Geisel School of Medicine at Dartmouth
Dartmouth-Hitchcock Medical Center
CURRICULUM VITAE

NAME: Joshua Levy PhD
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I. EDUCATION:

2017 BS in Physics
University of California, Berkeley, CA
College of Letters & Sciences: Highest Distinction graduation (top 1%)

2021 PhD in Quantitative Biomedical Sciences (Data Science)
Dartmouth College, Geisel School of Medicine, Hanover, NH
Co-mentors: Brock C. Christensen PhD (Department of Epidemiology)
Louis J. Vaickus MD, PhD (Department of Pathology and Laboratory Medicine)

Technical and Research skills:

Python • R • Shell • Supercomputer • Machine Learning • Dataviz • PyTorch • NLP
Sklearn • Plotly • Aircraft Pilot • Dask • Matlab • Javascript • C++ • SQL
Deep Learning • Docker • AWS • LaTEX • Nextflow • CWL Pipelines • Stan
Comp. Vision • Sensibly Constructing Statistical Golems • Graph Neural Networks

Relevant coursework:

Hierarchical, Bayesian Modeling, Social Network Analysis, Epidemiology, Biostatistics, Bioinformatics, Linear Algebra, Diff. Eq., Multivar. Calc., C++, Python, Statistics, Machine Learning, Health Promotion, Policy, Management, Quantum Computing and Stat Mechanics

II. POSTDOCTORAL TRAINING: N/A

III. ACADEMIC APPOINTMENTS:

2021-present Assistant Professor, Geisel School of Medicine at Dartmouth,
Departments of Pathology and Laboratory Medicine, and Dermatology

2021-present Adjunct Professor, Geisel School of Medicine at Dartmouth,
Department of Epidemiology

2021-present Faculty, Geisel School of Medicine at Dartmouth,
Quantitative Biomedical Sciences

IV. INSTITUTIONAL LEADERSHIP ROLES:

2018-present EDIT (Emerging Diagnostic and Investigative Technologies) Research Program
Editor, Department of Pathology and Laboratory Medicine, DHMC.

V. LICENSURE AND CERTIFICATION: N/A
VI. HOSPITAL OR HEALTH SYSTEM APPOINTMENTS: N/A
VII. OTHER PROFESSIONAL POSITIONS (NON-DARTMOUTH):

April 2015-Jun 2016 — CiBER lab, Berkeley, CA — Biomechanics Research Assistant
• Agama Lizard Turns: Matlab and ProAnalyst analysis of lizard turning tendencies

Jun 2016-May 2020 — Lawrence Berkeley National Lab, JGI Affiliate, Berkeley, CA — Software Developer
• Novel computational methods elucidate quality biofuels: pangenome phylogenetics, genomics workflows, metagenomics binning, machine learning via large-scale, automated, supercomputer pipelines (Python/Nextflow)

Jun - Dec 2017 — San Francisco Department of Public Health: Tuberculosis Control, San Francisco, CA — Public Service Aide
• Evaluated patient data integrity and transition to electronic health records.

May-Aug 2018 — Zymergen, Emeryville, CA — Software Engineer Intern
• Constructed many different HPC AWS bioinformatics pipelines using CWL Docker, and Seven Bridges, storing results in SQL databases.
• Used Convolutional Neural Networks and hyperbolic embeddings to explore relationships between gene and function for discovery of biomaterials.

Jan 2020-present — ArcticAI, Hanover, NH — Chief Technical Officer
• Developing core technology, IP, and vision for intraoperative medical device

Oct 2020-present — Veterans Affairs Healthcare System, White River Junction, VT — Statistical Consultant
• Consulting on machine learning-based natural language processing software for suicide risk prediction

VIII. PROFESSIONAL DEVELOPMENT ACTIVITIES:

2018-present	CITI Program, Biomedical Responsible Conduct of Research (RCR) course completion
2018-present	CITI Program, Biomedical Data or Specimens Research Basic course, completion
2018-present	CITI Program, Good Clinical Practice (US, FDA focus) clinical trials with investigational drugs and medical devices (GCP) course completion
2019	Supervised Teaching Workshop, Mentor Skills Development
2019	NIH Grant Workshop
2017	Coaching Corps Leadership Development Program
2016	Crisis Support Counselor Training Program

IX. TEACHING ACTIVITIES:

A. UNDERGRADUATE (COLLEGE) EDUCATION: N/A
B. GRADUATE EDUCATION:
Lectures:

2020	Introduction to Python (QBS 146)	2 hr/yr
2021	Introduction to Neural Networks (QBS 177)	2 hr/yr
2021	Application of Hierarchical Bayesian Methods to Machine Learning (QBS 122)	3 hr/yr
2021	Machine Learning in Pathology (QBS 110)	3 hr/yr
2021	R Software Packaging (QBS 181)	3 hr/yr

