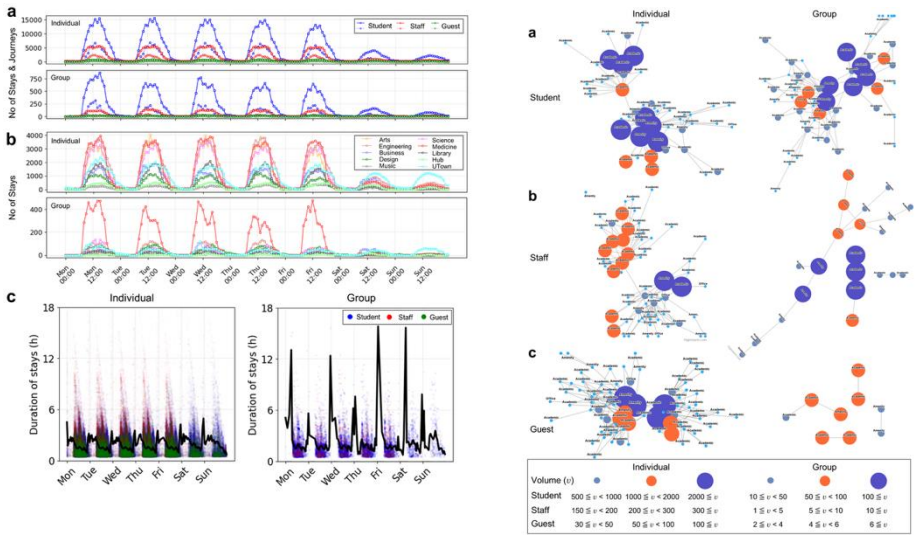
Juxtaposing Individual and Group Mobility from Sparse WiFi Signatures with Cloud-Assisted Computing ～ 個人と集団移動における並置解析フレームワークのクラウドネイティブ化 ～

Kohei Yamamoto (マイクロソフト), Zhou Guo (中山大学), Chen-Chieh Feng (シンガポール国立大学)

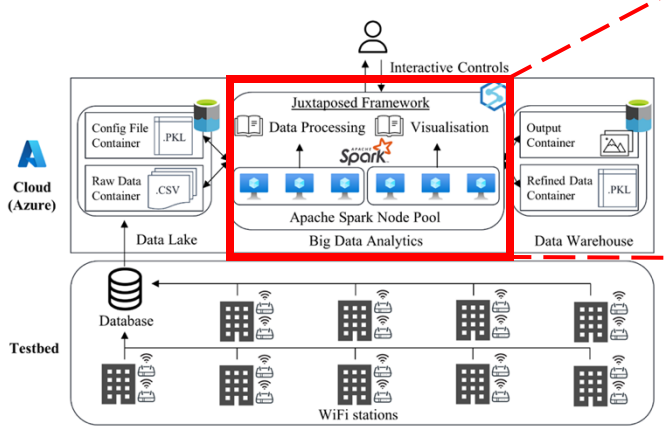
膨大な WiFi の接続履歴から、個人と集団の時空間におけるパターン解析の総計算コストを従来の**約 6 %までに圧縮**。
クラウドネイティブな並置解析フレームワークを提唱。**学術機関での仮説検証を迅速に実行**し、**位置情報に関する国際論文誌で採択**。

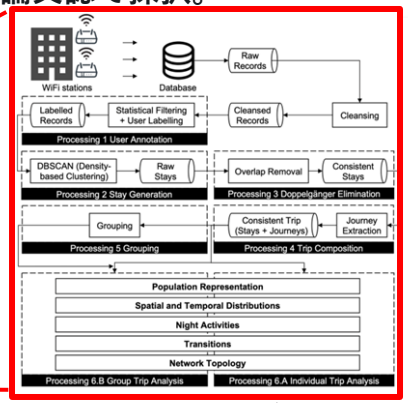
Challenge

- コロナ禍もあり**人の移動予測**が大きく注目
- 個人と集団移動での実証的**並置解析**はまだ乏しい
- フレームワークは**数日に及ぶ計算コスト**が発生
  - 仮説1: WiFi 接続履歴で個人と集団の異質性検証
  - 仮説2: 属性間での変異を検証
  - 仮説3:クラウド基盤での計算による計算効率化



Solution





- 分析フレームワークを Spark Cluster ベースの**分散基盤**で高速解析
- GitHub Copilot の活用により隙間時間**約1週間でコード変換・実装**

Agility　Scalability　Performance

Benefit

- ビッグデータ分析基盤で**スケーラブル**に実装
- 数日をまたぐ計算コストが**2~3時間**に圧縮
- シンガポール国立大学キャンパスの4.6万人1億超レコードで仮説を検証し、個人と集団の並置解析**フレームワークの妥当性を実証環境で証明**
- **クラウド**アーキテクチャの**実用性**を示唆
- 位置情報専門の**国際論文誌**で採択

