Lingli Kong, PhD

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Summary

Computational imaging scientist specializing in biomedical imaging (cryo-EM, microscopy). Shipped production **C++/Python + PyTorch** algorithms and tools (**CTFFIND5**, **Unbend**, **2DTM classifier**) with measurable impact—**TPR 38→98%**, **SNR +3–8%**, and **up to 3×** particle detections on cryo-EM datasets. Experienced with large-scale imaging data, temporal modeling (CNN-BiLSTM), and cross-functional collaboration with experimentalists. Currently building depth in Vision Transformers and self-supervised representation learning for cell-scale modeling.

Key Achievements

- Shipped **Unbend** local motion-correction into **cisTEM** (C++ backend, production GUI) with standardized metrics → **SNR +3–8%** and up to **3×** particle detections.
- Built a **PyTorch** dual-head classifier to recover membrane proteins from vesicles where 2D template matching fails → **template-selection bias 90→41%** on experimental cryo-EM data.
- Implemented CTF-based tilt estimation in **CTFFIND5** (C++) and absolute pre-tilt estimation in **fit_tilt_model** (C++) in **cisTEM**; released the methods as documented command-line utilities for batch processing.
- Automated **EELS core-loss edge recognition** with a **CNN–BiLSTM** pipeline → **94.9% accuracy**.

Skills

ML/CV: CNNs; temporal modeling (CNN–BiLSTM); evaluation and ablation studies; building depth in self-supervised learning and Vision Transformers (ViT).
Imaging: cryo-EM and cryo-ET pipelines, 2D template matching (2DTM), motion correction, CTF/tilt estimation, STEM tomography tooling.
Software/Systems: Python, C++, CUDA, Linux, **PyTorch**, OpenCV, scikit-learn, Git, Docker; large-scale image analysis with compute clusters. (Slurm, multi-GPU).

Research Experience

UMass Chan Medical School — Worcester, MA

Research Specialist — Computational Imaging & ML — 06/2022–Present

- Designed a dual-head **PyTorch** classifier to overcome 2DTM hard-thresholds on cryo-EM micrographs → **TPR 38→98%** on simulated data and **>50%** reduction in template bias on experimental data; built evaluation and ablation workflows.
- Implemented **local motion correction ("Unbend")** in **cisTEM** using a 3D-spline pixel-motion model → **+3–8% SNR** and **up to 3×** more detected particles across multiple in-situ samples; established standardized release metrics.
- Added **CTF-based tilt estimation** in **CTFFIND5** and implemented absolute pre-tilt estimation in **fit_tilt_model** within **cisTEM** using rotation-matrix fitting (downhill simplex); shipped documented C++ command-line utilities for batch processing in downstream cryo-EM analysis.
- Trained and evaluated on large-scale cryo-EM datasets; created reproducible scripts, quantitative reports, and method documentation for collaborators.

University of California, Irvine — Irvine, CA

Assistant Specialist — Imaging ML & Tools — 02/2022–06/2022

- Built a **CNN–BiLSTM** for EELS core-loss edge recognition → **94.9% accuracy**; contributed figures, pipeline, and analysis to a peer-reviewed publication.
- Developed a **PyQt** GUI to streamline STEM tomography alignment and processing on time-lapse image

streams, reducing operator time-to-result.

Lawrence Berkeley National Laboratory Berkeley, CA

Postdoctoral Scholar — High-noise EM 01/2020–01/2022

- Prototyped individual particle tomography alignment and 3D reconstruction strategies for liquid-phase EM under extreme noise.

University of Wyoming Laramie, WY

Graduate Research Assistant — Simulation & Modeling 09/2014–08/2019

- Built Grand Canonical Monte Carlo (**GCMC**) adsorption simulator (Fortran) and proposed statistical thermodynamics models predicting IUPAC-classified isotherms.

EDUCATION

Ph.D. in Chemical Engineering 08/2019
University of Wyoming Laramie, WY

B.S. in Petroleum Engineering 06/2014
China University of Petroleum Qingdao, P.R. China

Selected Publications

- **Kong, L.**, Cossio, P., Hanson, S., Furukawa, H., & Grigorieff, N. (2025). *Membrane protein detection from liposomes in cryo-EM images using 2D template matching and deep learning.* (manuscript in preparation) (**dual-head CNN classifier**)
- **Kong, L.**, Zottig, X., Elferich, J., & Grigorieff, N. (2025). *Unbend: Correction of local beam-induced sample motion in cryo-EM images using a 3D spline model. eLife*, under review.
- Arghittu, S., Dingeldein, L., Woollard, G., **Kong, L.**, Hanson, S., Petersen, M., Covino, R., & Cossio, P. (2025). *Exploring simulators for particle picking in cryo-electron tomography. NeurIPS 2025 Workshop on Imageomics*. (**U-Net particle picker**)
- Elferich, J., **Kong, L.**, Zottig, X., & Grigorieff, N. (2024). *CTFFIND5 provides improved insight into quality, tilt and thickness of TEM samples. eLife*, 97227.1.
- **Kong, L.**, Ji, Z., & Xin, H. (2022). *Electron energy loss spectroscopy database synthesis and automation of core-loss edge recognition by deep-learning neural networks. Scientific Reports*, 12, 22183. (**CNN–BiLSTM pipeline**)