Supervised Teaching:
Professional Level:

2021-	Applied Machine Learning (QBS)	150 hr/yr

Graduate Level:

2019	Foundations of Biostatistics (QBS 120)	150 hr/yr
2020-2021	Statistical Learning for Big Data (QBS 177)	150 hr/yr
2021	Hierarchical Bayesian Modeling (QBS 122)	150 hr/yr

Graduate Workshop:

2020	Fundamentals of Bioinformatics and High-Performance Computing	3 hr/yr

C. UNDERGRADUATE MEDICAL EDUCATION: N/A
D. GRADUATE MEDICAL EDUCATION: N/A
E. MULTIDISCIPLINARY / INTERDEPARTMENTAL:

2021	Mentorship Ethics Discussion Panelist	3 hr/yr

X. RESEARCH ADVISING/MENTORING:

Program Director, EDIT (Emerging Diagnostic and Investigative Technologies) 600hrs/yr
DPLM's newly established EDIT Lab sponsors highly qualified high school students to participate in a 10-week remote internship exploring research topic in digital pathology, machine learning and statistics. Through a series of lectures, guided projects and IRB supported basic research, students develop algorithms to explore various diagnostic spaces in pathology from cancer detection, to gigapixel image manipulation to text prediction. Undergraduate, Master's and medical students have participated in the ongoing year-round internship program. Joshua Levy and Louis Vaickus manage and organize the internship as Co-PI's. At the end of the 10-week program, internship culminates with a presentation to the DPLM faculty, residents and technical staff. Two interns have manuscripts in pre-print and submitted to journals (Harish, Vattikonda). The 2020 internship was so popular that we were able to recruit over 25 new interns for 2021 with many alumni returning to give selected lectures and mentor incoming students.

<u>HIGH SCHOOL STUDENTS:</u>

2020	Ajay Prabhakar	EDIT Summer Intern	Morphology Hierarchy
2020	Kaien Yang	EDIT Summer Intern	Secure Data Encryption
2020	Richard Zhan	EDIT Summer Intern	Virtual Staining
2020-2021	Sumanth Ratna	EDIT Summer Intern	Segmentation
2020-2021	Harsha Harish	EDIT Summer Intern	Cell/Tissue Clustering
2020-2021	Nishitha Vattikonda	EDIT Summer Intern	Natural Language Processing
2021	Sachin Kumar	EDIT Summer Intern	3D Tissue Modeling
2021	Ramya Reddy	EDIT Summer Intern	Morphological-Molecular Alteration
2021	Ram Reddy	EDIT Summer Intern	Morphological-Molecular Alteration
2021	Akshat Alok	EDIT Summer Intern	Omics Deep Staging Models
2021	Zarif Azher	EDIT Summer Intern	Multimodal Integration
2021	Andrew Wang	EDIT Summer Intern	Cellular Hierarchy
2021	Akash Pamal	EDIT Summer Intern	Surgical Cell Modeling
2021	Irfan Nafi	EDIT Summer Intern	Surgical Cell Modeling
2021	Tarushii Goel	EDIT Summer Intern	Surgical Cell Modeling
2021	Abhinav Angirekula	EDIT Summer Intern	Surgical Cell Modeling
2021	Cristian Clewis	EDIT Summer Intern	Tissue Staging Models

2021	Abena Kyereme-Tuah	EDIT Summer Intern	Tissue Staging Models
2021	Sameeksha Garg	EDIT Summer Intern	Tissue Staging Models
2021	Sagar Gupta	EDIT Summer Intern	Omics Deep Staging Models
2021	John Kim	EDIT Summer Intern	3D Tissue Modeling
2021	Aryan Kumawat	EDIT Summer Intern	3D Tissue Modeling
2021	Adnan Murtaza	EDIT Summer Intern	3D Tissue Modeling
2021	Edward Zhang	EDIT Summer Intern	Ink Imputation Histology
2021	Taein Kim	EDIT Summer Intern	Ink Imputation Histology
2021	Nikhil Kalidasu	EDIT Summer Intern	Cell Detection
2021	Mohan Liu	EDIT Summer Intern	Stain Preference
2021	Michael Cheng	EDIT Summer Intern	Cytology Translation

A. <u>UNDERGRADUATE</u>

Dartmouth College, Hanover NH

2019-2022	Jason Zavras - Presidential Scholar	Computational Stain Normalization Intra-institutional digital stain preference
2020-2022	Jason McFadden	Evaluation AI Technologies
2021	Osezele Okoruwa	Stain Preference
2021-2022	Jean Yuan	Medical Informatics

