

princeton university data science

princeton university data science represents a cutting-edge intersection of multiple disciplines aimed at extracting meaningful insights from complex data sets. As one of the leading institutions globally, Princeton University offers robust educational programs, pioneering research initiatives, and extensive resources dedicated to the advancement of data science. This article explores the comprehensive offerings of princeton university data science, highlighting key academic programs, research centers, faculty expertise, and career opportunities for students and professionals. The integration of statistics, computer science, and domain-specific knowledge forms the core of Princeton's approach to data science education and innovation. Additionally, the university's commitment to interdisciplinary collaboration fosters groundbreaking developments in machine learning, artificial intelligence, and data analytics. The following sections provide a detailed overview of princeton university data science's academic structure, research contributions, faculty leadership, and practical applications.

- Academic Programs in Data Science at Princeton University
- Research and Innovation in Princeton University Data Science
- Faculty and Leadership in Data Science
- Centers and Institutes Supporting Data Science
- Career Opportunities and Alumni Impact

Academic Programs in Data Science at Princeton University

Princeton University data science academic programs are designed to equip students with a strong foundation in computational and analytical skills. These programs emphasize a multidisciplinary curriculum that integrates computer science, statistics, mathematics, and domain-specific applications.

Undergraduate Programs

The undergraduate data science offerings at Princeton include courses in data analysis, machine learning, and statistical inference. Students have the opportunity to pursue concentrations in computer science with a focus on data science or enroll in interdisciplinary minors that combine data science principles with other fields such as economics, biology, or public policy.

Graduate and Professional Degrees

Graduate programs at Princeton University provide advanced training in data science methodologies and theoretical foundations. The Master's and Ph.D. tracks emphasize research-driven education with opportunities to work on real-world data challenges. Graduate students benefit from close mentorship

and access to state-of-the-art computational resources.

Curriculum Highlights

Core courses in Princeton University data science include:

- Introduction to Data Science and Analytics
- Machine Learning and Artificial Intelligence
- Statistical Methods for Data Analysis
- Big Data Systems and Infrastructure
- Ethics and Policy in Data Science

Research and Innovation in Princeton University Data Science

Research at Princeton University data science centers on developing novel algorithms, improving data-driven decision-making, and addressing societal challenges through data analysis. The university fosters a collaborative environment where faculty and students contribute to advancements in artificial intelligence, computational biology, and social data science.

Key Research Areas

Princeton's research initiatives cover diverse topics such as:

- Machine Learning and Deep Learning Technologies
- Computational Genomics and Biomedical Data Analysis
- Network Science and Graph Algorithms
- Data Privacy and Security
- Environmental and Climate Data Modeling

Collaborative Projects

The university encourages interdisciplinary projects that leverage data science techniques across fields like economics, neuroscience, and engineering. Collaborative research often involves partnerships with industry leaders and government agencies, enabling practical applications of theoretical advancements.

Faculty and Leadership in Data Science

Princeton University data science faculty represent a distinguished group of scholars and practitioners with expertise spanning machine learning, statistics, computer science, and applied mathematics. Their leadership drives both educational excellence and innovative research.

Notable Faculty Members

Leading professors at Princeton include experts known for contributions to algorithms, statistical theory, and artificial intelligence. These faculty members publish extensively in top journals and regularly present at international conferences, shaping the global data science landscape.

Faculty Roles and Contributions

Faculty members engage in mentoring students, developing new courses, and spearheading research initiatives. Their roles often extend to organizing workshops, seminars, and conferences that promote knowledge exchange in Princeton University data science and related fields.

Centers and Institutes Supporting Data Science

Several specialized centers and institutes at Princeton University provide infrastructure and intellectual resources that enhance the study and application of data science. These entities foster interdisciplinary collaboration and support cutting-edge research projects.

Princeton Data Science Institute

The Princeton Data Science Institute (PDSI) serves as the hub for research, education, and innovation in data science. It facilitates cross-departmental partnerships and offers resources such as computational tools, training programs, and funding for collaborative projects.

