John Dews-Flick

Machine Learning, AI Systems & Simulation Leader

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Summary

Machine learning and simulation leader with 10+ years of experience building research software and production systems. Currently manage the Biomechanics Modeling team at Align Technology, leading predictive modeling, optimization, and validation for orthodontic treatment planning. Hands-on expertise in PyTorch, transformers, large language models, vision-language models, RAG, LLM compute and inference, custom agent and evaluation harnesses, scientific computing, distributed systems, and finite element analysis.

Technical Skills

Machine Learning	PyTorch, TensorFlow, transformers, CNNs, RNNs, MLPs, geometric deep learning, graph embeddings, interpretability, model validation
LLM, Vision & Agents	Claude Code, OpenAI Codex, task-specific LLM and vision-language model (VLM) fine-tuning, RAG, embeddings, vector search, reranking, agentic workflows, custom harnesses
Scientific Computing	NumPy, SciPy, Pandas, Polars, optimization, FEA, nonlinear contact, multiphysics, Abaqus, FEBio, FEniCS
Infrastructure	Local GPU compute, vLLM serving, inference deployment and management, Python, Rust, C++, Go, JavaScript, WebAssembly, Docker, Linux, AWS, GCP, distributed computing, CI/CD

Experience

Feb 2026 - Present

Manager, Biomechanics Modeling

Align Technology — San Jose, CA

- Led validation of an ML-based treatment-planning model and developed a new validation method accepted by the FDA, supporting a June 2026 510(k) submission
- Lead a distributed R&D team developing patient-specific treatment-prediction models, biomechanics simulations, and optimization methods for orthodontic treatment planning
- Set technical strategy, prioritize the roadmap, establish model-review and validation standards, and coordinate delivery across research, clinical, software, and regulatory teams
- Develop models that learn from paired treatment plans and outcomes, combining 6-DOF movement prediction, biomechanical features, uncertainty analysis, and production integration

2025 - Jan 2026

R&D Team Lead, Simulation & Modeling

Align Technology — San Jose, CA

- Led development of treatment-prediction models, shape-optimization methods, unsupervised classification, and production model integration
- Built and launched a secure internal LLM/RAG platform with agentic workflows, permission-aware retrieval, custom reranking, and source-grounded citations

2023 - 2025

R&D Engineer III, Simulation & Modeling

Align Technology — San Jose, CA

- Designed transformer models for patient-specific treatment prediction and optimization using large clinical datasets of treatment plans and outcomes
- Built embeddings and classifiers for treatment and outcome data, enabling retrieval, similarity analysis, and data-driven treatment design
- Built distributed simulation pipelines for large-scale analysis and ML training-data generation

2022 - 2023

R&D Engineer II, Simulation & Modeling

Align Technology — San Jose, CA

- Built patient-specific simulation methods to measure how orthodontic appliances affect complex anatomy
- Created biomechanics metrics and automated analyses to evaluate past cases and guide treatment design

2020 - 2022

Research Assistant

University of Florida Gainesville, FL

- Researched nonlinear frictional contact for the OnSimulation finite element platform, including analytical geometry for contact detection and stick-slip behavior
- Developed and evaluated mesh-independent contact methods for immersed-boundary finite element analysis

2015 - 2023

Senior Developer

Catch The Fever

- Built and operated an automated e-commerce platform supporting multi-million-dollar revenue across online and retail sales
- Automated order processing, inventory, fulfillment, and shipping workflows to reduce manual operations and support business growth

Featured Machine Learning & Engineering Projects

2024 - 2025

Align Knowledge RAG Platform

Built a permission-aware production RAG platform with secure vector indexing, source citations, custom reranking and filtering, retrieval-quality metrics, and agentic ingestion workflows.

2025 - Present

LLM & Vision-Language Model Fine-Tuning, Compute & Harnesses

Fine-tuned task-specific LLMs and VLMs for ranking, classification, structured extraction, and multimodal analysis. Built evaluation datasets, managed local GPU inference with vLLM, and created custom harnesses for Claude Code and OpenAI Codex.

2026

Geometry & Graph-Based Latent Embeddings

Built geometry- and graph-based embeddings for clinical geometry and treatment data, supporting similarity search, clustering, classification, and prediction.

2023 - 2025

RustFEA

Created an open-source finite element analysis framework in Rust for high-performance, memory-safe scientific computing.

2024

Align Simulation Platform

Built a distributed orthodontic simulation platform for large-scale analysis and ML training-data generation.

2024

WebAssembly Neural Network Playground

https://mlp.johndews.com/ - Built an interactive MLP trainer in Rust and WebAssembly that visualizes loss, decision boundaries, and binary classifications in real time.

2026

QuadSim - Web-Based Quadcopter Simulation & Route Planning

https://choosedews.github.io/QuadSim/ - Built a browser-based quadcopter dynamics simulator with interactive 3D visualization, flight controls, constrained route planning, and trajectory analysis.

2021

Web-Based Immersed-Boundary FEA Solver

https://fea.johndews.com - Built a fully browser-based 2D solid-mechanics solver with Onshape geometry import, immersed-boundary meshing, boundary-condition setup, solution, and visualization.

Patents & Research

- **ML-Based Patient-Specific Orthodontic Prediction** - patent pending, 2025
- **Novel Simulation Techniques for Treatment Planning** - patent pending, 2025
- **Direct Fabrication of Orthodontic Aligners** - US20230301752A1, 2024
- **Non-Linear Frictional Contact Simulation** - master's thesis, University of Florida, 2022 (thesis.johndews.com)

Education

2022

Master of Science, Aerospace Engineering

University of Florida Gainesville, FL

Graduate focus: Custom finite element methods and solvers, computational fluid dynamics, reduced-order modeling, nonlinear mechanics and frictional contact, inductive logic, Bayesian decision-making, and Monte Carlo methods.

2021

Bachelor of Science, Aerospace Engineering

University of Florida Gainesville, FL

Selected coursework: Numerical methods, flight dynamics, orbital mechanics, path and trajectory optimization under constraints, computational fluid dynamics, and control theory.