Middlebury College

2021-2022	Jack Greenburg	Natural Language Processing for CPT Code Billing

University of Michigan

2021-2022	Carly Miles	Medical Informatics

B. <u>GRADUATE:</u>

2020-2022	Brody McNutt	Master's Student (QBS)	Secure Data Encryption
2020-2021	Julian Gullett	Master's Student (QBS)	Evaluation AI Technologies
2021-2022	Yunrui Lu	Master's Student (QBS)	Natural Language Processing
2021-2022	Uhuru Kamau	Master's Student (QBS)	Natural Language Processing
2021-2022	Shuyang Lu	Master's Student (QBS)	Natural Language Processing
2021-2022	Taylor Hudson	Master's Student (QBS)	CRISPR
2021	Sean McOsker	Master's Student (QBS)	Model Explainability
2021	Elizabeth Anderson	PhD Rotation (QBS)	Placenta Histology
2021-2022	Jeff Joseph	PhD Rotation (QBS)	Spatial Correlations

C. <u>MEDICAL STUDENTS:</u>

2020-2021	Eren Veziroglu	Medical Student	Digital Spatial Profiling
2020-2021	Mustafa Nasir Moin	Prospective Medical	Digital Spatial Profiling
2021-	Marietta Montivero	Geisel MD PhD Student	Surgical Excision

D. <u>RESIDENTS/FELLOWS:</u>

2019-2021	Robert Hamilton	Pathology Resident/Fellow	Auto-Machine Learning
2019-2021	Chris Jackson	Pathology Resident/Fellow	Virtual Immunofluorescence
2020-2021	Ryan Glass	Pathology Resident/Fellow	Bayesian Cytology Prediction

E. <u>RESEARCH ASSOCIATES:</u>

2018-2021	Christian Haudenschild	Medical Student Minnesota	Federated Data Networks
2018-2021	Jorge Lima	Data Scientist	Pressure Injury Prediction

F. FACULTY: N/A

XI. ADVISING / MENTORING:

A. UNDERGRADUATE STUDENTS: N/A
B. GRADUATE STUDENTS: N/A
C. MEDICAL STUDENTS: N/A
D. RESIDENTS/FELLOWS/RESEARCH ASSOCIATES: N/A

XII. ENGAGEMENT, COMMUNITY SERVICE / EDUCATION:

2015	American Heart Association Advocacy, Advocacy Intern, Oakland, CA
2011-2019	Special Olympics, Head Coach, Walnut Creek, CA
2015-2018	Coaching Corps, King Middle School, Basketball Coach, Berkeley, CA
2015-2018	Coaching Corps Berkeley Chapter Executive Recruitment Coordinator, Berkeley, CA
2015-2017	American Foundation for Suicide Prevention, Outreach Coordinator, Berkeley, CA
2011-2016	Telescope Makers Workshop, Astronomy Docent and Telescope Maker, Mount Diablo Astronomical Society, Berkeley, CA
2015-2018	National Suicide Prevention Lifeline, American Foundation for Suicide Prevention, Oakland, CA
2019	New Hampshire Academy of Sciences Mentor, Lyme, NH
2019	New Hampshire Special Olympics Volunteer, Lyme, NH

XIII. RESEARCH ACTIVITIES:

<u>Present</u>:

<u>Past</u>:

2019	Burroughs Wellcome Fund, Big Data Life Sciences Fellow 100% effort	Levy J (PI)	$60, 000
2020	I-Corps Business Development (33% effort)	Levy J (Co-PI)	$3,000
2021	Dartmouth Entrepreneurs Startup Competition Finalist (33%)	Levy J (Co-PI)	$5,000
2020	Prouty Grant *Validation of In-Vivo Imaging* (20%)	LeBeouf M (PI)	$50,000
2020	Department of Pathology and Laboratory Medicine, *QDP-Alpha* (33% effort)	Vaickus LJ (PI)	$160,000
2020	Neukom Institute CompX *Virtual Flow Cytometry* (20% effort)	Sriharan A (PI)	$40,000
2020	Neukom Institute CompX *Virtual Laboratory for Students* (95% effort)	Levy J (Co-PI)	$25,000
2020	Quantitative Biomedical Sciences, TA Fellowship 100% effort	Levy J (PI)	$5,000
2021	ISPCTN, Biostatistics Consulting 7.5% effort	Levy J (Co-I)	$5,000

<u>Pending</u>:

2021	Advancing Clinical Translational Science through Validation of Emerging Diagnostic Artificial Intelligence Technologies (NIH) 80% effort	Levy J (PI)	$1,250,000
2021	Sun Damage Reversal Therapies (COBRE)	Levy J (PI)	$50,000
2021	Prouty Grant *CRISPR Targeting of Merkel Cell Polyomavirus*	Levy J (Co-PI)	$50,000

