Leading Large-Scale Initiatives

Spring Quarter Mid-Career Workshop

May 5, 2022

ADVANCE CENTER FOR INSTITUTIONAL CHANGE
UNIVERSITY of WASHINGTON

Speakers

- Matt O'Donnell, Professor of Bioengineering and Frank and Julie Jungers Dean Emeritus, College of Engineering
- Nathan Kutz, Robert Bolles and Yasuko Endo Professor of Applied Mathematics and Electrical and Computer Engineering, and Director of the NSF-Funded AI Institute in Dynamic Systems
- Zaid Harchaoui, Associate Professor of Statistics and Leadership Team Member of the NSF-Funded Institute for Foundations of Data Science

Matt O’Donnell

Professor of Bioengineering
and Frank and Julie Jungers Dean Emeritus, College of Engineering

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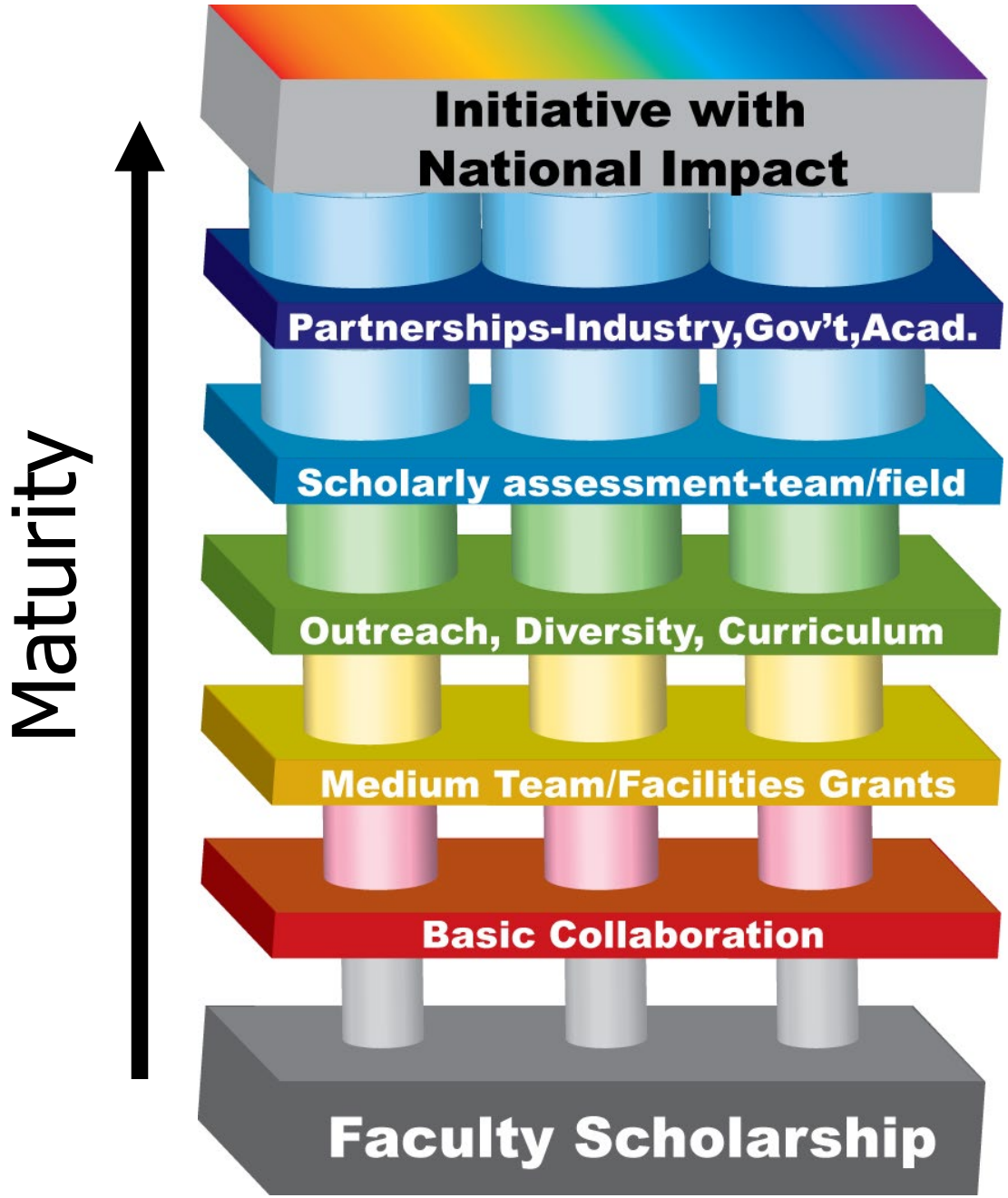

