

COVID Information Commons: Unlocking COVID-19 Insights with Data Science

Florence D. Hudson

Executive Director, Northeast Big Data Innovation Hub
PI - COVID Information Commons

Many thanks to Aryan Naik for preparing this presentation.

Agenda

- COVID Information Commons
- Data Science Tools and Techniques for COVID-19
- Future directions

NSF Award and PI Database Search

[Home](#)

NSF COVID Awards & PI Database

Search results for **rapid covid** found the following **990** results.[Download Results as CSV](#)

Projects ▾

Principal Investigator

Institution

[RAPID Collaborative: Relevance of linguistic and cross-cultural appropriateness in communication during the pandemic](#)

Award Abstract #2033712

Effective response to the COVID-19 pandemic depends on linguistic and cultural factors as well as social and economic ones. This is a special concern for indigenous and immigrant communities for whom information about the pandemic and important... [SHOW MORE](#)

Liliana Sanchez

University of Illinois at Chicago

[RAPID Collaborative: Relevance of linguistic and cross-cultural appropriateness in communication during the pandemic](#)

Award Abstract #2033739

Effective response to the COVID-19 pandemic depends on linguistic and cultural factors as well as social and economic ones. This is a special concern for indigenous and immigrant communities for whom information about the pandemic and important... [SHOW MORE](#)

Elena Koulidobrova

Central Connecticut State University

[RAPID/Collaborative Research: Quantifying Social Media Data for Improved Modeling of Mitigation Strategies for the COVID-19 Pandemic](#)

Award Abstract #2029733

This Rapid Response Research (RAPID) grant will support research that will contribute new knowledge related to modeling social behavior and community activity during the COVID-19 pandemic, as well as future pandemics with COVID-19 characteristics.... [SHOW MORE](#)

Anastasia Angelopoulou

Columbus State University

[Education and Dissemination of Mitigation Strategies](#)

Medicine Research

Southern Methodist University

FILTER BY KEYWORD

 Filter Results[Clear Filter](#)