Other Supporting Institutes

Additional centers contributing to Princeton University data science include the Center for Statistics and Machine Learning, the Institute for Computational Science and Engineering, and various domain-specific labs focusing on areas such as genomics, social sciences, and environmental studies.

Career Opportunities and Alumni Impact

Graduates of Princeton University data science programs are highly sought after in academia, industry, and government sectors. The comprehensive training and research experience prepare them to excel in roles involving data analytics, machine learning, and decision science.

Career Paths

Common career trajectories for Princeton data science alumni include:

- Data Scientist and Machine Learning Engineer
- Quantitative Analyst and Statistician
- Research Scientist in Academia or Industry
- Data Analytics Consultant
- Policy Advisor and Public Sector Analyst

Alumni Contributions

Princeton's data science alumni have made significant impacts across technology firms, research institutions, and entrepreneurial ventures. Their work often drives innovation in artificial intelligence, healthcare analytics, financial modeling, and more, reflecting the university's commitment to advancing the field globally.

Frequently Asked Questions

What data science programs are offered at Princeton University?

Princeton University offers data science courses through its Department of Computer Science, the Department of Operations Research and Financial Engineering, and interdisciplinary programs that combine statistics, machine learning, and computational methods.

Does Princeton University have a dedicated data science major or concentration?

Princeton does not have a standalone data science major, but students can pursue concentrations related to data science within computer science, statistics, or interdisciplinary programs such as the Certificate in Data Science.

What research opportunities in data science are available at Princeton University?

Princeton provides numerous research opportunities in data science through its Princeton Institute for Computational Science and Engineering (PICSciE), faculty labs focusing on AI, machine learning, and data analytics, as well as collaborative projects across departments.

Are there any data science-related student organizations at Princeton University?

Yes, Princeton hosts student organizations such as the Princeton Data Science Club, which offers workshops, hackathons, and networking events for students interested in data science.

What resources does Princeton University provide for data science students?

Princeton offers resources including access to high-performance computing, data visualization tools, workshops, seminars, and a strong network of faculty experts in data science and related fields.

How competitive is admission to study data science-related fields at Princeton University?

Admission to Princeton University is highly competitive overall. Prospective students interested in data science-related fields should demonstrate strong backgrounds in mathematics, computer science, and analytical skills.

Can graduate students at Princeton pursue data science research or degrees?

Yes, graduate students can engage in data science research through various PhD programs in computer science, statistics, and operations research, and can tailor their studies to focus on data science topics under expert faculty guidance.

Additional Resources

1. Data Science Essentials: A Princeton Perspective

This book offers a comprehensive introduction to data science principles with a focus on methodologies taught at Princeton University. It covers foundational topics such as data wrangling, statistical inference, and machine learning. Readers will benefit from practical examples drawn from real-world datasets and Princeton-led research projects.

2. Statistical Learning and Data Analysis at Princeton

Exploring the intersection of statistics and data science, this text delves into advanced statistical models and their applications. It highlights the innovative approaches developed by Princeton's faculty and students, emphasizing predictive modeling and uncertainty quantification. The book also features case studies from diverse disciplines including economics, biology, and social sciences.

3. Machine Learning: Insights from Princeton Researchers

Authored by leading Princeton data scientists, this book presents state-of-the-art machine learning techniques. It covers supervised and unsupervised learning, deep learning architectures, and reinforcement learning. The content is enriched with examples from Princeton's academic projects and collaborations with industry.

4. Big Data Analytics with Princeton Expertise

Focusing on the challenges and opportunities in big data, this book discusses scalable algorithms and data infrastructure. It explains how Princeton's data science community tackles large-scale data processing, storage, and analysis. Readers will find practical guidance on leveraging cloud computing and distributed systems.

