Databases, DNA & Digital Detours

From Smart Algorithms in Fish Portioning to Pioneering Pipelines in Long-Range DNA Sequencing and Digital Travel

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IVT Faculty Gathering: September 6, 2023

INDUSTRIAL ENGINEERING

Agenda

Personal Introduction

Academic Background

Research Highlights

Professional Experiences

Teaching Philosophy

Looking Ahead

My Journey: From Math to Academia

Academic Evolution:

- ▶ Started with math; transitioned to comp. science and applied math.
- ▶ Master's in Computational Engineering cemented my direction.

Into the Academic Realm:

- ▶ Began as TPR's TA, grew into PhD and *much* later, Post-Doc roles.
- ▶ Returned to teaching after a decade; found confidence in maturity.

Merging Industry & Academia:

- ▶ Tapped into industry insights: software dev., AI, and data science.

Passions Beyond Academia:

- ▶ Textile enthusiast: garment sewing, knitting, lace making, machine embroidery.
- ▶ A recent aficionado of modern board games.

Educational Journey

- **B.Sc. in Mathematics** (Emphasis on Computer Science), University of Iceland, 2005-2008.
- **M.Sc. in Computational Engineering**, University of Iceland, 2008-2010:
  - Erasmus exchange at Université de Valenciennes.
  - Focus: fouling in cross-flow heat exchangers with Prof. Sylvain Lalot
- **Ph.D. in Computational Engineering**, University of Iceland:
  - PhD Stipend from autumn 2009-2012
  - Started working full-time at Valka Jan 2013, PhD in spare time.
  - Defended in June 2016
- **Diploma in Teaching Studies for Higher Education**, 2010-2012.
  - Taught Operations Research 2011 and 2012

Dissertation

▶ Case Study on supervised learning approaches in dispatching rules for **Job Shop Scheduling Problem** (JSSP).

▶ Introduction of **Analysis & Learning Iterative Consecutive Executions** (ALICE) framework for effective training.

▶ Emphasized Training Data:
  ▶ Should match the induced data distribution via active imitation learning.
  ▶ Labels are derived using an expert policy.
  ▶ Account for data balance with respect to dispatching step.
  ▶ Use of $(K - k)$ roll-outs to augment stepwise features.

▶ Expert policy not just for labeling; also reveals vulnerabilities in the scheduling process.

▶ While stepwise optimality often aligns with good end performance, there's room for understanding trajectory deviations.

▶ Approach leverages preference learning but is flexible for substitutions and other scheduling problems.

Selected Publications & Contributions

Ph.D. Research

▶ Helga Ingimundardottir and Thomas Philip Runarsson (Nov. 2011). "Sampling Strategies in Ordinal Regression for Surrogate Assisted Evolutionary Optimization". In: **Intelligent Systems Design and Applications (ISDA), 11th International Conference on**. Cordoba, Spain, pp. 1158 –1163

▶ Helga Ingimundardottir and Thomas Philip Runarsson (Aug. 2018). "Discovering dispatching rules from data using imitation learning: A case study for the job-shop problem". In: **Journal of Scheduling** 21.4, pp. 413–428

▶ Helga Ingimundardottir and Thomas Philip Runarsson (2015). "Generating Training Data for Supervised Learning Linear Composite Dispatch Rules for Scheduling". In: **Learning and Intelligent Optimization**. Vol. 8994. Lecture Notes in Computer Science. Cham: Springer, pp. 236–248 (Nominated for Best Paper Award at LION 2015)

Master's Research

▶ Helga Ingimundardottir and Sylvain Lalot (2011). "Detection of Fouling in a Cross-Flow Heat Exchanger Using Wavelets". In: **Heat Transfer Engineering** 32.3-4, pp. 349–357

▶ Helga Ingimundardottir and Sylvain Lalot (2011). "Detection of Fouling in a Cross-Flow Heat Exchanger Using Wavelets". In: **Heat Transfer Engineering** 32.3-4, pp. 349–357

deCODE genetics Research

▶ Doruk Beyter et al. (June 2021). "Long-read sequencing of 3,622 Icelanders provides insight into the role of structural variants in human diseases and other traits". In: **Nature Genetics** 53, pp. 779–786

▶ Guillaume Holley et al. (Jan. 2021). "Ratatosk: hybrid error correction of long reads enables accurate variant calling and assembly". In: **Genome Biology** 22.1, p. 28

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- ▶ **deCODE genetics** (2016-2021):
  - ▶ Designed and managed the **ONT** long-range sequencing analysis pipeline.
  - ▶ Key role in handling 6 petabytes of data.
  - ▶ Contributed to significant research projects.
- ▶ **Valka** (2013-2015):
  - ▶ Developed fish bone detection algorithms.
  - ▶ Implemented fish portioning algorithms for multiple species.
- ▶ **AGR Dynamics**: SQL consultant for supply chain management system, AGR 5.
- ▶ **CCP Games**: Developed near-realtime recommendation engine for new EVE Online players.
- ▶ **Travelshift** (Head of AI Research): Led AI consultancy team optimizing travel plans on GuideToEurope.com.
- ▶ Advisor for **RANNÍS** Technology Development Fund 2015 & 2023.

Teaching Focus

▶ **Real-World Relevance:** Connecting classroom lessons with real-world applications, emphasizing the power of teamwork in solving modern challenges.

▶ **Technical Writing:** Emphasizing the importance of clear, concise communication. Teaching students the art of turning data and results into compelling narratives.

▶ **Data Storytelling:** Equipping students with tools and techniques for effective data visualization. Encouraging the creation of visual narratives from raw data.

▶ **Open Collaboration with GitHub:**
  ▶ Highlighting GitHub as an essential workforce skill.
  ▶ Using it for team assignments, fostering practical hands-on experience.

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Current Endeavors:

▶ Active contribution to **IDeLM**.

▶ Collaborative work with TPR on fairness model for **Anesthetist's Peel Assignment Problem**.

Future Aspirations:

▶ Carve a niche at the crossroads of AI and creativity.

▶ Dive into garment pattern optimization using 2D free-form binpacking.

▶ Utilize generative AI for an innovative knitting program.

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Always open for collaboration, brainstorming, and discussions.

▶ **E-mail**: helgaingim@hi.is
▶ **Temporary Office**: Squatting in TPR's office. Feel free to drop by for discussions!

Upcoming Talk: Save the Date!

Haustráðstefna Advania
Date: 8th September 2023
Time: 14:15 - 14:30
Venue: Harpa / Online

Pushing Boundaries: A Data-Driven Dive into **Legend of the Ice People**

Unravel the unexpected synergy of literature and data science as we navigate the narrative maze of Margit Sandemo's cherished series, extracting insights from its many incarnations – from print to audio to podcasts, showcasing the transformative power of data in unexpected territories.