
Self-Introduction

Jérôme Eertmans — Visiting Researcher at KDDI Research

Jérôme Eertmans

UCLouvain, Belgium

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Outline (アジェンダ)

1. Who Am I? (自己紹介)
2. What I Do (Ph.D. Research) (研究内容)
3. Why Am I Here? (KDDI総合研究所での目標)

Hello! (自己紹介)

- **Name:** Jérôme Eertmans
- **Age:** 27 years old
- **From:** Belgium (ベルギー)
- **University:** UCLouvain (Louvain-la-Neuve) (ルーヴァンカトリック大学)
- **Degree:** Ph.D. in Electrical Engineering (電気工学博士)
(Defended July 6, 2026)
- **Languages:** French (フランス語) (native), English (英語), Dutch (オランダ語), Italian (イタリア語) (basics), Japanese (日本語) (beginner (初級))



Jérôme Eertmans

Belgium & UCLouvain (ベルギーと大学紹介)

Belgium (ベルギー)

- Small country in Western Europe (西ヨーロッパ)
- Capital: Brussels (ブリュッセル) (EU de facto capital)
- 3 official languages: French, Dutch, German
- Famous for chocolate, waffles, and fries!

UCLouvain

- Founded in 1425 (600+ years of history)
- Located in Louvain-la-Neuve: a unique car-free university city (歩行者専用大学都市)



Hobbies & Interests (趣味・関心)

Sports & Outdoors (スポーツ・アウトドア)

- Running, hiking, and exploring nature
- 6 years as a Scout Leader (スカウトリーダー)

Culture (文化・趣味)

- Anime & Manga enthusiast (アニメ・マンガファン)
- Reading & history

Tech & Coding (技術・プログラミング)

- Open-source software developer (OSS開発)
- Contributor on GitHub (GitHubでの活動)
- Passionate about Rust, Python, and JAX

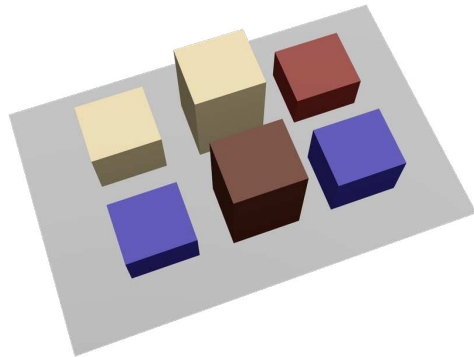
Destination (旅行)

- Long-time dream: Visiting and working in Japan! (日本での生活と研究)

Differentiable Ray Tracing (微分可能レイトレーシング) for Radio Propagation Modeling (電波伝搬モデリング)

Key Concepts (主要な概念) :

- **Radio Propagation:** Model wireless signals in complex urban and indoor environments (都市・室内での電波伝搬)
- **Ray Tracing:** Simulate physical wave interactions (reflections, diffractions) (反射・回折の物理シミュレーション)
- **Differentiability:** Compute gradients through physics for fast gradient-based optimization (勾配ベースの高速最適化)



Radio wave propagation in a street canyon

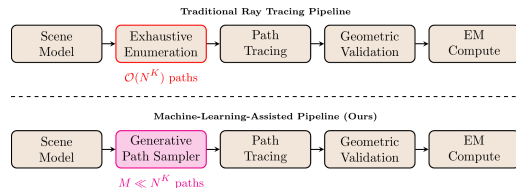
Key Highlight: Generative Path Sampling (研究成果：生成型経路サンプリング)

The Challenge (課題) :

- Point-to-point ray tracing requires searching $\mathcal{O}(N^K)$ candidate paths
- Exponential complexity (計算量の指数関数的増大) limits real-time 5G/6G digital twin simulations (デジタルツイン)

Our Solution (解決策) :

- Replace exhaustive search with an ML model (**GFlowNet**) (強化学習・生成モデル)
- Samples physically valid paths directly
- **100× speedup on CPU, 10× on GPU** (大幅な高速化) while maintaining high accuracy ($> 90\%$)