5. *Computational Data Science: Algorithms and Applications from Princeton*

This book bridges theory and practice by detailing computational algorithms essential to data science. Topics include optimization, graph algorithms, and numerical methods, all contextualized by Princeton research. The book serves as a valuable resource for students and professionals aiming to enhance their computational toolkit.

6. *Data Ethics and Privacy: The Princeton Approach*

Addressing the critical issues of data privacy and ethical use, this volume reflects Princeton's commitment to responsible data science. It explores frameworks for ethical decision-making, privacy-preserving technologies, and regulatory considerations. The book encourages readers to think critically about the societal impact of data-driven technologies.

7. *Network Science and Data Analysis at Princeton University*

This book focuses on the analysis of complex networks and relational data, a significant research area at Princeton. It covers network theory, community detection, and network dynamics with practical applications in social networks, biology, and communication systems. The book integrates theoretical insights with hands-on case studies.

8. *Princeton Data Science: Foundations and Future Directions*

Providing a broad overview of the field, this book synthesizes foundational concepts and emerging trends in data science as seen through Princeton's academic lens. It discusses interdisciplinary approaches, novel methodologies, and future challenges. The text is ideal for readers seeking a thorough understanding of data science evolution.

9. *Applied Data Science in the Princeton Curriculum*

This book reflects the practical orientation of Princeton's data science education, highlighting project-based learning and real-world applications. It showcases student projects, collaborative research, and industry partnerships. The book serves as inspiration for educators and learners aiming to apply data science skills effectively.

Princeton University Data Science

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princeton university data science: Causal Inference for Data Science Aleix Ruiz de Villa Robert, 2025-02-18 When you know the cause of an event, you can affect its outcome. This accessible introduction to causal inference shows you how to determine causality and estimate effects using statistics and machine learning. A/B tests or randomized controlled trials are expensive

and often unfeasible in a business environment. Causal Inference for Data Science reveals the techniques and methodologies you can use to identify causes from data, even when no experiment or test has been performed. In Causal Inference for Data Science you will learn how to:

- Model reality using causal graphs
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- Determine when to use A/B tests, causal inference, and machine learning
- Explain and assess objectives, assumptions, risks, and limitations
- Determine if you have enough variables for your analysis

It's possible to predict events without knowing what causes them. Understanding causality allows you both to make data-driven predictions and also intervene to affect the outcomes. Causal Inference for Data Science shows you how to build data science tools that can identify the root cause of trends and events. You'll learn how to interpret historical data, understand customer behaviors, and empower management to apply optimal decisions. About the technology Why did you get a particular result? What would have led to a different outcome? These are the essential questions of causal inference. This powerful methodology improves your decisions by connecting cause and effect—even when you can't run experiments, A/B tests, or expensive controlled trials. About the book Causal Inference for Data Science introduces techniques to apply causal reasoning to ordinary business scenarios. And with this clearly-written, practical guide, you won't need advanced statistics or high-level math to put causal inference into practice! By applying a simple approach based on Directed Acyclic Graphs (DAGs), you'll learn to assess advertising performance, pick productive health treatments, deliver effective product pricing, and more. What's inside

- When to use A/B tests, causal inference, and ML
- Assess objectives, assumptions, risks, and limitations
- Apply causal inference to real business data

About the reader For data scientists, ML engineers, and statisticians. About the author Aleix Ruiz de Villa Robert is a data scientist with a PhD in mathematical analysis from the Universitat Autònoma de Barcelona.

