Welcome
CAP Executive Board
October 7, 2021
CAP Chairman and Vice Chairman

GB Singh
Director, Business Management
Solar Turbines

John Black
Senior Vice President, New Product Development
Brain Corporation

Welcome
Meeting Protocol

➔ We will be recording this meeting

➔ Turn on video

➔ Mute all, use chat for comments

➔ Use “raise hand” for questions
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00-4:15pm</td>
<td>CAP Executive Board Chairman Welcome</td>
</tr>
<tr>
<td>4:15-4:25pm</td>
<td>Team Internship Program (TIP) Presentation: Solar Turbines TIP Team</td>
</tr>
<tr>
<td>4:25-4:35pm</td>
<td>Dean’s Report</td>
</tr>
<tr>
<td>4:35-4:50pm</td>
<td>Franklin Antonio Hall: An Innovation Ecosystem</td>
</tr>
<tr>
<td></td>
<td>Zachary Smith</td>
</tr>
<tr>
<td></td>
<td>Executive Director of Development, Jacobs School of Engineering</td>
</tr>
<tr>
<td>4:50-5:10pm</td>
<td>The Institute for Learning-enabled Optimization at Scale (TILOS)</td>
</tr>
<tr>
<td></td>
<td>Dr. Andrew Kahng</td>
</tr>
<tr>
<td></td>
<td>Director, TILOS</td>
</tr>
<tr>
<td></td>
<td>Professor, Computer Science &amp; Engineering</td>
</tr>
<tr>
<td>5:10-5:30pm</td>
<td>CAP Business</td>
</tr>
<tr>
<td>5:30pm</td>
<td>Adjournment</td>
</tr>
</tbody>
</table>
Welcome New CAP Partners
Welcome Guests

APPLE
BECHTEL
CANTO
IMAGINATION TECHNOLOGIES
INTEL
LOCKHEED MARTIN
MATHWORKS
NVIDIA
PALL AEROSPACE TECHNOLOGY
SINGULAR GENOMICS
VMWARE
Welcome Solar Turbines TIP Team

Investigation and Improved Maximum Power Algorithm

Solar Turbines
A Caterpillar Company
Dean’s Report

Albert P. Pisano
Dean, Jacobs School of Engineering

Full Speed Ahead
Welcome to the new Academic year!

- More than 9,400 engineering students ascend to the Jacobs School of Engineering
- In 2013 we set the goal to bring our faculty to student ratios 20:1 Undergrad, 10:1 Graduate
- We have nearly achieved this mission; 25:1 Undergrad, 12:1 Graduate
Graduate students honored as Siebel Scholars

On a mission to pioneer tools to improve the Human Condition:

- Graduate students working at the interface of engineering and medicine.
- Rare genetic disorders, microbial study of cancer, non-invasive wearable biosensors, physics of cell membrane deformation, and non-invasive cardiovascular evaluation
- Representing Electrical Engineering, Bioengineering, Nanoengineering and Bioinformatics
We continue to build cachet
The Jacobs School is ready to accelerate

We hired 27 new faculty in 2020/2021

Over 140 new faculty hired in 8 years, 281 total faculty
New major grant wins

$20M NSF grant creating The Institute for Learning-enabled Optimization at Scale (TILOS)

• Institute Director: Andrew Kahng, CSE & ECE

• Develop learning-enabled optimization tools for application areas of strategic importance to the United States, including chip design, robotics, and communication networks.

$12.25M NIH grant to develop and enhance brain-sensing and brain-stimulating platform technologies to enable treatment of drug-resistant epilepsy

• Project Lead: Shadi Dayeh, ECE, Integrated Electronics & Biointerfaces Laboratory

• Refine high-density sensor grids that more accurately identify seizure spots in brain
Gordon Center Reboot - 2.0 Coming Soon!

UC San Diego

JACOBS SCHOOL OF ENGINEERING
Gordon Engineering Leadership Center

STUDENT VETERANS
ServiceNow Terrace in Franklin Antonio Hall

• Executive Outreach Center Terrace will be named “ServiceNow Terrace”

• Joins fellow CAP Partners Cubic, Qualcomm, and Teradata in naming spaces in Franklin Antonio Hall

• Special Thanks to ServiceNow CAP Executive Magaly Drant for championing this opportunity
Special Presentation: Franklin Antonio Hall

Zack Smith
Executive Director of Development, Jacobs School of Engineering

Franklin Antonio Hall: An Innovation Ecosystem
Franklin Antonio Hall: An Innovation Ecosystem
Franklin Antonio Hall Translational Vision for the Digital Future