User Voice

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Microsoft 学術研究

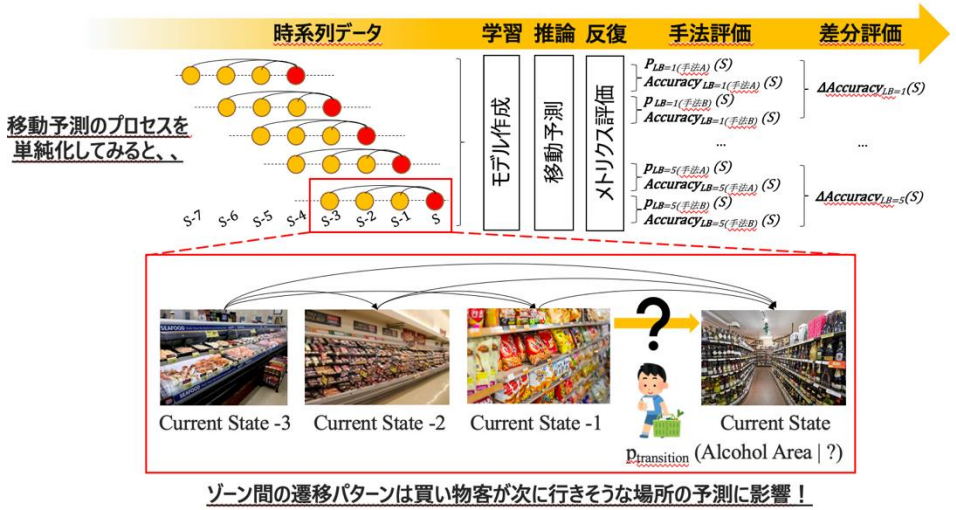
Analytical Framework in Cloud-Native Environments for Auto-Modelling Sparse Human Mobility Considering Memory of Past Contexts ～ 機械学習フレームワークのクラウドネイティブ化 ～

Kohei Yamamoto (マイクロソフト), Joie Lim (NUS; シンガポール国立大学), Filip Biljecki (NUS), Rudi Stouffs (NUS)

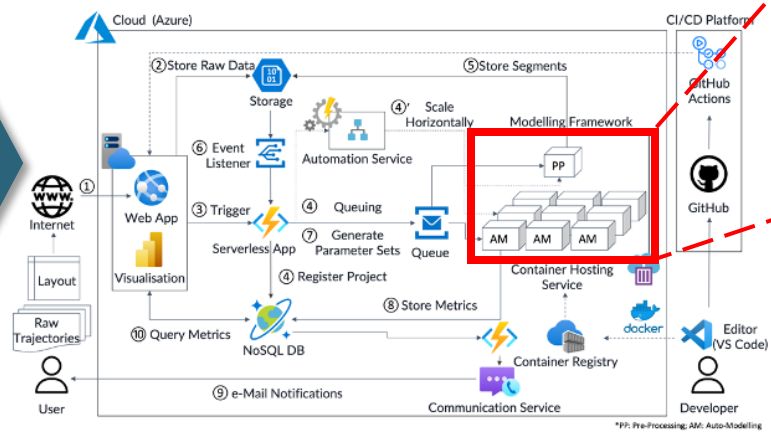
機械学習パラメータセット総計算時間を**約60倍効率化**。
クラウドネイティブなアーキテクチャで**学術機関での仮説検証を迅速に実行**し、**IEEE にて学術論文採択・登壇。クラウドの国際論文誌に提出。**

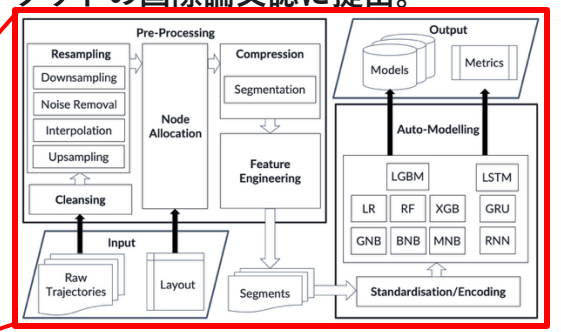
Challenge

- コロナ禍もあり**個人の移動予測**が大きく注目
- 1万弱パラメータセットの反復的な仮説検証に**1週間弱の計算コスト**が発生
  - 仮説1: どれほど過去情報を畳み込むべきか
  - 仮説2: 手法間でどれくらい差が出るか
  - 仮説3: 特徴量でどれくらい差が出るか



Solution



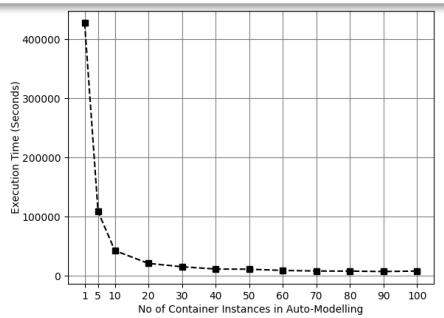


- 分析フレームワークを**コンテナ化・並列モジュール化**
- サーバレス型のアプリ(Functions) や GitHub Copilot の活用により隙間時間**約1ヶ月で迅速に実装**

Agility　Scalability　Reliability

Benefit

- PaaS の組み合わせで**迅速かつスケーラブル**に実装
- 週レベルの計算コストが**1~2時間**に圧縮
- 清華大学 (中国) 構内のスーパーマーケットのデータで仮説を検証し、**分析フレームワークおよびクラウドアーキテクチャの実用性を示唆**
- **IEEE にて学術論文採択** & **インドで登壇**
- **クラウド分野の国際論文誌**への投稿中



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