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princeton university data science: Cause and Effect Business Analytics and Data Science Dominique Haughton, Jonathan Haughton, Victor S. Y. Lo, 2025-07-15 Among the most important questions that businesses ask are some very simple ones: If I decide to do something, will it work? And if so, how large are the effects? To answer these predictive questions, and later base decisions on them, we need to establish causal relationships. Establishing and measuring causality can be difficult. This book explains the most useful techniques for discerning causality and illustrates the principles with numerous examples from business. It discusses randomized experiments (aka A/B testing) and techniques such as propensity score matching, synthetic controls, double differences, and instrumental variables. There is a chapter on the powerful AI approach of Directed Acyclic Graphs (aka Bayesian Networks), another on structural equation models, and one on time-series techniques, including Granger causality. At the heart of the book are four chapters on uplift modeling, where the goal is to help firms determine how best to deploy their resources for marketing or other interventions. We start by modeling uplift, discuss the test-and-learn process, and provide an overview of the prescriptive analytics of uplift. The book is written in an accessible style and will be of interest to data analysts and strategists in business, to students and instructors of business and analytics who have a solid foundation in statistics, and to data scientists who recognize the need to take seriously the need for causality as an essential input into effective decision-making.

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data science to public officials, policy analysts, and economists among others in order to further their application in the public sector. An expansion of the quantitative economics frameworks presented in policy and business schools, this book emphasizes the process of asking relevant questions to inform public policy. Its techniques and approaches emphasize data-driven practices, beginning with the basic programming paradigms that occupy the majority of an analyst's time and advancing to the practical applications of statistical learning and machine learning. The text considers two divergent, competing perspectives to support its applications, incorporating techniques from both causal inference and prediction. Additionally, the book includes open-sourced data as well as live code, written in R and presented in notebook form, which readers can use and modify to practice working with data.

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princeton university data science: Data Science Rui Mao, Hongzhi Wang, Xiaolan Xie, Zeguang Lu, 2019-09-13 This two volume set (CCIS 1058 and 1059) constitutes the refereed proceedings of the 5th International Conference of Pioneering Computer Scientists, Engineers and Educators, ICPCSEE 2019 held in Guilin, China, in September 2019. The 104 revised full papers presented in these two volumes were carefully reviewed and selected from 395 submissions. The papers cover a wide range of topics related to basic theory and techniques for data science including data mining; data base; net work; security; machine learning; bioinformatics; natural language processing; software engineering; graphic images; system; education; application.

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comprises data gathering, data fusion and analysis when it comes to manage big data sets. A major goal of this book is to understand data science as a new scientific discipline rather than the practical aspects of data analysis alone.

princeton university data science: *Practical Data Science with Python 3* Ervin Varga, 2019-09-07 Gain insight into essential data science skills in a holistic manner using data engineering and associated scalable computational methods. This book covers the most popular Python 3 frameworks for both local and distributed (in premise and cloud based) processing. Along the way, you will be introduced to many popular open-source frameworks, like, SciPy, scikitlearn, Numba, Apache Spark, etc. The book is structured around examples, so you will grasp core concepts via case studies and Python 3 code. As data science projects gets continuously larger and more complex, software engineering knowledge and experience is crucial to produce evolvable solutions. You'll see how to create maintainable software for data science and how to document data engineering practices. This book is a good starting point for people who want to gain practical skills to perform data science. All the code will be available in the form of IPython notebooks and Python 3 programs, which allow you to reproduce all analyses from the book and customize them for your own purpose. You'll also benefit from advanced topics like Machine Learning, Recommender Systems, and Security in Data Science. Practical Data Science with Python will empower you analyze data, formulate proper questions, and produce actionable insights, three core stages in most data science endeavors. What You'll Learn Play the role of a data scientist when completing increasingly challenging exercises using Python 3 Work work with proven data science techniques/technologies Review scalable software engineering practices to ramp up data analysis abilities in the realm of Big Data Apply theory of probability, statistical inference, and algebra to understand the data science practices Who This Book Is For Anyone who would like to embark into the realm of data science using Python 3.