- Precision Healthcare
- Distributed Renewable Energy
- Smart Materials
- Autonomy

- Machine-intelligent Security
- Cryptography
- Privacy
- Authentication

- Sensors
- Hardware
- Machine Vision
- 5G Networks

- Data Science
- Machine Learning
- Edge Computing
- Bioinformatics

COMMERCIALIZATION
1st Floor: Opportunities and Thanks

Available Spaces:
1. Learning Innovation Studio
2. Institute for the Global Entrepreneur Suite
3. Open Seating Space
4. Lobby Atrium
5. Event Lobby

Named Spaces:
1. Teradata Classroom
2. Qualcomm Classroom
3. Qualcomm Student Project Space
4. Minerva’s Café
5. Charles Lee Powell Café Terrace
Open Seating Area
2nd Floor: Opportunities and Thanks

Named Spaces:
1. Sanjay and Fiona Jha Collaboratory
2. Cubic Collaboratory
3. Jack Wolf Meeting Room
4. Founder’s Conference Room

Available Spaces:
1. Center for Engineered Natural Intelligence Collaboratory
2. Halıcıoğlu Data Science Institute Collaboratory
3. Open Seating Space
4. Offices
5. Kitchenette
6. Lounge
Meeting Room
3rd Floor: Opportunities and Thanks

Available Spaces:
1. CRI Collaboratory: Autonomous Systems
2. CRI Collaboratory: Medical Robotics
3. CRI Collaboratory: Cyber Physical Technology
4. Sustainable Power and Energy Collaboratory
5. Conference Room
6. Open Seating Space
7. Offices
8. Kitchenette
9. Lounge

Named Spaces:
1. Xiaosong Jiang and Paul Yu Meeting Room
4<sup>th</sup> Floor: Opportunities and Thanks

Named Spaces:
1. Jacobs | Salk Collaboratory
2. Chien | Farrell IEM Collaboratory
3. Erik Engelson Meeting Room
4. ServiceNow Terrace

Available Spaces:
1. Machine Intelligence Computing and Security Collaboratory
2. Executive Outreach Center
3. Classroom
4. Board Room
5. Open Seating Space
6. Offices
7. Kitchenette
8. Lounge
Executive Outreach Center/Terrace
Executive Outreach Center Classroom
Enable Use-Driven Research in Research Centers of Excellence
Executive Outreach Center Boardroom
Questions?
Faculty Presentation

Andrew Kahng
Professor, Computer Science & Engineering

The Institute for Learning-enabled Optimization at Scale (TILOS.ai)
TILOS AI Research Institute

Andrew B. Kahng

Jacobs School Fall CAP Board Meeting
October 7, 2021

The Institute for Learning-enabled Optimization at Scale

tilos.ai
About Me

Andrew B. Kahng is Distinguished Professor of CSE and ECE and holder of the endowed chair in high-performance computing in the Jacobs School of Engineering at UC San Diego. He was visiting scientist at Cadence (1995-97) and founder/CTO at Blaze DFM (2004-06). He is coauthor of 3 books and over 500 journal and conference papers, holds 35 issued U.S. patents, and is a fellow of ACM and IEEE. He was the 2019 Ho-Am Prize laureate in Engineering. He has served as general chair of DAC, ISPD and other conferences, and from 2000-2016 served as international chair/co-chair of the International Technology Roadmap for Semiconductors (ITRS) Design and System Drivers working groups. He currently serves as PI of “OpenROAD” https://theopenroadproject.org/, a $15M U.S. DARPA project targeting open-source, autonomous (“no human in the loop”) tools for IC implementation, and as PI of “TILOS” (The Institute for Learning-enabled Optimization at Scale, https://tilos.ai/), an NSF AI Research Institute.
What is TILOS?

NSF National AI Research Institute for Advances in Optimization

Mission: make impossible optimizations possible, at scale and in practice.

5-year grant, $20M total funding from NSF (start: November 1)

Partial support is from Intel Corporation (thank you!)