Maturity
Initiative with National Impact
Partnerships-Industry,Gov't,Acad.
Scholarly assessment-team/field
Outreach, Diversity, Curriculum
Medium Team/Facilities Grants
Basic Collaboration
Faculty Scholarship

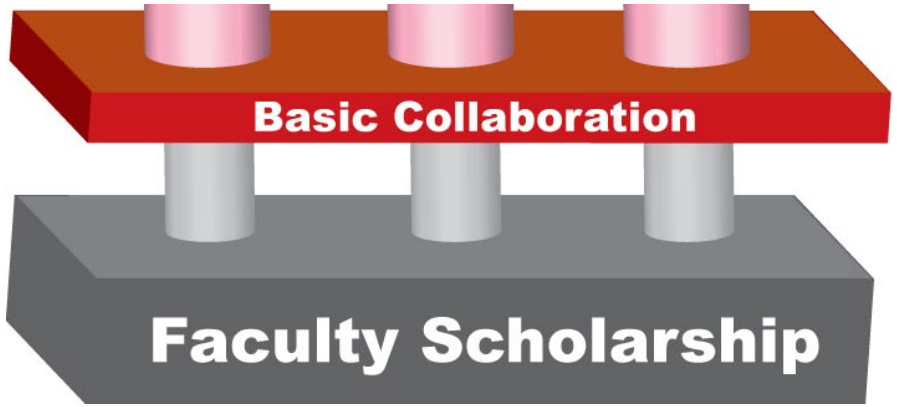
The Foundation

Faculty Scholarship

- High quality
- Good productivity
- Recognized externally

Collaborations

- Co-supervise students
- Co-author papers
- Co-author grants



External Needs

- None – don’t ask for anything beyond normal cost sharing on grants

The Foundation - Process

- Need to be good listeners and adaptive - may need to work across disciplines and redefine the theme many times
- Get a translator!
- Stay small and focused – define the core and get something done before expanding the core – NO SHOTGUN MARRIAGES

Growing the Team

Research

- MURI, NIRT, BRP…

Education

- NRT, T32, GAANN

Facilities

- NSF, Murdock, Keck, NIH

Outreach & Diversity

- Work with CoE programs
- RET, REU, MROP

External Needs

- Dean and Provost partner with Depts for matching and space when needed

Growing the Team - Process

- Get outside help! A new theme shouldn't be beaten up in public
- Reach out to many constituencies, but don't increase the core group significantly
- Leverage active outreach and diversity programs – don't reinvent the wheel
- Work with senior administration on resources – a targeted faculty hire may be appropriate

Initiative with National Impact

External Needs

- Dept, CoE, and Provost can help with externals
- Link hiring plans with campus strategic plans