XIV. PROGRAM DEVELOPMENT:

Aug 2018 – present:

EDIT (Emerging Diagnostic and Investigative Technologies)
Research Program, Department of Pathology and Laboratory Medicine, DHMC, Lebanon, NH

- Investigating emerging diagnostic deep learning technologies: molecular, histopathological, text, and image (Founder EDITor)
- Collaborating with other EDITors to automate diagnostic technologies
- User-centered design and validation.
- Machine-learning arm co-lead, whole genome sequencing
- Internship program co-head: conception, mentorship, skill development

XV. ENTREPRENEURIAL ACTIVITIES:
Related to the design of deep learning techniques for the analysis of whole slide images and high-resolution anorectal manometry devices (ongoing).

- I-Corps Incubator
- Dartmouth Innovations Accelerator
- DRIVEN Accelerator
- Dartmouth Entrepreneurs Startup Competition Finalists
- 3 Patents Pending

XVI. MAJOR COMMITTEE ASSIGNMENTS:
International: N/A

National: N/A

Institutional:
2018-2021 Synergy Biostatistics Consultant, Geisel School of Medicine at Dartmouth, Hanover, NH
2019-2021 Burroughs Wellcome Fund Fellow, Geisel School of Medicine at Dartmouth, Hanover, NH
2018-2020 Graduate Student Council Executive, Dartmouth College, Hanover, NH
2021- Quantitative Biomedical Sciences Ad-Hoc Reviewer Master's Admission Committee, Hanover, NH

XVII. MEMBERSHIPS, OFFICE, AND COMMITTEE ASSIGNMENTS IN PROFESSIONAL SOCIETIES:
2017-2019 Artificial Intelligence (AI) Enthusiast Club, Walnut Creek, CA, Founder
2018-2019 QuantBlitz Data Science Club, Hanover, NH, Member
2019 Epidemiology Students Club, Hanover, NH, Member
2020-2021 Natural Language Processing (NLP) Consultant, Department of Psychiatry, Hanover, NH
2019-2020 International Society for Computational Biology and Bioinformatics
2021- Quantitative Biomedical Sciences Ad-Hoc Reviewer Master's Admission Committee, Hanover, NH
2022- Norris Cotton Cancer Center, Cancer Population Sciences

XVIII. EDITORIAL BOARDS:
2021-present Frontiers in Medical Technology
Co-Guest Editor

XIX. JOURNAL REFEREE ACTIVITY:
Crohn's and Colitis 360 (x1)

Pacific Symposium on Biocomputing (x3)
BMC Biomedical Medical Research Methodology (x1)
Laboratory Investigation (x2)
PLOS Computational Biology (x1)
Cancer Cytopathology (x1)
Computational Statistics & Data Analysis (x1)
Computerized Medical Imaging and Graphics (x2)
Computer Methods and Programs in Biomedicine (x1)
Clinical Epigenetics (x2)
Journal of Translational Medicine (x1)
Neural Processing Letters (x1)
All Life (x1)
BMC Medical Informatics (x1)

XX. AWARDS AND HONORS:

2015-2017 UC Berkeley, Dean's List (Fall 2015, Spring 2016)
Honors (All Semesters); Highest Distinction; Cum. GPA: 3.97 / 4.0; Major GPA: 3.98 / 4.0

2020 Geisel School of Medicine at Dartmouth College
Center for Quantitative Biology Travel Award $2,000

2020 BIOSTEC 2020 Comp2Clinic Workshop, Best Paper

2021 Modern Pathology Article Top Pick of January 2021

XXI. INVITED PRESENTATIONS:

(*) those presentations to which an individual invitation was extended
(#) those presentations that were meetings where a poster/talk, was presented at a large society meeting)
(^) if the talk/presentation was applicable as a CME activity.

International:

2020 Preliminary Evaluation of Generative Image Translation Technologies for Histopathology
Podium presentation (Best Paper Award), Biomedical Engineering Systems and Technologies (Biostec) 2020 C2C Workshop, Valletta, Malta

National

2017 Snapshots of genome evolution and population dynamics in the allopolyploid grass Brachypodium hybridum. Poster, American Society of Plant Biologists (ASPB), Honolulu, HI

2020 PathFlowAI: Scalable Digital Pathology
Pacific Symposium Biocomputing 2020, Kona, HI

2021 Topological Feature Extraction for Whole Slide Images with Graph Neural Networks
Podium Talk, Pacific Symposium Biocomputing 2021, Kona, HI

2021 Digital spatial profiling identifies novel biomarkers for locally invasive tumors, *Association for Molecular Pathology 2021,* Virtual