UCSD is the lead institution

TILOS is housed at the Halicioglu Data Science Institute
Optimization: Find a best-possible solution

Fundamental challenges: scale and complexity

Nexus of AI/ML, Optimization, Use in practice

Vision: Four “virtuous cycles”
1. Foundations: AI and Optimization
2. Scaling: Foundations and Use Domains
3. Translation: Academia and Industry leading edge
4. Broad Impact: Education, Outreach, and Research
Institute and Research Leadership

**NSF**
- Director: Kahng
- Managing Dir: Pazzani

**EAB**

**IAB**

**COMMITTEES**
- Ethics/Early Career: Jegelka
- Diversity and Outreach: Taylor, Naderi
- Institute Culture: Vishnoi
- Education: Reeves, Jawad, Atashpaz-Gargari
- Translation: Kumar

**MANAGEMENT**
- AD Diversity and Outreach: Taylor
- AD Education: Reeves
- AD Translation: Kumar
- AD Research: YWang

**FOUNDATIONS**
- Mazumdar: Vishnoi
- Belkin: Chung-Graham
- Hassani: Javidi
- Jegelka: Ribeiro
- Karbasi: Leok
- Ma: Atanasov
- Sra: Su
- YWang: Taylor

**ROBOTICS**
- Christensen: Kumar
- Atanasov: Su
- Taylor: XWang

**NETWORKS**
- Javidi: Ribeiro
- Koushanfar: Rosing
- Saeedi-Bidokhti: Pan

**CHIPS**
- Kahng: Gao
- Koushanfar: Koushanfar
- Rosing: Rosing

The Institute for Learning-enabled Synergies of Scale
Robotics  

physical systems in the real world

• Challenged by
  • Dimensionality
  • Structural and Dynamic constraints
  • Dynamic world with a need to anticipate changes

• Optimization target: multi-robot interaction with these challenges
  • Reduce traffic congestion by 25+%
  • Perform efficient real-world learning
  • Deploy in regular homes
Communication Networks the infrastructure of the information age

- Challenged by
  - Decentralized management/control
  - Multiple design scales
    - Physical laws of signal propagation
    - Ubiquitous global connectivity
  - Impossible to sustain
    - Overprovisioning wastes energy

- Optimization target:
  - Federated learning/optimization
  - Automated (blackbox) optimization
  - Integrated representation of physics
Chips  *the fabric of information technology*

- Challenged by:
  - Complexity  billions of transistors, stack of abstractions, nanometer physics
  - **Optimization target:** 1000x speedups, scalability
    - Direct inference of layout
    - Verification
    - More system objectives “X”: X = security, resilience ...

*Timing, Security, Power …*  
10?????? states

---

*Direct Inference*
From Use Cases to Foundations

Use Cases

Foundations

Modeling/Representation

Learning

Optimization

Problems, Data, Domain knowledge

Methods, Models, Solutions
AI and Optimization

AI advances pose new challenges, provide new tools for optimization

Five Foundation “Pillars”

- Bridging Discrete and Continuous
- Distributed, Parallel, and Federated
- Optimization on Manifolds
- Dynamic Decisions Under Uncertainty
- Nonconvex Optimization in Deep Learning

New perspectives on classic problems

TILOS members have advanced all of these
+ Much More

• NSF’s NAIRI charge: become the national nexus for AI and Optimization

• People: Faculty, postdocs, Ph.D. students + additional faces

• Culture: How 30 faculty will move the needle
  - *Becoming an institute, being recognized for breakthrough impact, becoming self-sustaining*

• Education and Workforce Development
  - *Lifelong learning, skills refresh, curricula at AI-Opt-Use nexus, precision education, …*

• Broadening Participation: Diversity and Outreach
  - *Scalable “outreach in a box”: Lab 3.0*
  - *Tiers of engagement: Exposure, Experience, Environment*
  - *TILOS dedicated staff: Saura Naderi*
Collaborations With Industry  Translation, Impact

• **Research: advisors, collaborators, mentors, champions**
  - Skin in the game: committed bandwidth, success matters
  - Problem formulations, data, benchmarks – and expert **insight**
  - Supply the missing piece: **AI-Opt-Use in practice**

• **Workforce development**
  - Skills renewal
  - Curriculum guidance and contributions of tutorials, guest lectures

• **Broad engagement**
  - Compute resources
  - Hosting of postdocs and Ph.D. students
  - Challenge problems and optimization roadmap

• **Paths to growth and sustainability**
  - TILOS industry membership program, partnership models
How to Engage?

What’s important to a company?

• Move the needle on high-stakes, real-world optimizations
• Aim talent and the latest research breakthroughs at company’s problems

What’s important to faculty, postdocs, students?