Internal team

- Strengths/Weaknesses
- Hiring plan (w/depts)
- Unselfish leadership

External field

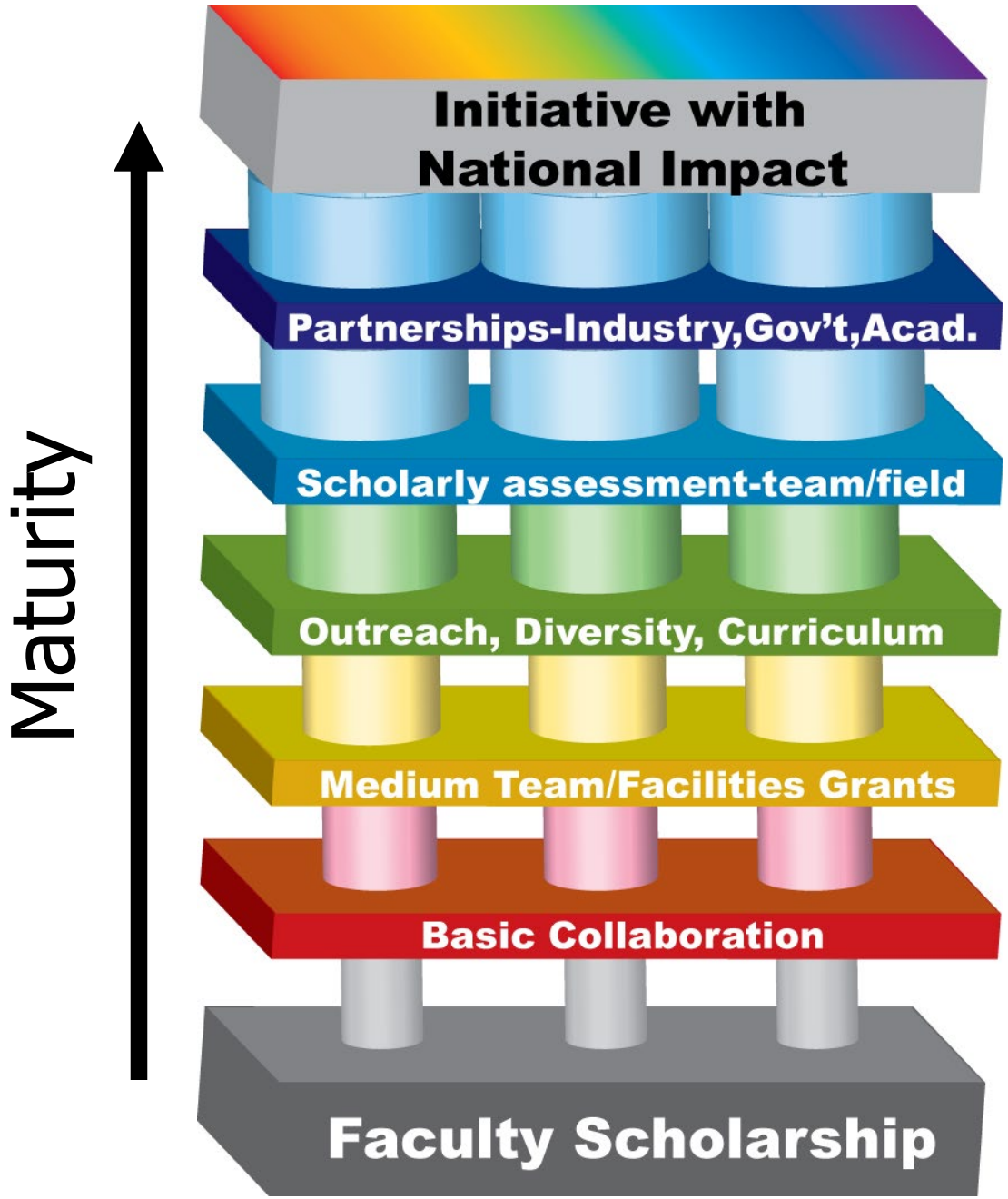
- Workshops, symposia, professional orgs
- Set national stage
- Federal agency support

Finalizing the Initiative

- Core group well defined with demonstrated working relationships
- Ready for national competition – e.g. ERC/STC
- Research, education, outreach & diversity programs are well integrated
- Senior administration is queued up – resources are well defined and integrated with strategic plans and hiring needs of departments