2022 Mixed effects machine learning on spatially localized immuno-oncology markers for colon metastasis prediction
Pacific Symposium Biocomputing 2022, Kona, HI

Local/Regional

2018 Where are Your Bug's Genes and What do They Do? Workflow Automation and Machine Learning for Gene Annotation and Function. Zymergen, Emeryville, CA & Seattle, WA

2019 Machine Learning Analytics of Pancancer Methylation Microarray and RNA-sequencing Profiles at Susceptibility Loci. Poster, Celebration of Biomedical Research at Dartmouth (CBRaD), Hanover, NH

2019 MethylNet: A Modular Deep Learning Approach to DNA Methylation Prediction
Quantitative Biomedical Sciences: (QBS) Retreat and NCCC Retreat, Hanover NH

2020 PathFlowAI: Scalable Digital Pathology
Dartmouth-Hitchcock Retreat, Hanover NH

2020 Improving Data Representation Software for DNAm and Histopathology,
Research in Progress, QBS, Hanover, NH

2020 Mortality Prediction from Satellite Imagery
Burroughs Wellcome Fellowship, Hanover, NH

2020 Automating the Paris System
Burroughs Wellcome Fellowship, Hanover, NH

2021 Opportunities for Machine Learning Research in Pathology and Dermatology
Department of Dermatology, Hanover, NH

2021 Introduction to Neural Networks, Guest Lecture for QBS Class, Hanover NH

2021 Application of Hierarchical Bayesian Methods for Medical Artificial Intelligence, Guest Lecture for QBS Class, Hanover NH

2021 Uncertainty in Disease Staging, Research in Progress, QBS, Hanover NH

2021 Emerging Diagnostic and Investigative Technologies: Validation of Deep Learning Technologies for DNA Methylation and Histopathology, Thesis Seminar Talk, Hanover NH

2021 Emerging Machine Learning Methods in Digital Pathology, EDIT Seminar Talk, Hanover NH

2021 Opportunities for Machine Learning Research in Pathology, QBS, Hanover NH

2021 R Software Packaging, Guest Lecture for QBS Class, Hanover NH

2021 Research Overview, Department of Epidemiology, Hanover NH

2021 Mixed effects machine learning on spatially localized immuno-oncology markers for colon metastasis prediction, NCCC Retreat, Lebanon NH

XXII. BIBLIOGRAPHY:

A. Peer-reviewed publications in print or other media

PhD Thesis:

1. **Levy J.** Emerging Diagnostic and Investigative Technologies: Validation of Deep Learning Technologies for DNA Methylation and Histopathology. 2021

Original articles:

1. **Co-first:** *Gordon SP, * **Levy J**, Vogel JP. PolyCRACKER, a robust method for the unsupervised partitioning of polyploid subgenomes by signatures of repetitive DNA evolution. BMC Genomics.

2. **Levy J**, Titus A, Salas L, Christensen B. PyMethylProcess - convenient high-throughput preprocessing workflow for DNA methylation data. Bioinformatics. 2019.

3. **Levy J**, Titus AJ, Petersen CL, Chen Y, Salas LA, Christensen BC. MethylNet: An Automated and Modular Deep Learning Approach for DNA Methylation Analysis. BMC Bioinformatics. 2020.

4. **Levy J**, Salas LA, Christensen BC, Sriharan A, Vaickus LJ. PathFlowAI: A High-Throughput Workflow for Preprocessing, Deep Learning and Interpretation in Digital Pathology. Pacific Symposium on Biocomputing, 2020;25:403–14.

5. **Levy J**, O'Malley AJ. Don't Dismiss Logistic Regression: The Case for Sensible Extraction of Interactions in the Era of Machine Learning. BMC Medical Research Methodology. 2020.

6. **Levy J**, et al. Preliminary Evaluation of the Utility of Deep Generative Histopathology Image Translation at a Mid-Sized NCI Cancer Center. Proceedings of the 13th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2020) - Volume 3: BIOINFORMATICS

7. **Levy J**, et. al. Topological Feature Extraction of Whole Slide Images with Graph Neural Networks. Pacific Symposium on Biocomputing. 2021.

8. **Levy J**, et. al. A Large-Scale Internal Validation Study of Unsupervised Virtual Trichrome Staining Technologies on Non-alcoholic Steatohepatitis Liver Biopsies. Modern Pathology, 2021

9. **Levy J**, Chen Y, et al. Biologically Motivated Organization of DNAm Neural Networks, Inspired by Capsule Networks, NPJSBA, 2021.

10. **Levy J**, et. al. Journey across Epidemiology's Third Variables: An Anesthesiologist's Guide for Successfully Navigating Confounding, Mediation, and Effect Modification. BMJ RAPM, 2021.

