Microsoft’s Unique Role in the Computing Research Ecosystem

Jeannette Wing
Corporate Vice President
Microsoft Research
open long-term basic in partnership with academia
Three Vignettes
Image Captioning

From Captions to Visual Concepts and Back


CVPR, 2015
A man standing on a tennis court holding a racquet.

The man is on the tennis court playing a game.
A man standing on a tennis court holding a racquet.

The man is on the tennis court playing a game.
A woman is standing near the road with a dog on a leash.

A blurry photo of a woman walking down the street.
A woman is standing near the road with a dog on a leash.

A blurry photo of a woman walking down the street.
1. Image Processing
- plate
- man
- player
- his
- on
- to
- baseball
- holding
- batter
- up
- throwing
- pitcher
- field
- game

2. Caption Generation
- A baseball player swinging a bat at a game.
- A man holding a baseball bat during a game.
- A pitcher throwing the ball.
- A close up of a baseball game.

3. Global Re-ranking
- A baseball player throwing a ball.

Visit mscoco.org for image information.
160k images
2M+ segmentations (700k people)
5 captions per image
Keypoints, attributes, ...

Over 100,000 worker hours to produce!
A person cross country skiing in the snow

A close up of a person with a cow

A crowd of people watching a baseball game

A young man holding a surfboard

Visit mscoco.org for image information
VQA: Visual Question Answering

Does this person have 20/20 vision?

Is this a vegetarian pizza?

More Information

MS COCO: http://mscoco.org

Research Showcase: Demo
Thurs. 9:45a - 1:00p

Vision to Language: Margaret Mitchell
Wed. 1:00p - 2:30p

Integrative AI: Larry Zitnick
Thurs. 1:00p - 2:30p
Machine Learning Applied to Gene Editing

Broad Institute of MIT and Harvard

John Doench  Ian Smith  David Root

Microsoft Research

Nicolo Fusi  Jennifer Listgarten
CRISPR: a system for gene editing

2007
naturally-occurring bacterial immune defense mechanism

2012
coop-ported for generic editing in any organism

human disease

drug development

agriculture

Image sources:
https://www.broadinstitute.org/news/5393 (scissors image)
http://www.the-scientist.com/?articles.view/articleNo/31325/title/How-Probiotic-Yogurt-Works/g (yogurt image)
http://www.nytimes.com/2014/03/04/health/a-powerful-new-way-to-edit-dna.html?r=0 (bacteria)
Two-part bacterial defense mechanism

1. Viral scrapbook

2. Cut & paste mechanism

[Image sources: http://www.nature.com/nature/journal/v519/n7542/images_supplementary/nature14237-a110.jpg
http://2013.igem.org/wiki/images/1/1b/UBC-CRISPR-Mechanism+Out.png
http://images.clipartpanda.com/scissors+clipart+McLkpSEca.png]
Machine learning predictive modelling for CRISPR

any organism of choice

DNA to be edited

synthetic viral memories

\[ f(\vec{x}) \]

\[ y = \text{very effective} \]

\[ f(\vec{x}) \]

\[ y = \text{not effective} \]

\[ f(\vec{x}) \]

\[ y = \text{medium effective} \]

\[ f(\vec{x}) \]

\[ y = \text{very effective} \]

Image sources:
http://techcrunch.com/2015/05/13/the-genome-engineering-revolution/
Tools and Papers

Prediction server on Azure ML


Safe Cyber-Physical Systems
People

Verification & OS
- Ethan Jackson
- Chris Hawblitzel
- Shaz Qadeer
- Ben Zorn

UAS & Sensing
- Shawn Keshmiri
- Vijay Kumar
- Ashish Kapoor
- Ranveer Chandra

Biological Data
- Douglas Norris
- Anandasankar Ray
- James Pipas
- Eamonn Keogh

Hardware Design
- Alex Ching
- Patrick Therien

System Integration
- Janos Sztpanovits
- Sandeep Neema

Internet of Things
- Mike Chieh-Jan Liang
- Feng Zhao
Safe Cyber-Physical Systems

Safe and smart autonomy

interacting with the physical world at scale
Safety, From the Ground Up

High-level Planning

Correct Control

Robust Sensing

Secure OS

Safe despite limited power, external disturbances, sensor noise, and complex missions
To Automate a Safer World
More Information

Project Demo: Ethan Jackson  Thurs. 9:45a - 1:00p

Privacy in Context: Ben Zorn  Wed. 1:00p - 2:30p

Programming Models for Estimates, Approximation, and Probabilistic Reasoning: Kathryn McKinley  Wed. 1:00p - 2:30p
Two Exciting Announcements
Project Catapult

Request for Proposals
Project Catapult
Doug Burger (Microsoft Research) and Derek Chiou (Bing)

FPGA-based fabric for datacenter
Increase performance, reduce power consumption
Provide new capabilities

From Research to Datacenter Deployments
Bing – Search Indexing Acceleration (improved by ~2x)
Azure SmartNIC – Azure Service Fabric CPU offloading
Project Catapult Request for Proposals

Cutting-edge FPGA hardware available at scale for research via university collaborations

Access to large Catapult-equipped cluster hosted at Texas Advanced Computing Center

Catapult hardware research at EPFL and ETH Zurich

Come join Microsoft in redefining datacenters

Resources available Fall 2015

Submit Proposals – Information at aka.ms/catapult-fs
HoloLens Academic Research Grant

Request for Proposals
Discover New Possibilities

World’s first holographic computer

Profound excitement to unlock all-new ways to create, communicate, work and play
Go beyond the screen and bring ideas to life

Stimulate and advance academic research for holographic computing

Explore potential roles and applications in mixed reality
Solve difficult problems and contribute insights to any domain
Envision novel ways of using HoloLens
Case Western Reserve University
HoloLens RFP Details

- 5 awards, each with US$100,000 and 2 HoloLens development kits
- No restrictions to any one discipline or a particular methodology
- Submission deadline is midnight (PST) September 5, 2015
- Award recipients announced on October 6, 2015

HoloLensResearch.com
The future is for us to invent – together!
Thank You!
Microsoft Research
Faculty Summit 2015
July 8-9, 2015