Research & Education Initiatives
An Example: Molecular Engineering

- Leverages Nationally recognized UW scholarship (embodied in CMDITR, GEMSEC, UWEB, CNT)
- Strong advocacy in A&S - complements CoE
- Linked to national curricular discussion - ChemE
- 70% of top UW technologies ($) are molecules
- Attacks CoE need for more chem/bio lab facilities
- Working group now established



Partnerships cement the external impact

Research Impact

- Partners ensure broadest dissemination
- Translational activities

Knowledge Impact

- Regulatory agencies and Mission-oriented labs
- Define schools of thought

Community Impact

- Export outreach and diversity programs

CoE can help as a match maker

Final Thoughts

- For impact, many disciplines are usually needed
- Get a translator early
- Engage administration early – not with resource requests, but with a plan showing how the dept, CoE, and Provost can help you move ahead
- Don’t forget education, outreach and diversity – they can turn out to have the most impact!

Nathan Kutz

Robert Bolles and Yasuko Endo Professor of Applied Mathematics and Electrical and Computer Engineering; Director of the NSF-funded AI Institute in Dynamic Systems

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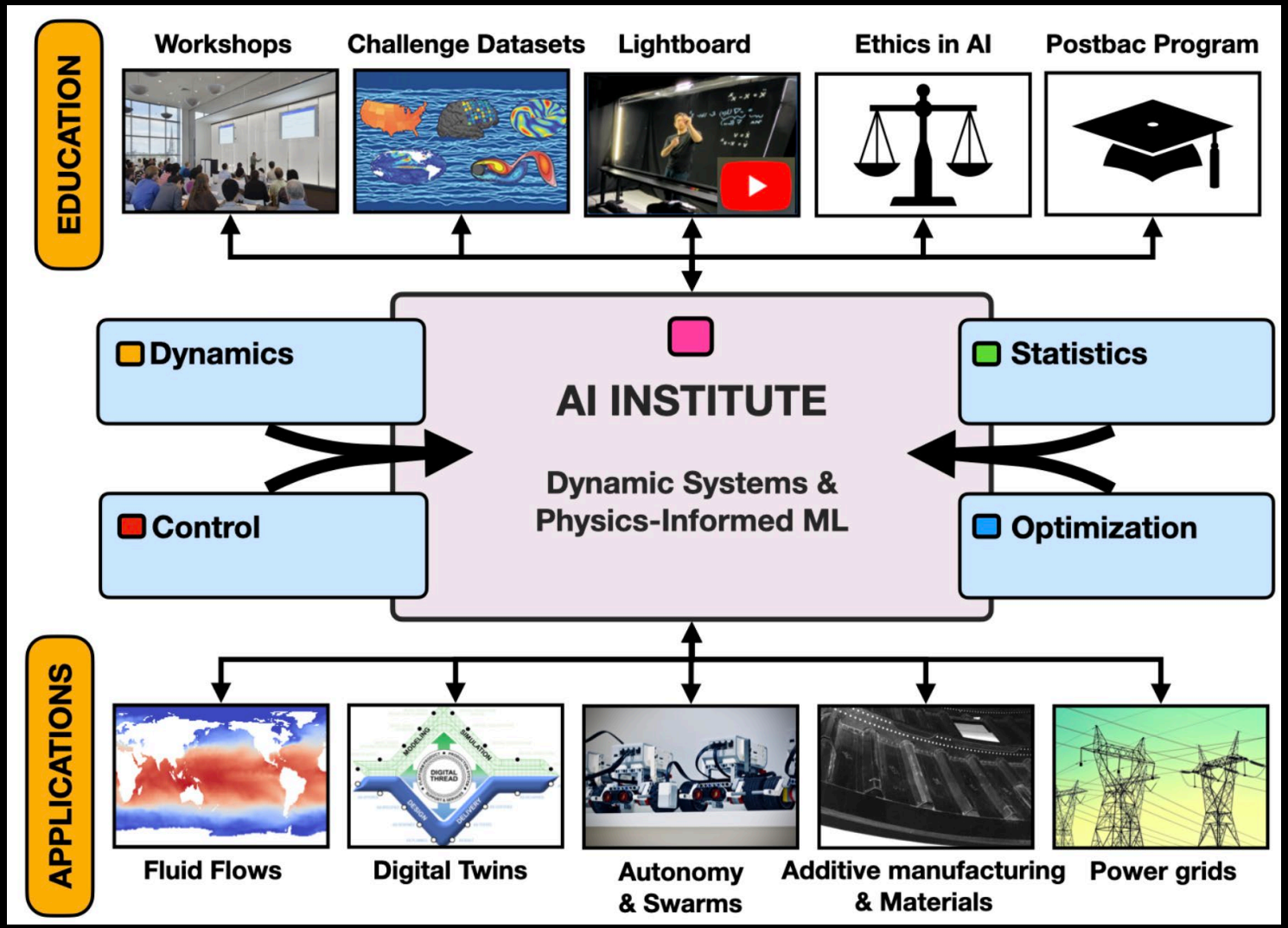
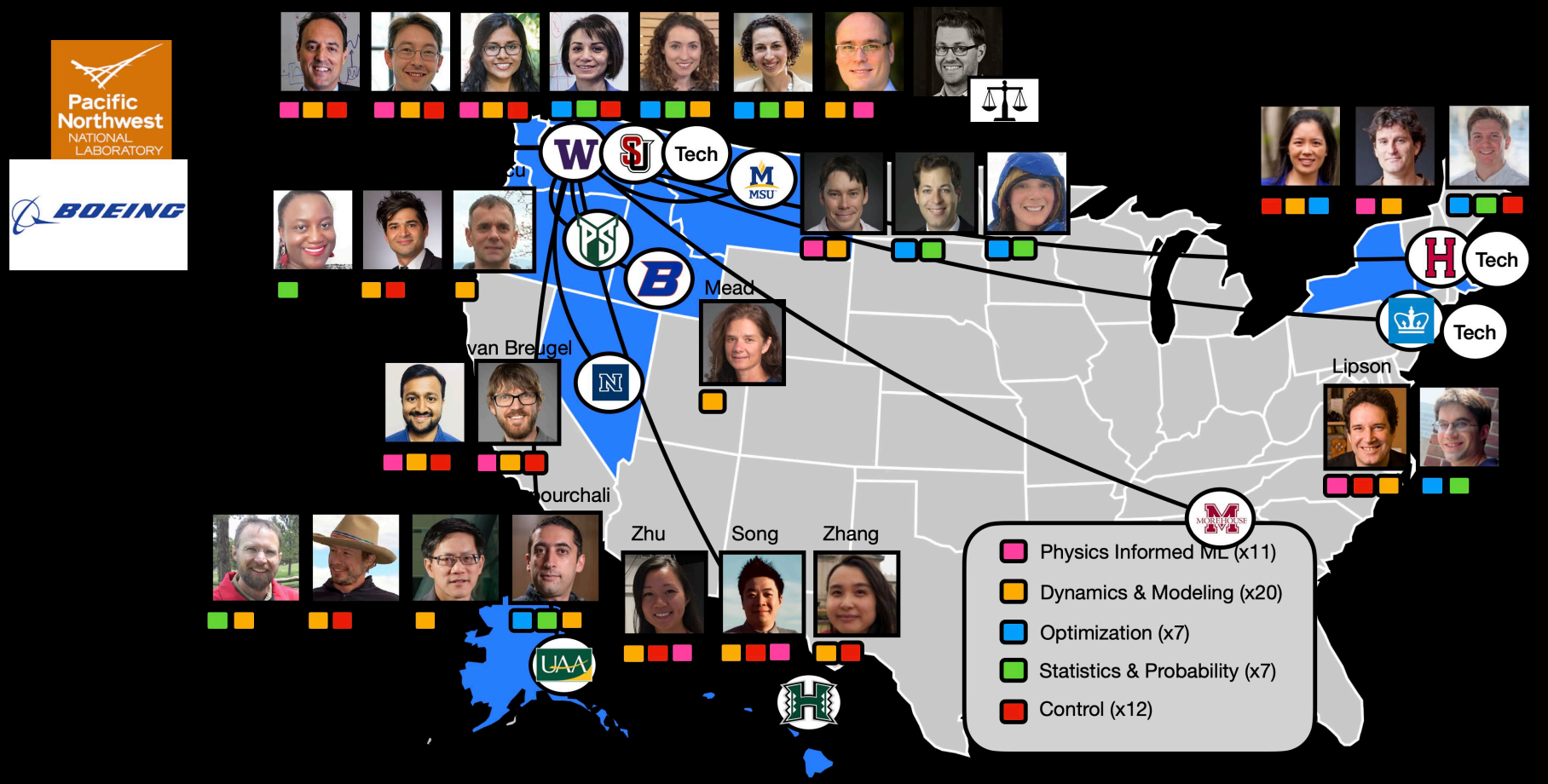
Towards Big Scale Research Efforts