11. **Levy J**, Lebeaux, R. M., Hoen, A. G., et al. Using Satellite Images and Deep Learning to Identify Associations Between County-Level Mortality and Residential Neighborhood Features Proximal to Schools: A Cross-Sectional Study. Frontiers in Public Health 9, 1652 (2021).

12. **Levy J**, Bobak C, et. al. Mixed Effects Machine Learning Models for Colon Cancer Metastasis Prediction using Spatially Localized Immuno-Oncology Markers. Pacific Symposium on Biocomputing. 2022.

13. **Levy, J.,** Vattikonda, N., Haudenschild, C., Christensen, B. & Vaickus, L. Comparison of Machine Learning Algorithms for the Prediction of Current Procedural Terminology (CPT) Codes from Pathology Reports. *Journal of Pathology Informatics* (2022)

14. Co-first: *Kelliher, M., ***Levy, J.,** *Nerenz, R., *et.al.* Comparison of Symptoms and Antibody Response Following Administration of Moderna or Pfizer SARS-CoV-2 Vaccines. *Archives of Pathology & Laboratory Medicine* (2022).

15. Azher, Z. L., Vaickus, L. J., Salas, L. A., Christensen, B. C. & **Levy, J. J.** *Development of Biologically Interpretable Multimodal Deep Learning Model for Cancer Prognosis Prediction*. ACM/SIGAPP SAC

2022.

16. Haudenschild, C., Vaickus, L. & **Levy, J.** *Configuring a federated network of real-world patient health data for multimodal deep learning prediction of health outcomes*. 2021. ACM/SIGAPP SAC 2022.

17. Copeland-Halperin L, Reategui M, **Levy J**, et al. Does the Timing of Postoperative Showering Impact Infection Rates? A Systematic Review and Meta-Analysis. JPRAS. 2020.

18. Gordon SP, Moreira BC, **Levy J**, et. al. Gradual polyploid genome evolution revealed by a pan-genomic analysis of Brachypodium hybridum and its diploid progenitors. Nature Comm. 2020.

19. Brady R, **Levy J**, et. al. The mediating effects of perceived vulnerability to disease in the relation between disgust and contamination-based OCD. J Anxiety Disord. 2021

20. Copeland-Halperin L, Reategui M, **Levy J**, et. al. MRI Screening after Silicone Implant-based Breast Surgery: A Survey of Patient Awareness of and Adherence with FDA Recommendation

21. Glass R, **Levy J**, et. al. Atypia of Undetermined Significance in Thyroid Cytology: Nuclear and Architectural Atypia are Associated with Different Molecular Alterations and Risks of Malignancy

22. Glass R, **Levy J**, et. al. Utilizing molecular testing to improve the management of thyroid nodules with indeterminate cytology: an institutional experience

23. Azizgolshani, N., Petersen, C. L., Chen, Y., **Levy, J.J.,** et al. DNA 5-hydroxymethylcytosine in pediatric central nervous system tumors may impact tumor classification and is a positive prognostic marker. Clinical Epigenetics (2021).

Manuscripts in review:

1. **Levy J**, Lima J, et al. A Machine Learning Personalized Pressure Injury Prediction Model

2. **Levy J**, et. al. Pathflow-MixMatch for Whole Slide Image Registration: An Investigation of a Segment-Based Scalable Image Registration Method

3. **Levy J**, et. al. GCN4R: Latent Position of Actors in Social Networks with Graph Neural Networks

4. **Levy J**, Christensen C, Vaickus L, Shah E. A Deep Learning Method for Prediction of Abnormal Anorectal Manometry Exams

5. **Levy J**, Bobak C, et. al. Bridge Category Models: Development of Bayesian Modelling Procedures to Account for Bridge Ordinal Ratings for Disease Staging

6. **Levy J**, Bobak C, et. al. Application of Hierarchical Bayesian Bridge Modeling Approaches for Estimating Inter-Rater Variability in Fibrosis Staging

7. **Levy J**, Bobak C, et. al. An Improvement to the Virtual Trichrome Assessment through Bridge Category Models

8. Levis M, **Levy J**, et. al. Dynamic Topic Modeling Reveals Evolving Patterns of Suicidal Ideation in Veteran Population

9. Levis M, **Levy J**, et. al. Machine Learning Modeling to Predict Suicide Amongst Veterans

10. Hong J, Quon R, Song Y, Xie T, **Levy J**, et. al. Seizure onset in the supplementary motor area drives re-mapping of the mesial frontal motor areas.