> Directorate

> Division

> Institution

> State/Territory

> Region

> PI Name

> NSF Program Officer

> NSF Program Name

> NSF Program Reference Code

> NSF Program Element Code

> Start/End Date

01/01/2020 – 12/31/2023

> Award Amount

\$5,445.00 – \$1,444,390.00

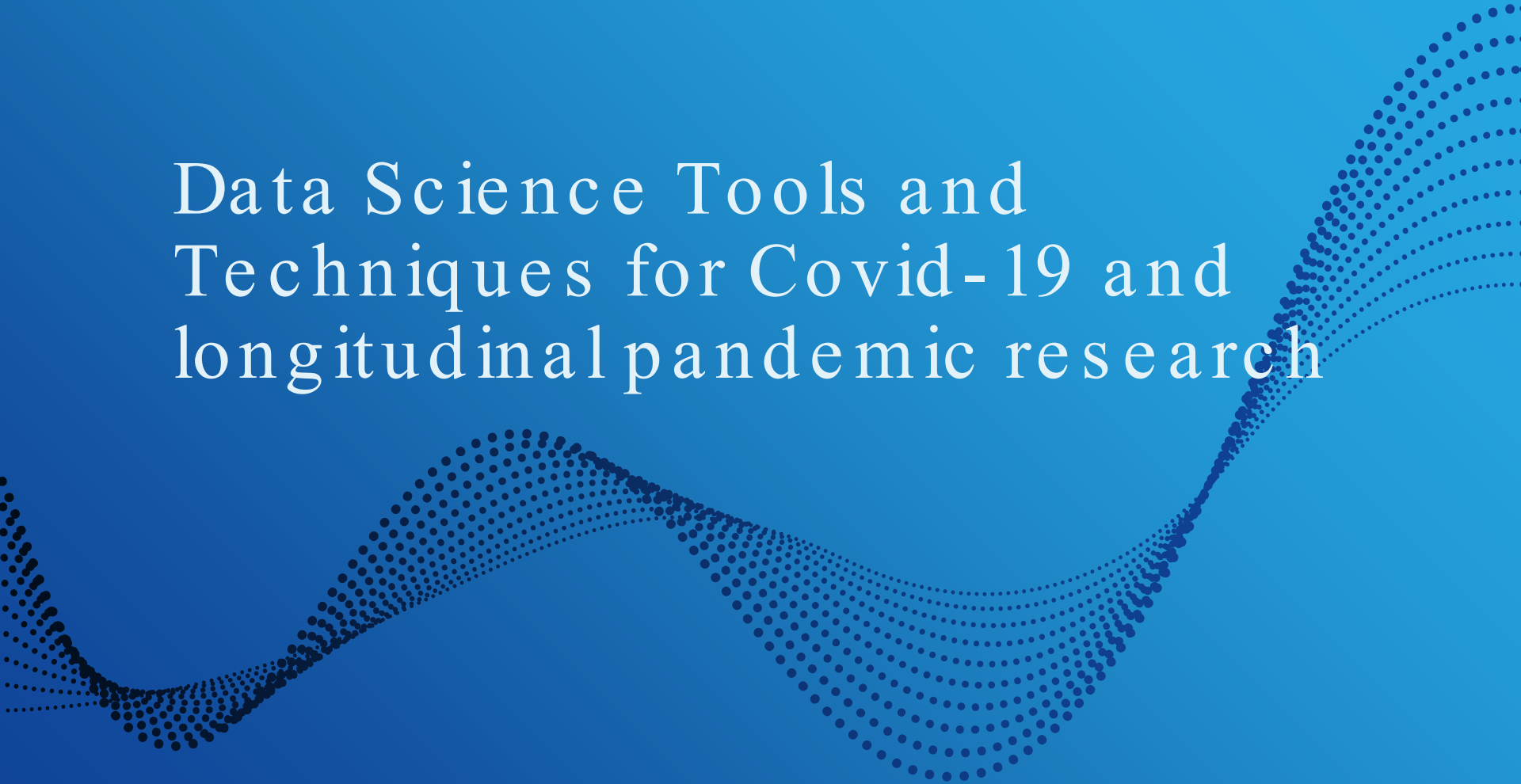
The COVID Information Commons

The COVID Information Commons (CIC) is a portal and community to facilitate knowledge sharing and collaboration across COVID research efforts, funded by the NSF Convergence Accelerator.

The CIC serves as a resource for researchers, students and decision-makers from academia, government, nonprofits and industry to identify collaboration opportunities, leverage each other's research findings, and accelerate research to mitigate the societal impacts of the COVID-19 pandemic.



Data Science Tools and Techniques for Covid-19 and longitudinal pandemic research



Methodology

Papers considered in this review were obtained from COVID Information Commons NSF COVID awards and PI Database. Search query of machine learning.

The screenshot shows the COVID Information Commons website. At the top, a search bar contains the text 'machine learning' with a blue 'Search' button. Below the search bar, the website header includes the text 'COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK' and 'COVID INFORMATION COMMONS'. A navigation menu lists 'About', 'CIC Search Tools', 'Meet the Researchers', 'Opportunities & Resources', 'Events', 'News', 'Team', and 'Contact'. Below the navigation menu, a breadcrumb trail shows 'Home' and 'COVID Awards & PI Database'. The main content area displays search results for 'rapid covid and machine learning', indicating 96 results. A 'Download Results as CSV' button is visible. A table lists search results with columns for 'Projects', 'Principal Investigator', and 'Institution'. The first result is 'EAGER: Collaborative Research: Understanding Human Behaviors and Mental Health using Federated Machine Learning on Smart Phones' by Ruoming Jin at Kent State University. A 'Filter Results' section on the right allows filtering by keyword, with 'machine learning' entered. Below this, there are filter options for 'Filter Results' and 'Clear Filter', and a list of filters including 'Directorate', 'Division', and 'Institution'.

COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

COVID INFORMATION COMMONS

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Home COVID Awards & PI Database

Search results for rapid covid and machine learning found the following 96 results.