Organize into transformative thrusts



DynamicsAI.org

Build Diverse/Dynamic Partnerships



Know your sponsor

- Do they care about education?
- Do they care about diversity?
- Is it just research deliverables?

It is not just about being the best research team

Institute for Foundations of Data Science (IFDS)

ADVANCE STEM

Zaid Harchaoui
Associate Professor of Statistics
Adjunct Faculty in Allen School
eScience Data Science Fellow
Member of Leadership Team of IFDS

UNIVERSITY of WASHINGTON

History of NSF's TRIPODS program

2016: NSF ran invited workshop on Theoretical Foundations of Data Science, led to detailed report

2017: first **NSF TRIPODS program** formed: collaboration of CISE & DMS directorates, responding to NSF's 10 Big Ideas, HDR (Harnessing the data revolution) program

Transdisciplinary Research In Principles Of Data Science aims to bring together the *statistics, mathematics, theoretical computer science and electrical engineering* communities to develop the theoretical foundations of data science through integrated research and training activities.

CFP out in early 2017. UW received **one of the 12 national** awards for a phase I institute: ADSI (Algorithmic foundations for Data Science Institute), co-directed by S. Kakade & M. Fazel ($1.5 M)
co-PIs YT Lee, D. Drusvyatskiy, Z. Harchaoui

What helped us: existing collaborations; tight merging of topics (not separate sections)

(NSF announcement, UW announcements here, here)

NSF TRIPODS+X

2018: Spin-off of TRIPODS: Solicited new proposals where TRIPODS members partner with researchers in an application area ("+X") on specific set of problems, using theoretical analysis, foundational DS methods.

ADSI submitted 4 proposals, **3 awarded**. 2 in 'research' and 1 in 'education' category (news link)

Our topics:

- Learning in Robotics (led by Z. Harchaoui, co-PIs S. Kakade, S.Srinivasa, M. Fazel)
- Fast sampling methods for epidemiology and analysis of metabolic networks (led by Yin-Tat Lee, co-PI: Abie Flaxman from IHME)
- Designing tutorials for hackweeks, in collaboration with *eScience Institute*
  (led by Maryam, co-PIs Ariel Rokem, Anthony Arendt)

What helped us: Lots of communications with NSF PMs. eScience's strong 'hackweeks' program.