Traditional ray tracing (top) vs. ML-assisted path sampling (bottom)

DiffeRT (微分可能レイトレーシング・ライブラリ)

- Open-source Python library for differentiable radio ray tracing
- Built with JAX (GPU acceleration) & Rust (high performance)
- <https://github.com/jeertmans/DiffeRT>

Manim Slides (プレゼンテーションツール)

- Presentation tool for math & scientific animations
- Used by researchers worldwide; published in JOSE journal

ADE Scheduler (大学公式時間割システム)

- University-wide course scheduling tool for UCLouvain (30k+ active student users)

Why KDDI Research & Internship Goals (KDDI総合研究所での研究目標)

Why KDDI Research? (志望理由)

- Leading global telecommunications operator (通信分野の世界的リーダー)
- Strong alignment with 5G/6G channel modeling, digital twins, and AI-driven network planning
- Opportunity to bring academic differentiable ray tracing to industrial applications (産業応用への展開)

Internship Goals (インターンシップの目標)

- **Professional:** Collaborate with KDDI researchers and produce high-impact R&D results
- **Personal:** Improve Japanese language skills, experience Japanese work culture, and build lasting connections

Thank you!

ご清聴ありがとうございました

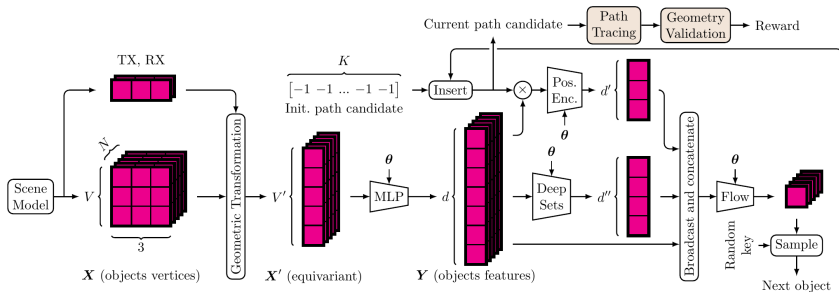
Jérôme Eertmans

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Appendix / Backup Slides

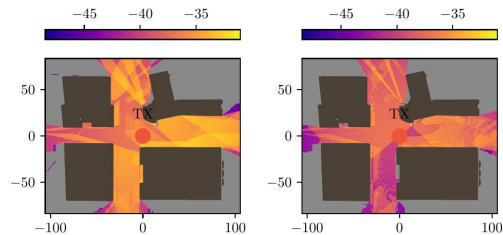
(補足資料)

Backup: Generative Path Sampling Architecture (補足：モデル構成)



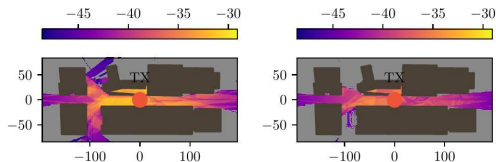
- **GFlowNet** trained to sample promising ray paths
- Canonical transformation for spatial invariance
- Physics-based action masking to eliminate invalid reflections
- Robust training via experience replay buffer

Backup: Manhattan Benchmark Results (補足：Manhattan都市モデル評価)



(a) Ground truth G_{GT} (dB) (small scene).

(b) Prediction G_{pred} (dB) (small scene).



(c) Ground truth G_{GT} (dB) (medium scene). (d) Prediction G_{pred} (dB) (medium scene).

Out-of-Distribution Generalization

(汎化性能)

- Trained on street canyons, tested on real OpenStreetMap Manhattan geometry (N up to 805 objects)
- Captures dominant propagation channels efficiently



Prof. Claude Oestges (UCLouvain)

Channel modeling, propagation, MIMO

- **EuCAP 2026 Best Propagation Paper Award** (*Fast, Differentiable, GPU-Accelerated Ray Tracing*)
- Submitted to *npj Wireless Technology* (2026)



Prof. Laurent Jacques (UCLouvain)

Signal processing, computational sensing