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princeton university data science: *Statistical Foundations of Data Science* Jianqing Fan, Runze Li, Cun-Hui Zhang, Hui Zou, 2020-09-20 Statistical Foundations of Data Science gives a thorough introduction to commonly used statistical models, contemporary statistical machine learning techniques and algorithms, along with their mathematical insights and statistical theories. It aims to serve as a graduate-level textbook and a research monograph on high-dimensional statistics, sparsity and covariance learning, machine learning, and statistical inference. It includes ample exercises that involve both theoretical studies as well as empirical applications. The book begins with an introduction to the stylized features of big data and their impacts on statistical analysis. It then introduces multiple linear regression and expands the techniques of model building via nonparametric regression and kernel tricks. It provides a comprehensive account on sparsity explorations and model selections for multiple regression, generalized linear models, quantile regression, robust regression, hazards regression, among others. High-dimensional inference is also thoroughly addressed and so is feature screening. The book also provides a comprehensive account on high-dimensional covariance estimation, learning latent factors and hidden structures, as well as

their applications to statistical estimation, inference, prediction and machine learning problems. It also introduces thoroughly statistical machine learning theory and methods for classification, clustering, and prediction. These include CART, random forests, boosting, support vector machines, clustering algorithms, sparse PCA, and deep learning.

princeton university data science: *Network Science Models for Data Analytics Automation*

Xin W. Chen, 2022-02-21 This book explains network science and its applications in data analytics for critical infrastructures, engineered systems, and knowledge acquisition. Each chapter describes step-by-step processes of how network science enables and automates data analytics through examples. The book not only dissects modeling techniques and analytical results but also explores the intrinsic development of these models and analyses. This unique approach bridges the gap between theory and practice and channels' managerial and problem-solving skills. Engineers, researchers, and managers would benefit from the extensive theoretical background and practical examples discussed in this book. Advanced undergraduate students and graduate students in mathematics, statistics, engineering, business, public health, and social science may use this book as a one-semester textbook or a reference book. Readers who are more interested in applications may skip Chapter 1 and peruse through the rest of the book with ease.

princeton university data science: *Big Data Science and Analytics for Smart Sustainable*

Urbanism Simon Elias Bibri, 2019-05-30 We are living at the dawn of what has been termed 'the fourth paradigm of science,' a scientific revolution that is marked by both the emergence of big data science and analytics, and by the increasing adoption of the underlying technologies in scientific and scholarly research practices. Everything about science development or knowledge production is fundamentally changing thanks to the ever-increasing deluge of data. This is the primary fuel of the new age, which powerful computational processes or analytics algorithms are using to generate valuable knowledge for enhanced decision-making, and deep insights pertaining to a wide variety of practical uses and applications. This book addresses the complex interplay of the scientific, technological, and social dimensions of the city, and what it entails in terms of the systemic implications for smart sustainable urbanism. In concrete terms, it explores the interdisciplinary and transdisciplinary field of smart sustainable urbanism and the unprecedented paradigmatic shifts and practical advances it is undergoing in light of big data science and analytics. This new era of science and technology embodies an unprecedentedly transformative and constitutive power—manifested not only in the form of revolutionizing science and transforming knowledge, but also in advancing social practices, producing new discourses, catalyzing major shifts, and fostering societal transitions. Of particular relevance, it is instigating a massive change in the way both smart cities and sustainable cities are studied and understood, and in how they are planned, designed, operated, managed, and governed in the face of urbanization. This relates to what has been dubbed data-driven smart sustainable urbanism, an emerging approach based on a computational understanding of city systems and processes that reduces urban life to logical and algorithmic rules and procedures, while also harnessing urban big data to provide a more holistic and integrated view or synoptic intelligence of the city. This is increasingly being directed towards improving, advancing, and maintaining the contribution of both sustainable cities and smart cities to the goals of sustainable development. This timely and multifaceted book is aimed at a broad readership. As such, it will appeal to urban scientists, data scientists, urbanists, planners, engineers, designers, policymakers, philosophers of science, and futurists, as well as all readers interested in an overview of the pivotal role of big data science and analytics in advancing every academic discipline and social practice concerned with data-intensive science and its application, particularly in relation to sustainability.

princeton university data science: *Machine Learning, Optimization, and Data Science*