Download Results as CSV

Projects	Principal Investigator	Institution
EAGER: Collaborative Research: Understanding Human Behaviors and Mental Health using Federated Machine Learning on Smart Phones Award Abstract #2041065 ...ate action. This project will develop a federated machine-learning (FL) framework and application on mobile device for understanding human behaviors and mental health. The planned research will synergize interdisciplinary research and particularly pu... SHOW MORE	Ruoming Jin	Kent State University

FILTER BY KEYWORD

machine learning

Filter Results Clear Filter

> Directorate

> Division

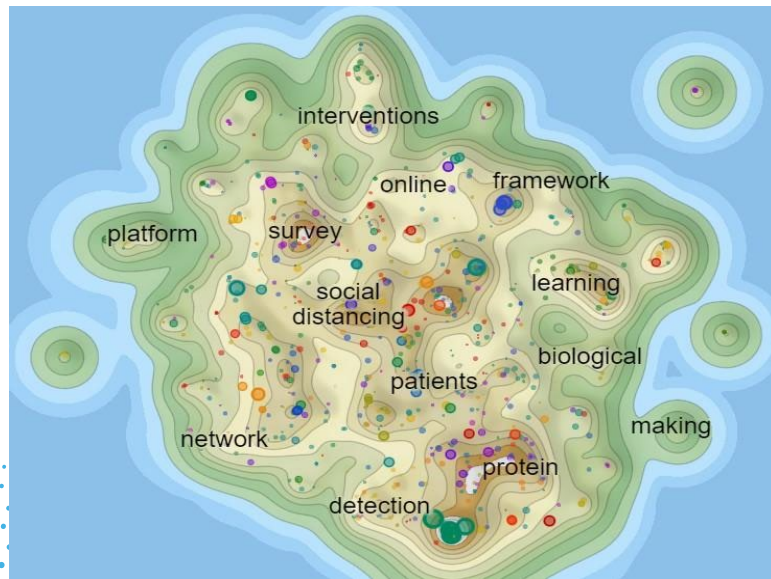
> Institution

Research in the age of COVID

Throughout the ongoing Covid -19 pandemic data scientists and machine learning experts have attempted to apply machine learning algorithms to real world data as fast as possible. The NSF has supported this effort through RAPID Awards. RAPID awards have greatly decreased the amount of time needed for researchers to be given funding from months to mere days. So far 990 of these RAPID Awards have been accounted for in the COVID Information Commons.

COVID Research Explorer Machine Learning (ML) Maps

Topic: Machine Learning

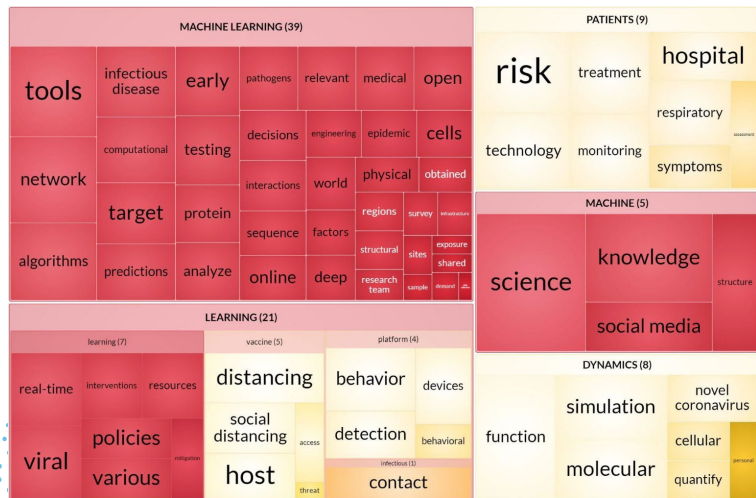


Topic: Deep Learning

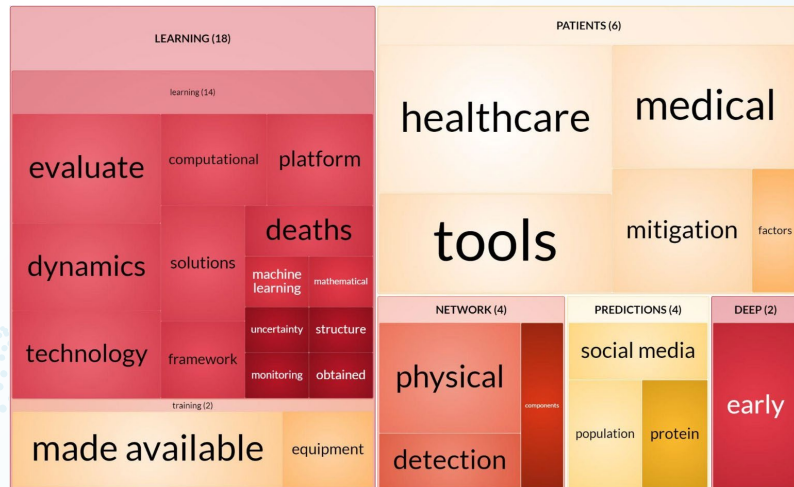


ML clusters of NSF COVID Awards

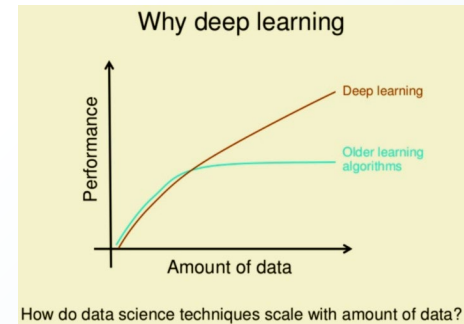
Topic: Machine Learning



Topic: Deep Learning

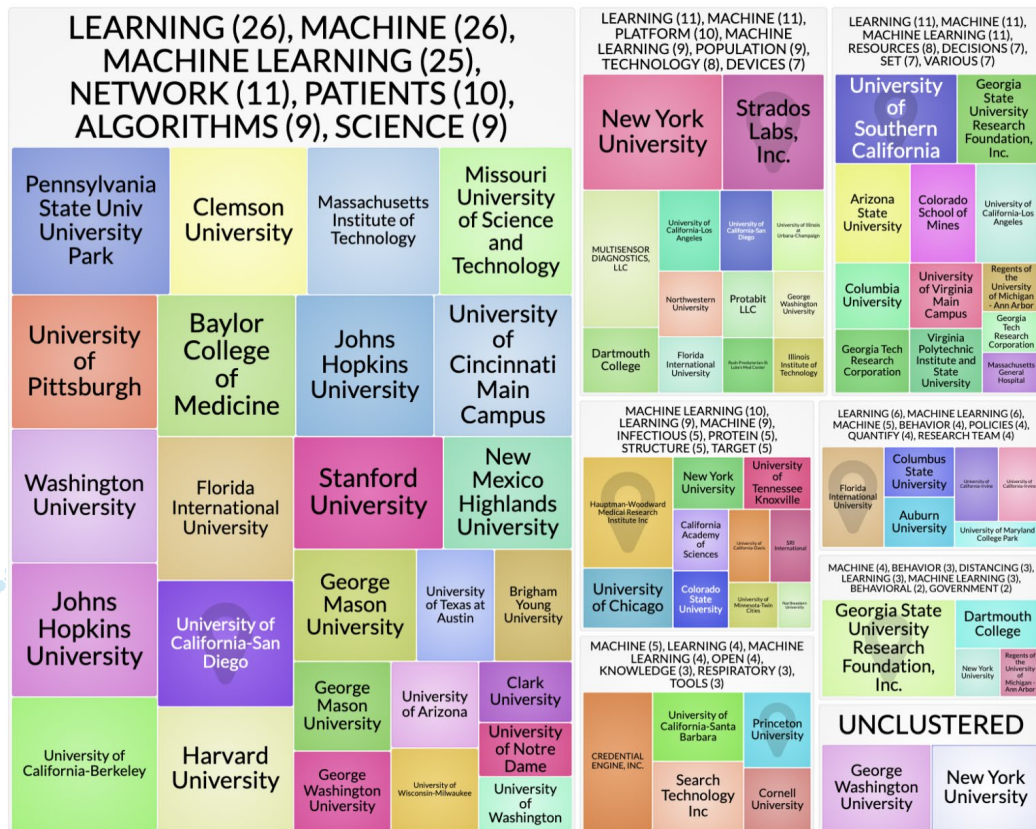


ML vs . Deep Learning

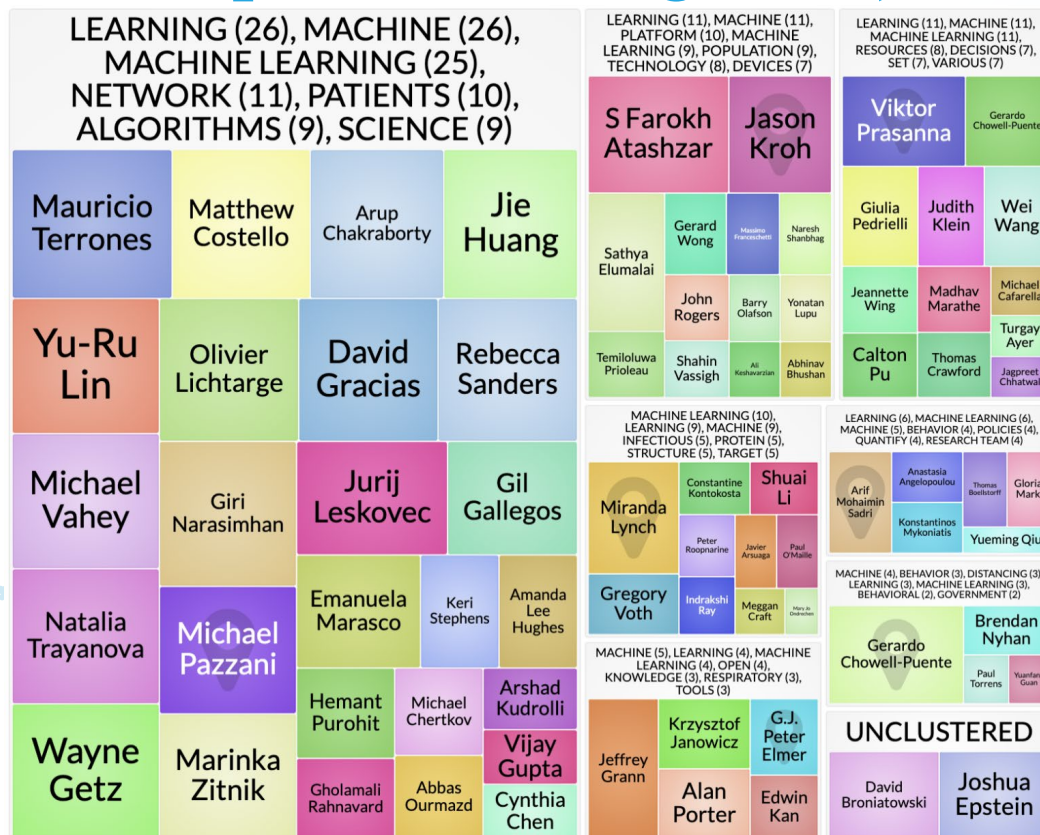


- “Deep Learning is a subset of Machine Learning that achieves great power and flexibility by learning to represent the world as nested hierarchy of concepts, with each concept defined in relation to simpler concepts, and more abstract representations computed in terms of less abstract ones.”
- Data sets with a larger amount of data can benefit from deep learning techniques.
- With the larger datasets of COVID deaths and general healthcare, deep learning can give better performance.

COVID-19 Machine Learning Research funded by NSF (by Institution)



COVID-19 Machine Learning Research (By Principal Investigator)

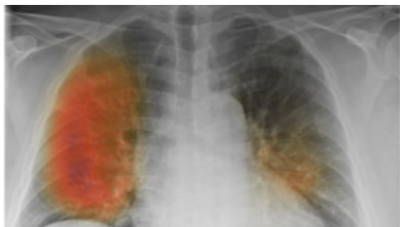


Focus of COVID Machine Learning Research in the CIC

- Prediction cardiac response, population spread, host pathogen protein-protein interactions
- Resource allocation
- Epidemiology analysis
- Analysis of CT Scans
- Presymptomatic Detection
- Response Enhancement
- Cyber Hostility online
- And more

CIC Lightning Talks

- Monthly CIC PI Lightning Talk Webinars have attracted over 800 participants since July 2020, plus 2,400 additional YouTube views.
- Lightning talks allow Principal Investigators (PIs) to explain their research further in the form of a video. Talks are hosted by the COVID Information Commons.



Michael Pazzani and Albert Hsiao, UC San Diego

Explainable Machine Learning for Analysis of COVID-19 Chest CT

COVID INFORMATION COMMONS

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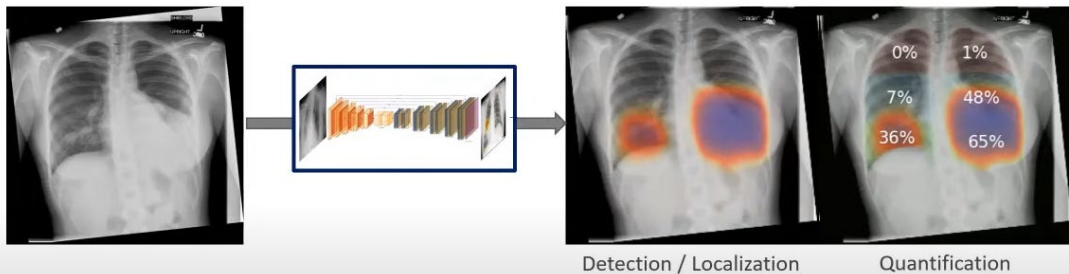
[Home](#) [Meet the Researchers](#)

COVID-19 Research Lightning Talks

Meet the researchers studying COVID-19. Visit our [Events](#) page to register for upcoming monthly lightning talks and our [Webinar Videos](#) page to watch full recordings of past events.

Explainable AI

- AI can be used heavily in a number of different domains, however in order to be effective we must build trust with professionals already in these fields.
- Explainable AI helps to build trust, as it does not act as a “black box”. To build better AI we must build AI for humans.



UC San Diego
HALICIOĞLU DATA SCIENCE INSTITUTE



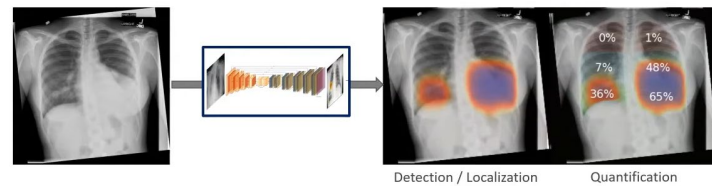
UC San Diego
Department of Radiology



AI for COVID-19 Pneumonia

Multiple strategies for AI explainability

- U-net (Segmentation) vs. ResNet, etc... (Classification)
- LIME - Local Interpretable Model-Agnostic Explanation
- Layerwise Relevance Propagation
- CDeepEx: Contrastive Deep Explanations



SBIR - Small Business Innovation Research - is also focused on COVID.

The CIC NSF Awards Database is not limited to just RAPID awards.

Projects	Principal Investigator	Institution
SBIR Phase I: Development of a Low-cost, Scalable Sampler for Airborne COVID-19 Virus Detection Award Abstract #2027696 The broader impact/commercial potential of this Small Business Innovation Research (SBIR) Phase I project is the development of an accurate, robust tool for sampling airborne viruses, bacteria, fungi and other bioaerosols. Major deficiencies with... SHOW MORE	Patricia B Keady	Aerosol Devices Inc.
SBIR Phase I: Automated Medical Supply Dispenser to Decrease Spread of COVID-19 to Healthcare Professionals Award Abstract #2014255 The broader impact/commercial potential of this Small Business Innovation Research (SBIR) Phase I project is to protect healthcare workers and conserve personal protective equipment (PPE) through automated medication delivery. The healthcare system... SHOW MORE	Cheryl Lohman	MEDAPPTIC, LLC

▼ NSF Program Name

SBIR Phase I

SBIR Phase I

> NSF Program Reference
Code

Future Response Development

- Utilizing machine learning we can gather data that can be used for future pandemic responses.
- RAPID awards are currently in the areas of reducing the spread of COVID-19 in small communities, developing new machine learning models for protein-protein interactions, and predicting antibody binding for COVID-19 variants.
- All of this amazing research can be repurposed in the future.

Research to Tackle Pandemics

- As we continue into a new phase of this pandemic with the rise of the delta variant it is important to review research done in the earlier waves.
- Combined with ongoing research we can formulate a far better response to the ongoing pandemic and understand what areas still need more research.
- NSF is planning Predictive Intelligence for Pandemic Prevention (PIPP) grants to address future pandemic challenges.

