

# Hebi Li

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## Education

- **Iowa State University** *Aug. 2014 - Aug. 2022 (expected)*
  - PhD Candidate in Dept. of Computer Science. *Advisor: Prof. Jin Tian*  
Major: Programming Language and System; AI, Machine Learning and NLP
- **University of Science and Technology of China** *Sep. 2010 - Jun. 2014*
  - B.E. in Electrical Engineering

## Professional Skills

- **Programming:** Python, Julia, Javascript, Racket/Scheme/Lisp, Meta Prog, DSL, C/C++, Clang/LLVM
- **System & Web:** Linux, Container, Docker, Tmux, Jupyter, ReactJS, ExpressJS, GraphQL, SQL, NoSQL
- **Machine Learning:** Tensorflow, Pytorch, Flux, MLP, CNN, LSTM, Auto-encoders, Scikit-learn, Numpy, Pandas

## Projects & Experience

- **Programming Language (PL) & Software Engineering (SE)**
  - *Embedded Programming Language and System for PCB Designs* (<https://bhdl.org>) *Feb. 2020 - Oct. 2021*
    - Designed **BHDL** [1], the first open-source embedded domain-specific language (eDSL) for creating PCBs. BHDL enables engineers to program complex and reusable PCBs.
    - Co-Designed **DRL-MCTS** [2], an AI-driven automatic routing algorithm for PCBs using deep reinforcement learning (RL) and Monte Carlo Tree Search (MCTS). It yields 33.3% higher success rate than A\* and PPO.
  - *Hierarchical IDE for Interactive Development at Scale* *Aug. 2020 - Oct. 2021*
    - Designed and developed **CodePod**[3], the first scalable Jupyter-like Integrated Dev Env (IDE) for interactive development. Thanks to its novel namespace rules, CodePod permits developing production-scale codebase.
    - CodePod is implemented as a fullstack web app using ReactJS, ExpressJS, GraphQL, PostgreSQL, Prisma ORM.
- **AI & Machine Learning (ML) & Natural Language Processing (NLP)**
  - *Self-supervised DAG Structure Learning* (<https://github.com/lihebi/DAG-EQ>) *Nov. 2019 - Aug. 2021*
    - Proposed **DAG-EQ** [4], the first self-supervised learning formulation of the DAG structure learning problem.
    - Applied equivariant neural networks to solve the problem and achieved state-of-the-art on DAG learning.
    - Applied transfer learning and ensemble learning and show significantly better scalability to large graphs.
  - *End-to-end Semantics-based Summary Quality Assessment* *Feb. 2019 - Feb. 2020*
    - Co-designed a reference-free supervised approach **BetterRouge** [5] for Summary Quality Assessment.
    - Proposed two negative sampling methods for fully automatic training data augmentation.
    - Utilized MLP, CNN and LSTM, and applied the model to both word embedding and sentence embedding.
    - Our approach significantly outperforms reference-free baselines for extractive summarizers.
  - *Adversarial Attacks and Defense* (<https://github.com/lihebi/AdvAE>) *Aug. 2018 - Sep. 2019*
    - Proposed a novel adversarial auto-encoder **AdvAE** [6] that protects Neural Networks from adversarial attacks.
    - Showed that AdvAE significantly outperforms other purifying-based adversarial defense techniques.
- **Dynamic Program Analysis**
  - *Demand-driven Dynamic Program Analysis via Syntactic Patching* *May. 2015 - Mar. 2018*
    - Designed an algorithm that runs any selection of a program by constructing a minimal executable sub-program.
- **Robotics**
  - *USTC RoboGame-2012* *May. 2012 - Aug. 2012*
    - Designed a robot car that fetches flowers from point A to point B. Notable features: identifying and picking up the flowers; auto-routing with computer vision; climbing up/down the stairs
    - Led a team of 4 and ranked 3rd among 26 teams. Video available at <https://youtu.be/NOEbvINeiy4>

## Publications

- [1] **Hebi Li**, Y. He, Qi Xiao, Jin Tian, F. Bao. “*BHDL: A Lucid, Expressive, and Embedded Programming Language and System for PCB Designs*”, published as a conference paper at IEEE/ACM DAC 2021. web: <https://bhdl.org>, source: [github.com/bhdl/bhdl](https://github.com/bhdl/bhdl)
- [2] Youbiao He, **Hebi Li**, Forrest Bao, “*Circuit Routing Using Monte Carlo Tree Search and Deep Reinforcement Learning*”, arXiv preprint arXiv:2006.13607 (2020). full paper in submission.
- [3] **Hebi Li**, F. Bao, Qi Xiao and Jin Tian, “*CodePod: A Hierarchical Jupyter for Interactive Development at Scale*”, in submission
- [4] **Hebi Li**, Qi Xiao, and Jin Tian. “*Supervised Whole DAG Causal Discovery.*”, arXiv:2006.04697 (2020). full paper in submission  
Source Code: <https://github.com/lihebi/DAG-EQ>
- [5] F. Bao, **Hebi Li**, Ge Luo, Cen Chen, Y. Yang, and M. Qiu. “*End-to-end Semantics-based Summary Quality Assessment for Single-document Summarization.*” preprint arXiv:2005.06377 (2020), full paper in submission.
- [6] **Hebi Li**, Qi Xiao, Shixin Tian, and Jin Tian. “*Purifying Adversarial Perturbation with Adversarially Trained Auto-encoders.*”, preprint arXiv:1905.10729 (2019). Source Code: <https://github.com/lihebi/AdvAE>
- [7] Qi Xiao, **H. Li**, J. Tian and Z. Wang. “*Groupwise Feature Selection for Supervised Learning*”, full paper in submission