Related programs: DIRSE (data-intensive science & eng).
UW's EDSI (led by Magda Balazinska, through eScience)

TRIPODS Phase II

UW leads the new multi-site institute, Institute for Foundations of Data Science (IFDS). **One of two** phase II institutes nationwide (the other is led by MIT and Berkeley). **Total: $12.5 M**

CFP in 2019. Reverse site visit in March 2020 (virtual). IFDS launched Sep 2020 (news).
Lead is Maryam Fazel, Co-PIs: Zaid Harchaoui, Kevin Jamieson, Yin Tat Lee, Dima Drusvyatskiy, Abel Rodriguez

What helped us:

- Story: Phase 1, +X's, UW's ecosystem. Demonstrate bridging of math/stat/CSE/ECE: projects, publications, co-advising, workshops
- Partner early on: UW and Wisconsin: shared philosophy, research, joint summer school+workshops. Teamed up with UCSC's institute and UChicago later.
- Regular communication with PMs

TRIPODS program now: more phased-institutes model:
funded second cohort of Phase I's

AI Institutes, e.g., IFML –-led by UT Austin and involves UW (Sewoong Oh)
aslo AI Inst. for Dynamics (Nathan Kutz)

Additional IFDS information

IFDS Agenda

Key methods in DS/AI, e.g., deep learning, can fail spectacularly due to corruptions, manipulations, and biases in data/models. This is challenging for safety-critical applications, and limits trust in algorithmic decisions, making it harder to use in areas such healthcare. A principled framework combining math/stats/CS/ECE viewpoints enables a better understanding of when core methods work or fail, to help address the pitfalls.

Research Themes:

Complexity, Robustness, Closed-loop DS, Ethics & Algorithms

- Co-advised students: IFDS RAs
- Co-advised postdocs
- SIGs: focused study/working groups
- Virtual seminars: across different campuses
- This summer: first NSF review. Summer school, workshop, partnership with AI4All (led by Anat Caspi)

IFDS@UW

- Core faculty:
  - **Maryam Fazel (ECE), Lead**
  - Zaid Harchaoui (Stat)
  - Kevin Jamieson (CSE)
  - Yin Tat Lee (CSE)
  - Abel Rodriguez (Stat)
  - Dmitriy Drusvyatskiy (Math)

- Active faculty affiliates & collaborators:

  L. Ratliff (ECE), S. Du (CSE), J. Morgenstern (CSE), J. Bilmes (ECE), L. Schmidt (CSE), S. Oh (CSE), L. Jain (Foster), S. Bubeck (MSR), L. Xiao (Meta AI),...

- eScience Institute: hub for DS, connecting scientific applications with data science tools
- NSF AI Institute in Dynamic Systems: synergy with IFDS closed-loop theme
- NSF AI Institute: Inst. for Foundations of ML
- Allen Institute for AI (AI2)

Award-winning Research

Awards (UW, ADSI+IFDS):

- Two NeurIPS Best Paper Awards (2018, 2021)
- ICML Test of Time Award (2020)
- INFORMS Young Researcher Prize (2019)
- MSR Faculty Fellowship (2019)
- Sloan Fellowship (2020)
- Tucker Prize in Optimization (2018)
- Packard Fellowship (2020)
- Young Researcher Best Paper Award of ICCOPT (2019)
- NSF CAREER Award
- Google Research, Amazon Scholar awards

T1: Algorithms & Complexity
Stochastic optimization, matrix/tensor methods, faster linear programming, graph estimation

T2: Robust DS
Distributionally robust optimization, robust RL, model adaptation

T3: Closing the Loop in DS
Online/interactive learning, dynamic environments, decision-dependent data, connecting RL and control theory

T4: Ethics & Algorithms
Differentially private algs, fairness, robustness under strategic data

IFDS Activities

Summer School 2019

- Research: Graduate RAs (14), Postdocs (3)
  - Co-mentored in 2 fields
  - Weekly seminars at UW; Monthly IFDS-wide seminars
- Develop cutting-edge curricula
- Outreach:
  - Workshops & summer schools for grad students
  - With CSE's Taskar Center, co-organized AI4All@UW, 2-week workshop for high-schoolers
- Summer 2022:
  - PIMS-IFDS Summer School on Optimal Transport
  - IFDS Research Workshop on Robust ML
  - AI4All 2022

Workshop 2021

Workshop 2019