11. Copeland-Halperin L, Reategui M, **Levy J**, et. al. A Systematic Review and Meta-Analysis of Factors Pertaining to Gastronomy Tube Placement

12. Copeland-Halperin L, Reategui M, **Levy J**, et. al. Internal Validation of Predictive Model for Gastronomy Tube Placement and Complications

Select manuscripts in preparation:

1. **Levy J**, et. al. HistoBayes: An Interactive Web Application for Bayesian Deep Learning on Histopathology, with Applications in Cytopathology
2. **Levy J**, et. al. Hyperbolic MethylMaps: Hyperbolic Embeddings Pseudotime Bulk DNA Methylation
3. **Levy J**, et. al. InteractMethylXtract: Random Forest Selected DNA Methylation Interactions
4. **Levy J**, Haudenschild C, et. al. MetaCRACKER: Deep Clustering of Metagenomic Reads
5. **Levy J**, Christensen C, Vaickus L. Urothelial Cell Cluster Algorithm
6. **Levy J**, Christensen C, Vaickus L. Large-Scale Prospective Validation of the AutoParis System
7. **Levy J**, LeBoeuf M, Christensen C, Vaickus L. Surgical Assistance Tool
8. **Levy J**, LeBoeuf M, Christensen C, Vaickus L. Quality Assessment Method
9. **Levy J**, Christensen C, Vaickus L, Shah E. Multicenter Prospective Validation of Anorectal Manometry AI Technologies
10. **Levy J** *, Ratna S*, et al. PyNuclei: A Software Framework for Nuclei Segmentation
11. **Levy J** *, Harish H*, et al. DeepCellCluster: A Software Framework for Nuclei Clustering
12. **Levy J**, Glaser A, et. al. DNA Methylation Brain Cell-Type Adjustment and Meta-Analysis Reveals Important Markers of Huntington's Disease
13. **Levy J**, et. al. Turing Test 2.0: Improving Clinical Applicability of Visual Inspection of Virtual Staining Technologies
14. **Levy J**, et. al. Applications of Digital Spatial Profiling for the Assessment of Colorectal Cancer Metastasis
15. **Levy J**, et. al. On the Potential for Selection Bias using Digital Spatial Profiling Technologies
16. **Levy J**, et. al. Inter-Rater Variability of the Paris System: A Single Institutional Perspective
17. Anderson E, …, **Levy J**. Product of Conception Assessment
18. McNutt B, …, **Levy J**. Federated Learning Working Group
19. McNutt B, …, **Levy J**. Federated Learning Working Group for Pathology
20. McNutt B, …, **Levy J**. HistoCrypt: A Federated Learning Platform for Pathology
21. Gullet J, …, **Levy J**. Hierarchical Bayesian Analyses in Pathology
22. Zavras J, …, **Levy J.** Impact of Stain Normalization on Deep Learning Models
23. Zhang E, …, **Levy J**. Green Ink Imputation with Graph Neural Networks
24. Greenburg J, …, **Levy J**. NLP Application to Detect Hospital Underbilling
25. Farrel K, **Levy J**, et. al. Vaginal Birth after Cesarean: Adoption of a Regional Guideline
26. Satti K, …, **Levy J**, et. al. Inflammatory Markers Predictive of Changes in BMI
27. Kerr D, Goyette E, **Levy J**, et. al. Decalcification Protocol with Optimal Timing and Maximal Tissue Preservation for High-Quality Histologic Examination and Molecular Analysis
28. Kerr D, Goyette E, **Levy J**, et. al. Mesenchymal Molecular Assessment
29. Kerr D, Goyette E, **Levy J**, et. al. Digital Spatial Profiling Dupuytren
30. Dunkle A, **Levy J**, et. al. Influenza Test Positivity Rates From 2019-2020 with the Onset of Social Distancing Due To COVID
31. Glass R, **Levy J**, et. al. Comparing NC Ratios between Eyeball and Diameter-Based Measurements
32. Greene C, ..., **Levy J**. Opportunities and obstacles for deep learning in biology and medicine, 2nd update.

<u>Reviews</u>:

1. **Levy J**, Vaickus L. Applications of AI in Anatomic Pathology. *Advances in Molecular Pathology,* 2021

Book Chapters:

1. **Levy J**, Vaickus L. Applications of AI in Molecular Pathology (Chapter Proofing)

Letters to the Editor: N/A

B. Other scholarly work in print or other media including editorially-reviewed publications (e.g., Op-Ed pieces, Letters to the Editor), print resources (e.g., workshops) and electronic resources (e.g., MOOCs, educational websites, modules, videos, virtual patients): N/A

C. Abstracts:

Presented at National Meetings:

