

Microsoft's Unique Role in the Computing Research Ecosystem

Jeannette Wing
Corporate Vice President
Microsoft Research

Microsoft Research

Faculty Summit

2015

July 8-9, 2015

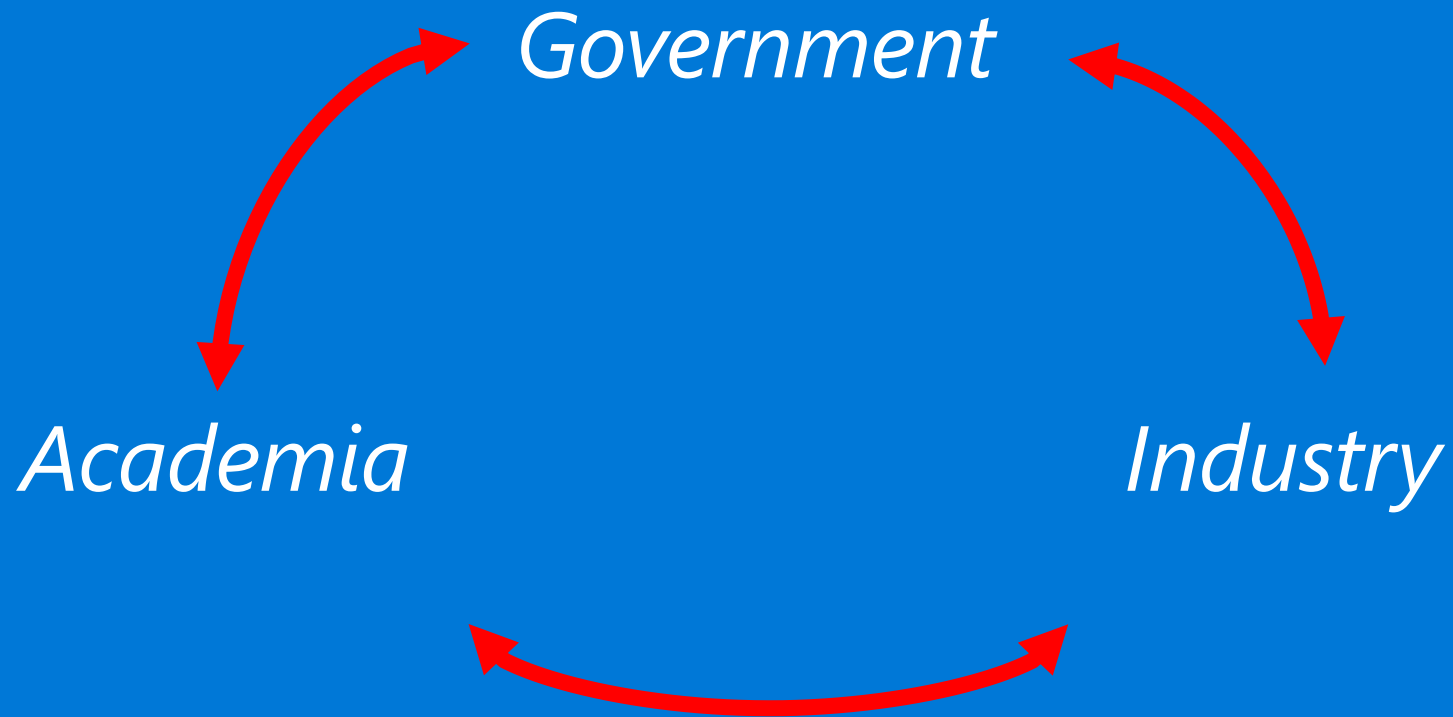


open

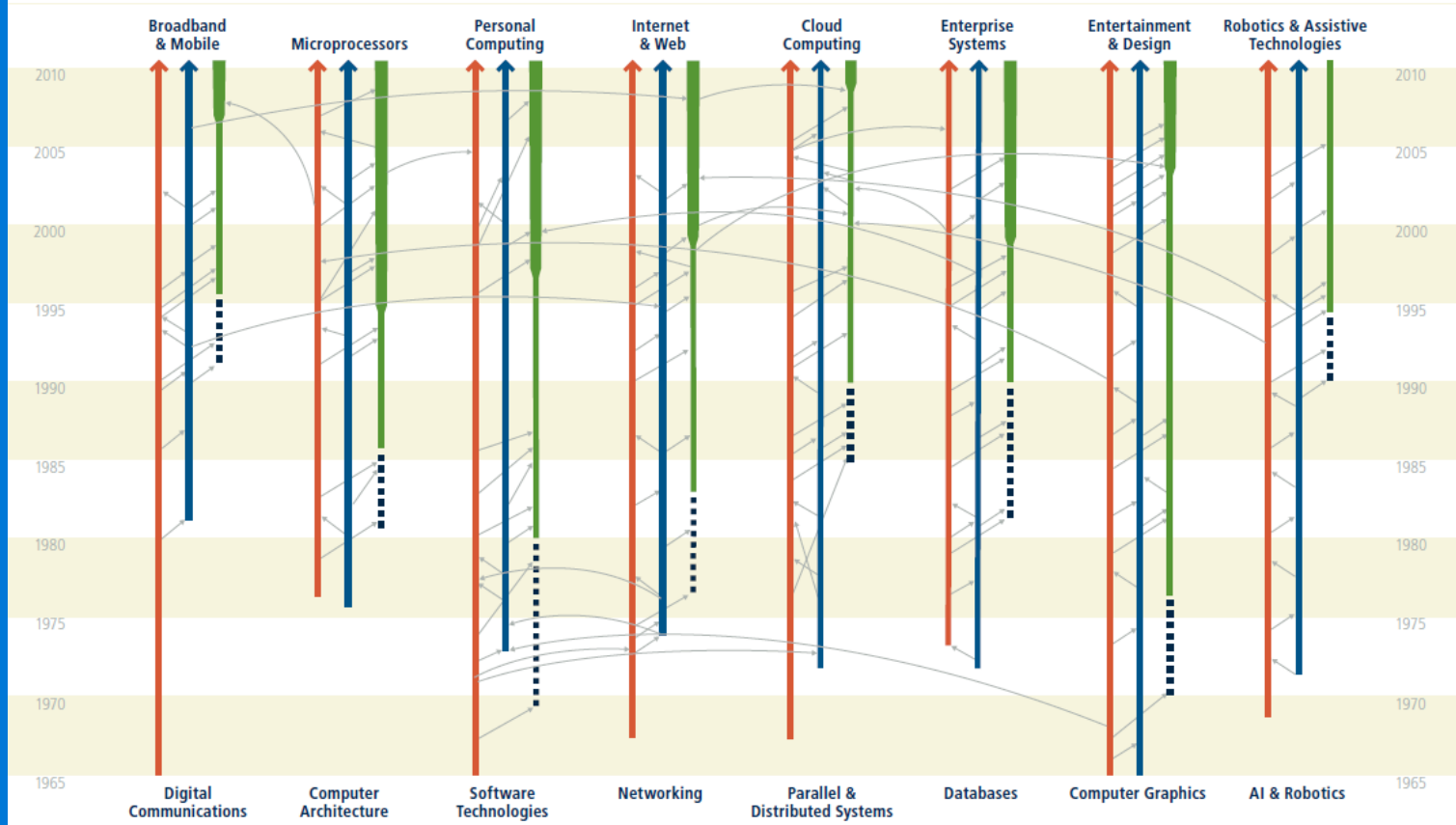
long-term

basic

in partnership with academia



Motorola AMD Intel eBay Akamai Yahoo! IBM Electronic Arts
 Qualcomm HP Symantec Juniper Facebook Twitter VMware HP Adobe Autodesk Nuance
 Texas Instruments Apple Cisco Amazon Microsoft Oracle nVidia Pixar Xbox
 iPhone Dell Google iRobot Intuitive Surgical

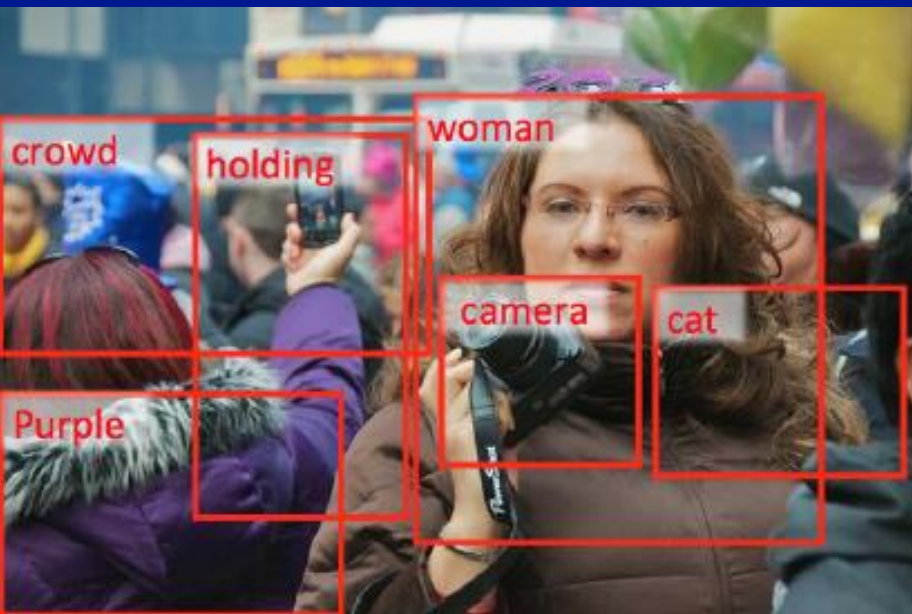


Areas of Fundamental Research in IT

■ University
 ■ Industry R&D
 Products
 ■ \$1 Billion Market
 ■ \$10 Billion Market

Three Vignettes

Image Captioning



From Captions to Visual Concepts and Back

H. Fang, S. Gupta, F. Iandola, R. Srivastava,
L. Deng, P. Dollár, J. Gao, X. He, M. Mitchell,
J. Platt, C.L. Zitnick, and G. Zweig

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.

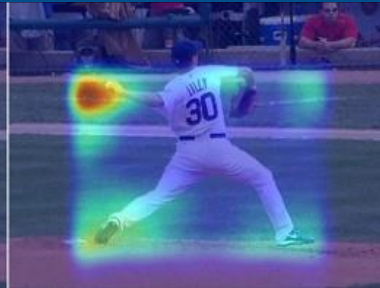


baseball

ball

player

throwing



1 Image Processing

plate baseball
 man on holding
 to batter
 player up pitcher
 throwing
 his game field

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.**



Microsoft COCO

Common Objects in Context





Microsoft COCO

Common Objects in Context



Tsung-Yi Lin
Cornell Tech



Genevieve Patterson
Brown University



Serge Belongie
Cornell Tech



Pietro Perona
Caltech



James Hays
Brown University



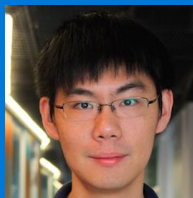
Deva Ramanan
CMU



Michael Maire
TTI Chicago



Matteo Ronchi
Caltech



Yin Cui
Cornell



Lubomir Bourdev
Facebook



Piotr Dollar
Facebook



Ross Girshick
Microsoft Research



Larry Zitnick
Microsoft Research



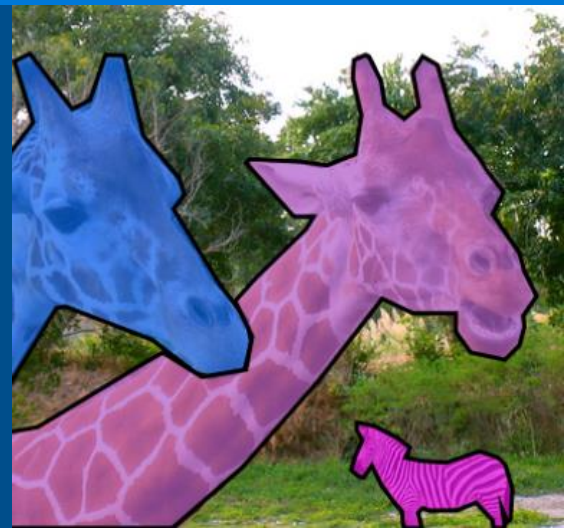
160k images

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



VQA: Visual Question Answering



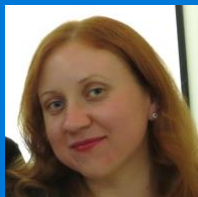
Does this person have 20/20 vision?



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



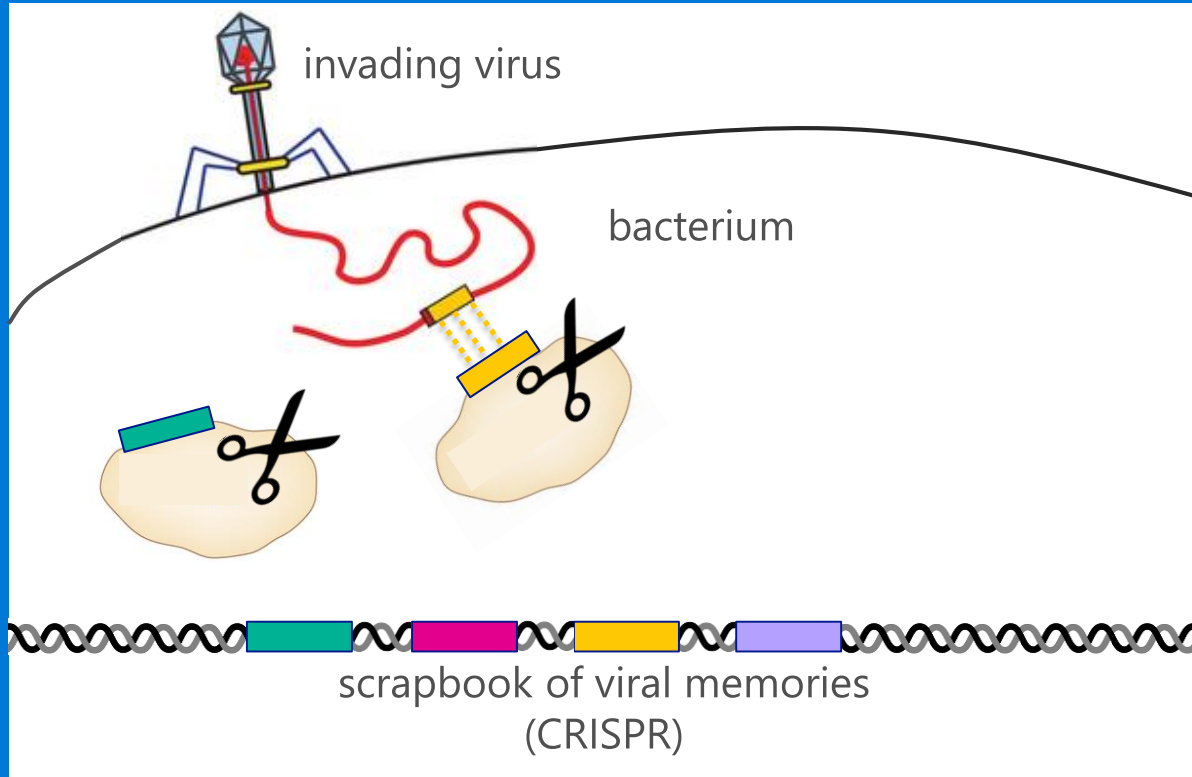
Image sources:

<https://www.broadinstitute.org/news/5393> (scissor image)

<http://www.the-scientist.com/?articles.view/articleNo/31325/title/How-Probiotic-Yogurt-Works/> (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



2 Cut & paste mechanism

1 Viral scrapbook

Image sources:

http://www.nature.com/nature/journal/v519/n7542/images_supplementary/nature14237-sf10.jpg

<http://2013.igem.org/wiki/images/1/1b/UBC-CRISPR-Mechanism-Out.png>

<http://images.clipartpanda.com/scissors-clipart-McLKp5Eca.png>

Machine learning predictive modelling for CRISPR

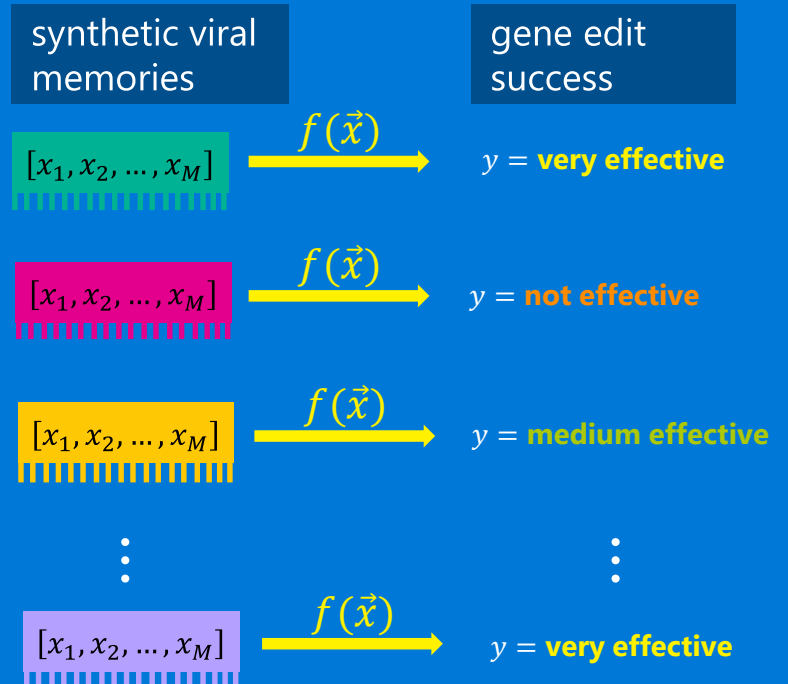
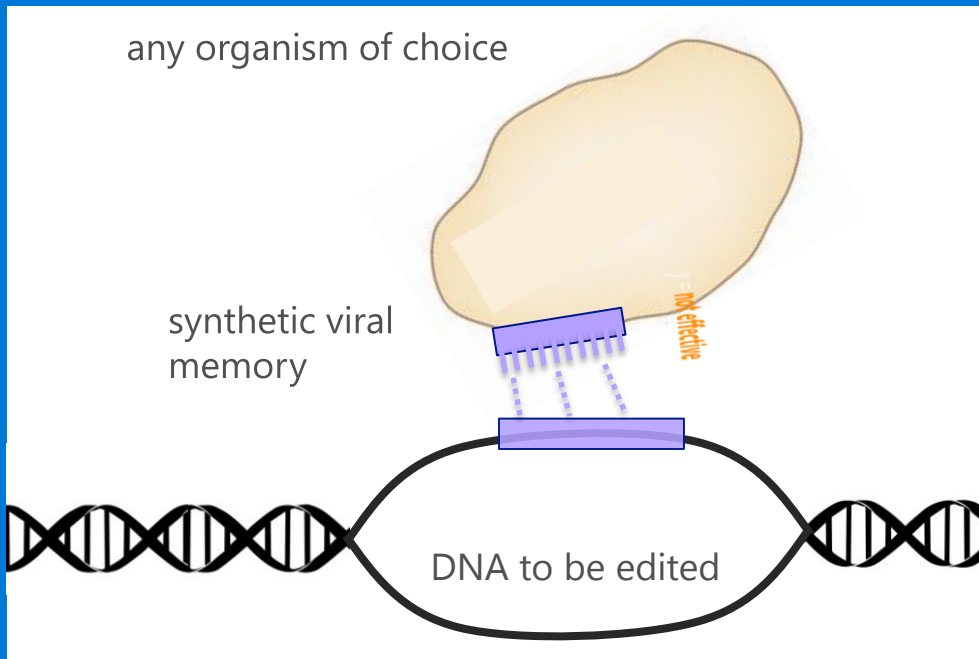


Image sources:

<http://techcrunch.com/2015/05/13/the-genome-engineering-revolution/>

<http://uicdesign.com/des150-s14c/wp-content/uploads/2014/02/dna.jpg>

Tools and Papers

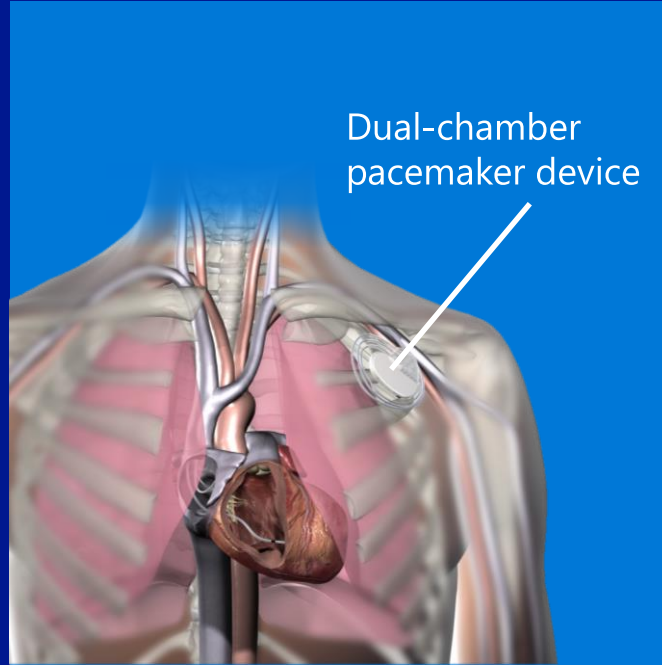
Prediction server on Azure ML

<http://research.microsoft.com/en-us/projects/azimuth>

[1] J.Doench, M. Sullender, M. Hegde, E. W. Vaimberg, I. Smith, C. Wilen, R. Orchard, N. Fusi, J. Listgarten, H. W. Virgin, D. Root, Optimized sgRNA design to maximize activity and minimize off-target effects for genetic screens with CRISPR-Cas9 (in revision),

[2] N.Fusi, I. Smith, J. Doench, J. Listgarten, *In Silico* Predictive Modelling of CRISPR/Cas9 guide efficiency (in review, and on *bioRxiv* June 2015, <http://dx.doi.org/10.1101/021568>)

Safe Cyber-Physical Systems



People

Verification & OS



Ethan Jackson



Chris Hawblitzel



Shaz Qadeer

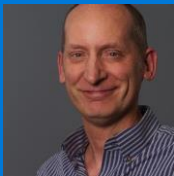


Ben Zorn

Hardware Design

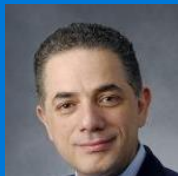


Alex Ching



Patrick Therien

UAS & Sensing



Shawn Keshmiri



Vijay Kumar



Ashish Kapoor



Ranveer Chandra

System Integration



Janos Sztipanovits



Sandeep Neema

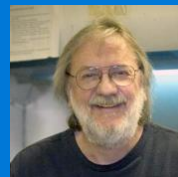
Biological Data



Douglas Norris



Anandasankar Ray



James Pipas



Eamonn Keogh

Internet of Things



Mike Chieh-Jan
Liang



Feng Zhao



Johns Hopkins
University



UC Riverside



University
of Kansas



University of
Pennsylvania



University
of Pittsburgh



Vanderbilt
University

Safe Cyber-Physical Systems

Safe and smart
autonomy



interacting with the
physical world at scale

Safety, From the Ground Up

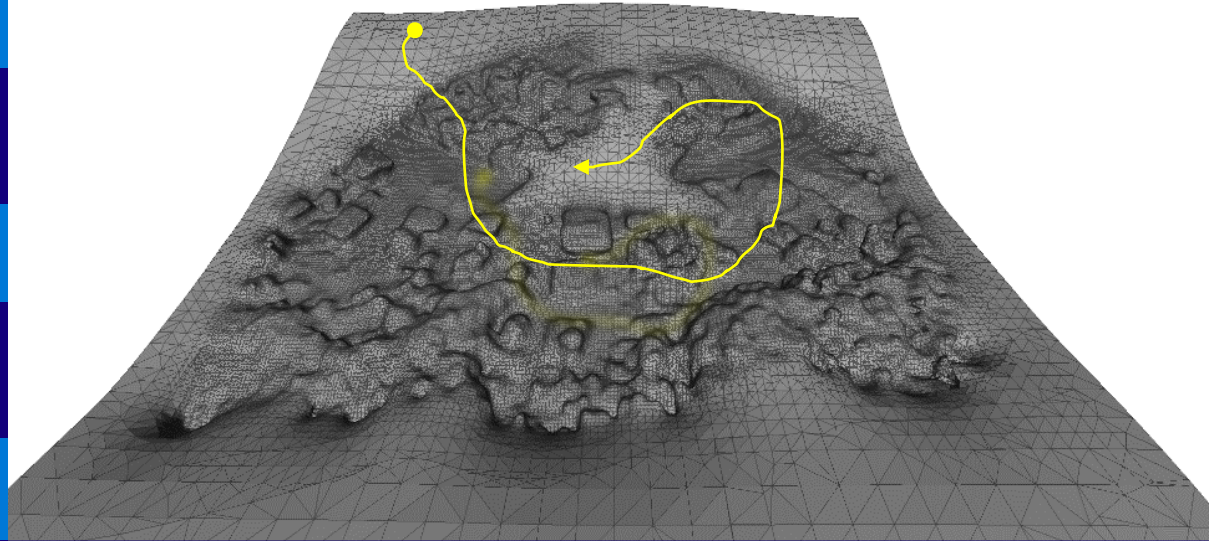
High-level Planning

Safe despite limited power, external disturbances,

Correct Control

Robust Sensing

Secure OS



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

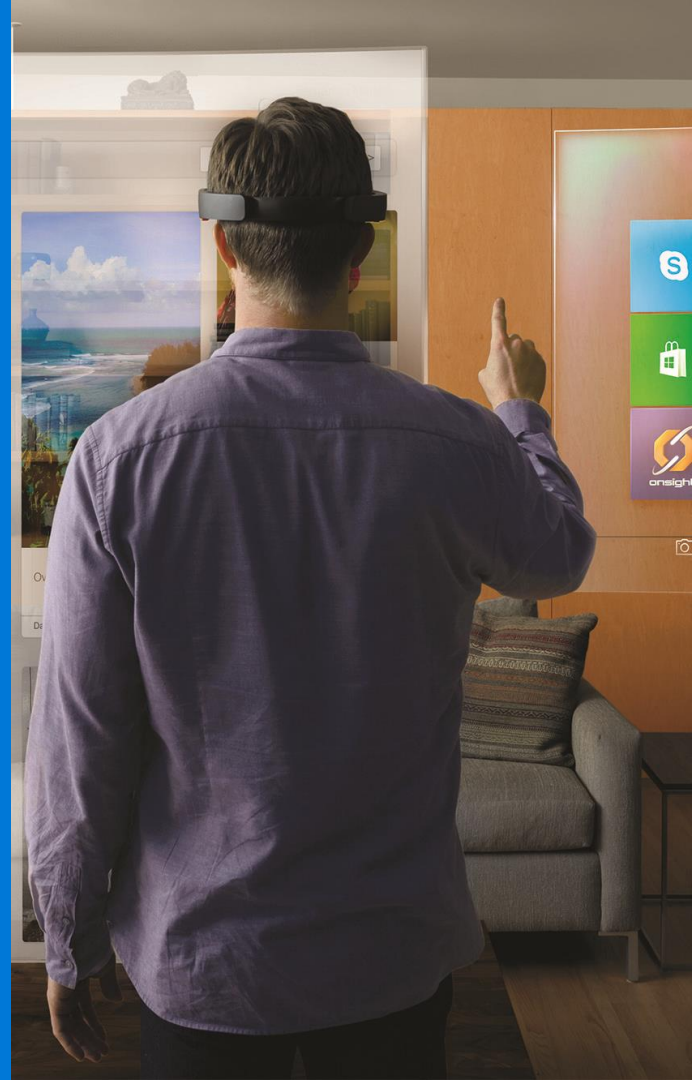
Go beyond the screen and bring ideas to life

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