• Working on challenges that matter
• Impact at the leading edge of practice
• High-quality bandwidth, attention, data, internships, …

What we all want:

• Quality bandwidth and attention, path to success (e.g., data), interns, jobs…
• Company makes the first move！😊
Thank You

The Institute for Learning-enabled Optimization at Scale

tilos.ai

abk-tilos@eng.ucsd.edu
CAP Business

Wil Dyer
Director, Corporate Affiliates Program

CAP Updates
Jacobs School Corporate Affiliates Program
We help you define and execute your talent acquisition strategy with the Jacobs School

➔ Tech Talks
➔ Information Sessions
➔ Professional Student Organizations
➔ Internships & Full-time Jobs
➔ Team Internship Program (TIP)
➔ Cooperative Education (Co-op)
➔ Ph.D Mentor Program (New!)
➔ Alumni for experienced roles (New!)

Contact Alice Grgas at agrgas@eng.ucsd.edu
TIP & Co-op recruitment begins now!

Team Internship Program (TIP)
- 2-5 members; Undergraduate, Masters, and Ph.D.
- All engineering majors - multi-disciplinary teams encouraged; can include non-engineering majors
- Paid Internships, 10-12 weeks over the summer
- Full-time, i.e., 40 hour/week commitment

Cooperative Education (Co-op)
- First in the UC System
- Cohort #4: June-December 2022
- Full-time (30-40 hours per week) for up to 6 months - Summer and Fall quarters
- Undergraduate & Master’s engineering students

Contact Alice Grgas at agrgas@eng.ucsd.edu

<table>
<thead>
<tr>
<th>Recruiting Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>October - December</td>
</tr>
<tr>
<td>Companies include TIP/Co-op in budget planning. Companies define and submit projects and recruitment starts</td>
</tr>
<tr>
<td>January - March</td>
</tr>
<tr>
<td>Companies continue to submit their projects and recruitment continues; offers extended</td>
</tr>
<tr>
<td>April</td>
</tr>
<tr>
<td>Finalize recruitment &amp; offers</td>
</tr>
<tr>
<td>May</td>
</tr>
<tr>
<td>Selections completed Intern pre-deployment training</td>
</tr>
<tr>
<td>June-December</td>
</tr>
<tr>
<td>TIP period during 10-12 consecutive weeks (Jun-Sept) Co-op period up to 6 months (Jun-Dec)</td>
</tr>
</tbody>
</table>
Post your open positions at the Jacobs School

- Post full/part-time opportunities, internships, TIP & Co-op positions
- Proactively identify qualified students through tailored resume book
- Qualified referrals and pre-screened applicant pool
- New! Targeted outreach to alumni for open positions all year round

Contact Alice Grgas
agrgas@eng.ucsd.edu

Learn more and access the portal at
http://jacobsschool.ucsd.edu/talent
Call for mentors! CAP Ph.D Mentor Program

Provide mentorship for our Ph.D students, and help your company build relationships with relevant graduate students for current/future positions

*Looking for more industry Ph.D mentors; Over 100 Ph.D students registered!*

➔ One Ph.D Student Mentee for six months, November - May
➔ Monthly one-hour meetings arranged by mentor/mentee
➔ Kick off meeting Oct 25, 12-1pm PST

Contact Alice Grgas at agrgas@eng.ucsd.edu
Senior Design Capstone Projects

Graduating students working at the Jacobs School with our equipment, on your projects. Submit 1-2 page project description for review by faculty member.

Mechanical & Aerospace Engineering
→ Submit project description in October
→ Projects run from Nov-Feb or Mar-Jun

Electrical & Computer Engineering
→ Submit project in Nov/Dec
→ Projects run from Jan-Mar or Mar-Jun
Save the Date
November 18-19, 2021
Center for Wireless Communications
5G and Beyond Forum
CWC.ucsd.edu
Current Slate of Important Dates

October 4/5, 2021  Computer Science & Engineering (CSE) Tutor Networking Night - Top 5% CSE students

October 19, 2021  Professional Evening with Industry (PEI) - NSBE, SHPE, SWE, WIC, and oSTEM Student Networking Night

October 20, 2021  Honors Career Fair - honors societies Tau Beta Pi and Eta Kappa Nu

October 26, 2021  Defense Night - Government & Defense Networking Night

October 27, 2021  Nano- and Chemical Engineering Day & Pitching Competition

November 19, 2021  Center for Wireless Communications (CWC.ucsd.edu) 5G & Beyond Forum

February 4, 2022  Winter CAP Executive Board Meeting

**All events virtual until further notice**
Thank you!
Next CAP Executive Board Meeting: February 4, 2022