CIC Student Paper Challenge

- COVID-19 has created societal challenges for communities around the world. Collaboration and knowledge sharing are key to accelerating the research response to the pandemic's widespread impacts.
- Undergraduate college students from around the world participated in the inaugural 2021 CIC Undergraduate Student Paper Challenge.
- They leveraged the CIC and other resources to do research and submit papers, joining the research community addressing the COVID-19 pandemic.
- Winning papers are published on the CIC website, added to the Columbia University Academic Commons, and presented at a CIC event.
- Please contact info@covidinfocommons.net for more information.

2021 CIC Student Paper Challenge Winners



First Place: Jane Pan, Columbia University.

"Contradiction Detection of COVID-19 Randomized Controlled Trials via BERT Language Models"



Second Place: Samson Qian, University of California, San Diego.

"Generating Explanations for Chest Medical Scan Pneumonia Predictions" [🔗](#)



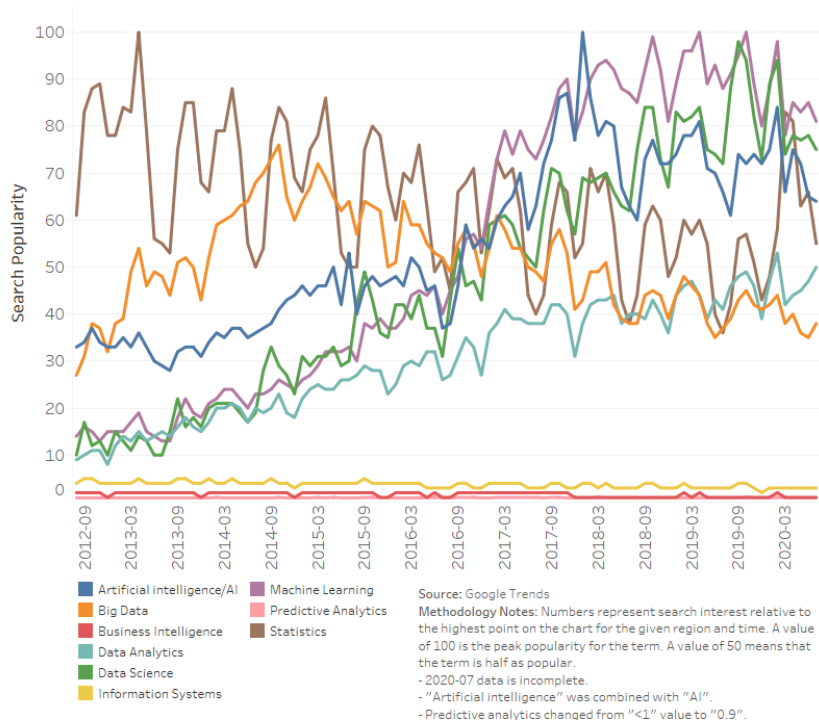
Third Place: Aditya Kulkarni, University of Minnesota.

"Human Mobility Patterns Linked to COVID-19 Prone Locations" [🔗](#)

Future of Data Science

- Data science is becoming more accessible as methods become easier to use and understand.
- Machine learning is being added to undergraduate programs.
- APIs will continue to make data science more accessible.

"Data-Related" Search Topics



Bibliography

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<https://covidinfocommons.datascience.columbia.edu/awards/2031548>

<https://covidinfocommons.datascience.columbia.edu/awards/2033921>

<https://covidinfocommons.datascience.columbia.edu/awards/2029885>

<https://covidinfocommons.datascience.columbia.edu/awards/2026809>

<https://covidinfocommons.datascience.columbia.edu/awards/2029603>

<https://covidinfocommons.datascience.columbia.edu/awards/2032264>

<https://covidinfocommons.datascience.columbia.edu/awards/2033772>

<https://towardsdatascience.com/why-deep-learning-is-needed-over-traditional-machine-learning-1b6a99177063?gi=dcbd91567642>

Thank you

The background features a solid blue gradient. Overlaid on this are several wavy, horizontal lines composed of small, dark blue dots. These lines create a sense of motion and depth, with some lines appearing more prominent than others, especially towards the right side of the frame.