1. Glass R, **Levy J**, et. al. Atypia of Undetermined Significance in Thyroid Cytology: Nuclear and Architectural Atypia are Associated with Different Molecular Alterations and Risks of Malignancy (abstract)
2. Glass R, **Levy J**, et. al. Utilizing molecular testing to improve the management of thyroid nodules with indeterminate cytology: an institutional experience (abstract)
3. Copeland-Halperin L, … **Levy J,** … et. al. Oral Cancer Patients Undergoing Resection with Free Flap Reconstruction: Predictors of Gastrostomy Tube Placement, *STARS* 2021
4. Stewart T, …, **Levy J**, … et. al. Predictors of Gastronomy Tube Placement for Patients Undergoing Resection of Head and Neck Cancer with Flap-based Reconstruction: Protocol for Systematic Review and Meta-Analysis. *ACSVT* 2021
5. Copeland-Halperin L, …, **Levy J,** …, et.al. Indications for Gastrostomy Tube Placement in Oral Cancer Patients Undergoing Resection with Immediate Free Flap Reconstruction. *AHNS* 2021
6. Copeland-Halperin L, …, **Levy J,** …, et.al. Does the Timing of Postoperative Showering Impact Infection and Complication Rates? *NESPRS* 2020
7. Barney RE, Palisoul SM, **Levy J**, Vaickus LJ, Lin CC, Tsongalis GJ, Zanazzi G. Digital Spatial Profiling Identifies Novel Biomarkers for Locally Invasive Tumors. J Molec Diagn 2021;23, 1648 (TT31)

Presented at Local Meetings:

1. Farrel K, **Levy J**, et. al. Vaginal Birth After Cesarean Section in Northern New England: Assessing the Adoption and Impact of Regional Guidelines, Dartmouth Hitchcock Medical Center, Lebanon, NH
2. Catalan P, …, Gordon S, **Levy J**, et. al. Integrative Genomic Characterization of the Brachypodium Polyploid Model to Unravel Bases of Success of Polyploidy in Flowering Plants, DOE JGI, Berkeley, CA
3. Chen Y, **Levy J**, et. al., Machine Learning Analytics of Pan-cancer Methylation Microarray and RNA-sequencing Profiles at Susceptibility Loci, CBRaD 2019

XXIII. Personal Statement:

My formal background and training are in Physics and Quantitative Biomedical Sciences, which is an interdisciplinary data science discipline at the intersection of Epidemiology, Biostatistics and Bioinformatics. My experience in Physics motivated me to think abstractly about how information could be represented using n-dimensional objects, which has been of great benefit as my research shifted towards applied machine learning. Prior to my PhD training, I learned to develop, implement and deploy over one hundred sophisticated reproducible, containerized genomics and bioinformatics workflows at scale in High Performance Computing (HPC) computing environments as a software developer/engineer at both the Lawrence Berkeley National Labs and Zymergen, which instilled in me a mindset of doing public good through high throughput computations. My motivations for my recent career aspirations originated through my work in the San Francisco Department of Public Health (SFDPH), where I witnessed first-hand some of the many challenges associated with implementing new digital technologies in a healthcare setting which was, at times, averse to change and frustrations on behalf of the stakeholders, which inspired me to think more critically about how I would engage stakeholders when I am put in a position to develop and implement novel biomedical technologies. Now that I am in a position to develop and implement these technologies, I have taken these principles to heart by directly integrating with the stakeholders which I aim to benefit. I served as a Burroughs

Wellcome Fellow, which enabled me to build closer relationships with the Department of Pathology. Currently, I serve as an Assistant Professor of Pathology and Laboratory Medicine, and Dermatology and as an Adjunct Professor of Epidemiology and am one of the founders and the co-head of the Machine Learning arm of the Emerging Diagnostic and Investigative Technologies (EDIT) program. My research group aims to justify the use of digital pathology technologies by developing and validating machine learning technologies and envisioning how they would fit into the clinical workflow. As such, I am in an optimal position to develop and implement digital pathology technologies through effective stakeholder engagement.

To this end, my doctoral work centered around creating standardized, high throughput, open-source software to enable domain experts to extract key insights from two high dimensional data types, DNA Methylation and histopathological data, while validating emerging technologies which could provide immediate benefit to the end user, such as processes to virtually stain tissue to obviate the need for chemical tissue staining. My research group's aims extend beyond these original objectives to include new aims such as the integration of hierarchical Bayesian statistical methodologies with machine learning technologies to provide fair assessments of digital pathology technologies and further methods development and application for spatial omics technologies.

I am committed to the vision of creating a self-sufficient digital pathology program in EDIT through building an independent research lab composed of researchers with diverse, interdisciplinary skillsets. My mentorship experience to date includes launching a year-round internship program which has run successfully for two years, of which I directly have mentored 28 high school students, 4 undergraduate students, 2 Master's students, 2 medical students, and 3 pathology resident fellows.

Updated by:

Date: