# Abe Davis

Assistant Professor
Department of Computer Science
Cornell University

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## Education

2020-Present **Assistant Professor**, *Cornell University Department of Computer Science*.

2019-2020 **Postdoc**, *Cornell Tech*.
- Advisers: Noah Snavely & Serge Belongie

2016-2019 **Postdoc**, *Stanford University*.
- Adviser: Maneesh Agrawala
- Funding: Brown Institute for Media Innovation Magic Grants

2010-2016 **PhD, Electrical Engineering and Computer Science**, *Massachusetts Institute of Technology*.
- Adviser: Frédo Durand
- Thesis: "Visual Vibration Analysis"
- Funding: Mathworks Fellowship, National Science Foundation Graduate Research Fellowship

2010–2012 **MS, Electrical Engineering and Computer Science**, *Massachusetts Institute of Technology*.
- Adviser: Frédo Durand
- Thesis: "Unstructured Light Fields"

2006–2010 **BS, Computer Science**, *Stanford University*, (with honors).
- Thesis: "Interactive Hand-held Light Field Capture"

## Research Experience

Sept 2020 to Present **Cornell University**, *Graphics, Vision, HCI, Computational Imaging, AR/VR*.
*Assistant Professor:* I am teaching and starting a research group.

Oct 2019 to Sept 2020 **Cornell Tech**, *Computer Vision, AR/VR*.
*Postdoc:* Short postdoc to help build connections between Cornell Tech and Ithaca

Sept 2016 to Oct 2019 **Stanford University**, *HCI & Graphics Groups*.
*Postdoc:* Conducting research and helping advise students in Computer Graphics, Vision, and Human-Computer Interaction. (PI: Maneesh Agrawala)

2010–2016 **Massachusetts Institute of Technology**, *Computer Graphics and Vision Groups*.
*Graduate Research Assistant:* Developed new computational photography systems, algorithms for image-based rendering and light field capture, and techniques for visual vibration analysis. (Adviser: Frédo Durand)

2014 **NVIDIA Research**.
*Summer Intern:* Research intern, Visual Computing Group, focused on SLAM and computational photography.

2011 **Adobe Research**.
*Summer Intern:* Research intern, Creative Technologies Lab, focused on image-based rendering.

2008-2010 **Stanford University Computer Graphics Lab**.
*Undergrad researcher:* Conducted research in computer graphics and computational photography as part of Marc Levoy's lab. Focused on augmented reality, image-based rendering, and image processing.

2006-2007 **Firaxis Games**.
*Summer Intern:* Game and automated testing tools developer for "Sid Meier's Civilization Revolution!" and "Sid Meier's Railroads!"

2006 **Johns Hopkins Computer Graphics Lab**.
*High school researcher:* Developed a technique for collision detection on GPUs using bounding volume hierarchies encoded into image pyramids.

## Select Awards

2020 **Best Paper Nominee for Visual Chirality, CVPR 2020**.

2018 **Brown Institute for Innovation in Media Magic Grant for "Paraframe"**.

2017 **ACM SIGGRAPH Dissertation Award Runner-up**.

2017 **Brown Institute for Innovation in Media Magic Grant for "Visual Beat"**.

2017 **IWSHM 2017 Structural Health Monitoring in Action Award**.

2016 **George M. Sprowls Award for Best PhD Thesis in Computer Science at MIT**.

2016 **MIT 100K Pitch Competition Finalist**.

2016 **Forbes "30 under 30" in Science**.

2016 **Business Insider "The 8 most innovative scientists in tech and engineering"**.

2011 **NSF Graduate Reasearch Fellow**.

2011 **Mathworks Fellow**.

2011 **Optical Society of America Color Constancy Competition**, *(3rd Place)*.

2010 **Eurographics 2010, Second Best Paper**.

2009 **Stanford CS348B Annual Rendering Competition**, *(Grand Prize)*.
*Featured in the textbook *Physically Based Rendering: From Theory to Implementation*

2006 **Intel Science Talent Search**, *(7th Place)*.

# Publications

2023 Mackenzie Leake, Kathryn Jin, Abe Davis, and Stefanie Mueller. *Institches: Augmenting sewing patterns with personalized material-efficient practice*. ***ACM Conference on Human Factors in Computing Systems (CHI 2023)***.

2022 Ruyu Yan, Jiatian Sun, Longxiulin Deng, and Abe Davis. *Recapture: Ar-guided time-lapse photography*. ***ACM Symposium on User Interface Software and Technolog (UIST 2022)***.

2021 Mackenzie Leake, Gilbert Bernstein, Abe Davis, and Maneesh Agrawala. *A mathematical foundation for foundation paper pieceable quilts*. ***SIGGRAPH 2021 (accepted)***.

2020 Zhiqiu Lin, Jin Sun, Abe Davis, and Noah Snavely. *Visual chirality*. ***IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2020)***, *(Selected for Oral, Best Paper Nominee)*.

2020 Zhengqi Li, Wenqi Xian, Abe Davis, and Noah Snavely. *Crowdsampling the plenoptic function*. ***Proc. European Conference on Computer Vision (ECCV 2020)***, *(Selected for Oral)*.

2020 Harald Haraldsson, Søren Skovsen, Ser-Nam Lim, Steve Marschner, Serge Belongie, and Abe Davis. *Head-mounted augmented reality for guided surface reflectance capture*. ***CVPR Workshop on Computer Vision for Augmented and Virtual Reality***.

2020 Sor e n Skovsen, Harald Haraldsson, Abe Davis, Henrik Karstoft, and Serge Belongie. *Decoupled localization and sensing with hmd-based ar for interactive scene acquisition*. ***CVPR Workshop on Computer Vision for Augmented and Virtual Reality***.

2018 Abe Davis and Maneesh Agrawala. *Visual rhythm and beat*. ***SIGGRAPH 2018***.

2017 Mackenzie Leake, Abe Davis, Anh Truong, and Maneesh Agrawala. *Computational video editing for dialogue-driven scenes*. ***SIGGRAPH 2017***.

2017 Abe Davis, Katherine L. Bouman (co-first author), Justin G. Chen, Michael Rubinstein, Oral Buyukozturk, Fredo Durand, and William T. Freeman. *Visual vibrometry: Estimating material properties from small motions in video*. ***IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)***.

2017 Abe Davis, Justin G. Chen, Oral Buyukozturk, Frédo Durand, and Doug L. James. *Structural health monitoring from the window seat of a passenger airplane*. ***11th International Workshop on Structural Health Monitoring (IWSHM 2017)***.

2016 Neal Wadhwa, Hao-Yu Wu, Abe Davis, Michael Rubinstein, Eugene Shih, Gautham J. Mysore, Justin G. Chen, Oral Buyukozturk, John V. Guttag, William T. Freeman, and Frédo Durand. *Eulerian video magnification and analysis*. ***Communications of the ACM***.

2016 Lukas Murmann, Abe Davis, Jan Kautz, and Frédo Durand. *Computational bounce flash for indoor portraits*. ***SIGGRAPH Asia 2016***.

2016 Abe Davis. *Visual Vibration Analysis*. PhD thesis, Massachusetts Institute of Technology, Sep 2016, **MIT Sprowls Award | *Runner-up, SIGGRAPH Dissertation Award**.

2016 Oral Buyukozturk, Justin G Chen, Neal Wadhwa, Abe Davis, Frédo Durand, and William T Freeman. *Smaller than the eye can see: Vibration analysis with video cameras*. ***19th World Conference on Non-Destructive Testing (WCNDT 2016)***.

2015 Abe Davis, Justin G. Chen, and Frédo Durand. *Image-space modal bases for plausible manipulation of objects in video*. ***SIGGRAPH Asia 2015***.

2015 Abe Davis, Katherine L. Bouman (co-first author), Justin G. Chen, Michael Rubinstein, Fredo Durand, and William T. Freeman. *Visual vibrometry: Estimating material properties from small motion in video*. ***IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2015)***, *(Selected for Oral Presentation)*.

2015 Justin G Chen, Neal Wadhwa, Abe Davis, Frédo Freeman Durand, T William, and Oral Buyukozturk. *Long distance video camera measurements of structures*. ***10th International Workshop on Structural Health Monitoring (IWSHM 2015)***.

2015 Justin G Chen, Abe Davis, Neal Wadhwa, Frédo Durand, William T. Freeman, and Oral Buyukozturk. *Video camera-based vibration measurement for condition assessment of civil infrastructure*. ***International Symposium Non-Destructive Testing in Civil Engineering (NDT-CE 2015)***.

2014 Lixin Shi, Haitham Hassanieh, Abe Davis, Dina Katabi, and Fredo Durand. *Light field reconstruction using sparsity in the continuous fourier domain*. ***ACM TOG | SIGGRAPH 2015***.

2014 Abe Davis, Michael Rubinstein, Neal Wadhwa, Gautham J. Mysore, Frédo Durand, and William T. Freeman. *The visual microphone: Passive recovery of sound from video*. ***SIGGRAPH 2014***.

2013 Abe Davis. *Unstructured light fields*. Master's thesis, Massachusetts Institute of Technology, Sep 2013.

2012 YiChang Shih, Abe Davis, Samuel W. Hasinoff, Frédo Durand, and William T. Freeman. *Laser speckle photography for surface tampering detection*. ***IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2012)***, **Google Student Travel Award**.

2012 Abe Davis, Marc Levoy, and Fredo Durand. *Unstructured light fields*. ***Computer Graphics Forum | Eurographics 2012***.

2010 Andrew Adams, Jongmin Baek, and Abe Davis. *Fast high-dimensional filtering using the permutohedral lattice*. ***Computer Graphics Forum | Eurographics 2010***.

# Patents (As Myers Abraham Davis)

Issued:

**"Laser speckle photography for surface tampering detection"**, *US Patent 9,131,118*, Yichang Shih, Samuel Hasinoff, William T. Freeman, Frédo Durand, and **Abe Davis** .

**"Method and Apparatus for Recovering Audio Signals from Images"**, *US patent No. 10129658*, Michael Rubinstein, Frederic Durand, William T. Freeman, Neal Wadhwa, and **Abe Davis**.

Pending:

**"Systems and Methods for Dancification"**, *US Application 62/685,743*, **Abe Davis** and Maneesh Agrawala.

**"Video-based identification of operational mode shapes."**, *US Application 15/012,835*, Oral Buyukozturk, William T. Freeman, Frédo Durand, Neal Wadhwa, Justin G. Chen, and **Abe Davis**.

**"Methods and apparatus for modeling deformations of an object"**, *US Patent Application 15/068,357*, **Abe Davis** and Frédo Durand, Justin G. Chen.

**"Methods and devices for measuring object motion using camera images"**, *US Patent Application 62/382,709*, Oral Buyukozturk, William T. Freeman, Frédo Durand, Neal Wadhwa, Justin G. Chen, and **Abe Davis**.

# Teaching

Spring 2020 **Cornell CS6682: Computation for Content Creation**, *Instructor*, A graduate course covering a breadth of topics from graphics, vision, HCI, signal processing, and music—all related to computational tools for content creation..

Fall 2020 **Cornell CS4620/5620/4621/5621: Intro to Computer Graphics**, *Co-Instructor*.

Spring 2020 **Cornell CS5670: Intro to Computer Vision**, *Co-Instructor*.

2016 **Stanford EE368/CS232 "Digital Image Processing"**, *Guest Lecturer*, Guest lecturer on computational photography and visual vibration analysis.

2012–2016 **MIT 6.882 (Computational Photography)**, *Guest Lecturer*, Guest lecturer on light fields and image based rendering.

2013 **MIT 6.882 (Computational Photography)**, *Teaching Assistant*, Ran office hours, prepared and graded assignments, created and presented one of the course lectures.

2008 **Stanford CS248 (Intro to Computer Graphics)**, *Teaching Assistant*, Gave some lectures, held office hours and review sessions, helped design assignments and exams.

2005 **Baltimore Polytechnic, Computer Programming**, *Instructor*, Created and taught a free computer programming class for Baltimore City public high school students.

2005 **Baltimore Algebra Project**, *Algebra Tutor*, Tutored inner-city kids from Robert Poole Elementary (shut down in 2009) in algebra.

## Select Invited Talks

2017 **ProVideoCoalition.com Webinar**.
Title: "The Beginning of the End for Assistant Editors"

2017 **Unity Technologies**.
Title: "Computational Video Editing"

2017 **Stanford Center for Image Engineering (SCIEN)**.
Title: "Visual Vibration Analysis"

2016 **Microsoft Future Decoded 2016**.
Keynote, $10,000^{+}$ in attendance | Title: "Vision Beyond the Visible"

2016 **Google Daydream Team**.
Title: "Dynamic Video"

2016 **FMX 2016 Computational Cinematography**.
(Talk and Panel)

2016 **2016 World Game Protection Conference (WGPC)**.
Keynote Speaker

2015 **TED 2015**.
Title: "Abe Davis: New video technology that reveals an object's hidden properties"

## Committees

2021 **SIGGRAPH 2021 Technical Papers Committee**.

2019 **SIGGRAPH Asia 2019 Technical Papers Committee**.

## Select Press Coverage

My work has been featured in most major media outlets that cover science and technology. Below are a few examples of coverage for different projects. More can be found on the press coverage page of my website.

General:

2016 **Forbes**, *"30 under 30"*.

2015 **Business Insider**, *"The 8 most innovative scientists in tech and engineering"*.

Visual Microphone:

2014 **The Washington Post**, *"MIT researchers can listen to your conversation by watching your potato chip bag "*.

2014 **TIME**, *"MIT Researchers Can Spy on Your Conversations With a Potato-Chip Bag"*.

Interactive Dynamic Video:

2016 **IEEE Spectrum**, *"Beyond Pokémon GO: The Secret to a Better Augmented Reality Experience"*.

2016 **NBC News**, *"Want More Life in Your Pokemon? Now They Can React in the Real World"*.

2016 **Fox News**, *"Breakthrough lets you touch videos instead of just watch"* .

Computational Video Editing:

2017 **Engadget**, *"AI film editor can cut scenes in seconds to suit your style"*.

2017 **Digital Trends**, *"Adobe and Stanford just taught AI to edit videos — with impressive results"*.

## Select Videos

I frequently create videos about my research and post them on line. Many can be found at this link. A few examples, as well as my 2015 TED talk, are also provided below:

(* indicates >1M views)

2020 **Visual Chirality**, *https://youtu.be/gc5IvTozU9M*.

2020 **Crowdsampling the Plenoptic Function**, *https://youtu.be/MAVFKWX8LYo*.

2018 **Visual Rhythm and Beat**, *youtube.com/watch?v=K3z68mOLbNo*.

2017 **Computataional Video Editing**, *youtube.com/watch?v=tF43Zqoue20*.

* 2016 **Interactive Dynamic Video**, *youtube.com/watch?v=4f09VdXex3A*.

2016 **Pokemon GO and Interactive Dynamic Video**, *youtube.com/watch?v=9f1fCCb3hVg*.

* 2014 **The Visual Microphone**, *youtube.com/watch?v=FKXOucXB4a8*.

* 2015 **TED 2015** ***New video technology that reveals and object's hidden properties***, *ted.com/talks/abe_davis_new_video_technology_that_reveals_an_object_s_hidden_properties*.