Giuseppe Nicosia, Panos Pardalos, Giovanni Giuffrida, Renato Umeton, Vincenzo Sciacca, 2019-02-16 This book constitutes the post-conference proceedings of the 4th International Conference on Machine Learning, Optimization, and Data Science, LOD 2018, held in Volterra, Italy, in September 2018. The 46 full papers presented were carefully reviewed and selected from 126

submissions. The papers cover topics in the field of machine learning, artificial intelligence, reinforcement learning, computational optimization and data science presenting a substantial array of ideas, technologies, algorithms, methods and applications.

princeton university data science: Data Science Foundations Fionn Murtagh, 2017-09-22 Data Science Foundations is most welcome and, indeed, a piece of literature that the field is very much in need of...quite different from most data analytics texts which largely ignore foundational concepts and simply present a cookbook of methods...a very useful text and I would certainly use it in my teaching. - Mark Girolami, Warwick University Data Science encompasses the traditional disciplines of mathematics, statistics, data analysis, machine learning, and pattern recognition. This book is designed to provide a new framework for Data Science, based on a solid foundation in mathematics and computational science. It is written in an accessible style, for readers who are engaged with the subject but not necessarily experts in all aspects. It includes a wide range of case studies from diverse fields, and seeks to inspire and motivate the reader with respect to data, associated information, and derived knowledge.

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Netherlands

princeton university data science: *R for Political Data Science* Francisco Urdinez, Andres Cruz, 2020-11-17 *R for Political Data Science: A Practical Guide* is a handbook for political scientists new to R who want to learn the most useful and common ways to interpret and analyze political data. It was written by political scientists, thinking about the many real-world problems faced in their work. The book has 16 chapters and is organized in three sections. The first, on the use of R, is for those users who are learning R or are migrating from another software. The second section, on econometric models, covers OLS, binary and survival models, panel data, and causal inference. The third section is a data science toolbox of some of the most useful tools in the discipline: data imputation, fuzzy merge of large datasets, web mining, quantitative text analysis, network analysis, mapping, spatial cluster analysis, and principal component analysis. Key features: Each chapter has the most up-to-date and simple option available for each task, assuming minimal prerequisites and no previous experience in R. Makes extensive use of the Tidyverse, the group of packages that has revolutionized the use of R. Provides a step-by-step guide that you can replicate using your own data. Includes exercises in every chapter for course use or self-study. Focuses on practical-based approaches to statistical inference rather than mathematical formulae. Supplemented by an R package, including all data. As the title suggests, this book is highly applied in nature, and is designed as a toolbox for the reader. It can be used in methods and data science courses, at both the undergraduate and graduate levels. It will be equally useful for a university student pursuing a PhD, political consultants, or a public official, all of whom need to transform their datasets into substantive and easily interpretable conclusions.

princeton university data science: *Cultural Data Science* Harald Klinke,

princeton university data science: *Applied Data Science* Martin Braschler, Thilo Stadelmann, Kurt Stockinger, 2019-06-13 This book has two main goals: to define data science through the work of data scientists and their results, namely data products, while simultaneously providing the reader with relevant lessons learned from applied data science projects at the intersection of academia and industry. As such, it is not a replacement for a classical textbook (i.e., it does not elaborate on fundamentals of methods and principles described elsewhere), but systematically highlights the connection between theory, on the one hand, and its application in specific use cases, on the other. With these goals in mind, the book is divided into three parts: Part I pays tribute to the interdisciplinary nature of data science and provides a common understanding of data science terminology for readers with different backgrounds. These six chapters are geared towards drawing a consistent picture of data science and were predominantly written by the editors themselves. Part II then broadens the spectrum by presenting views and insights from diverse authors – some from academia and some from industry, ranging from financial to health and from manufacturing to e-commerce. Each of these chapters describes a fundamental principle, method or tool in data science by analyzing specific use cases and drawing concrete conclusions from them. The case studies presented, and the methods and tools applied, represent the nuts and bolts of data science. Finally, Part III was again written from the perspective of the editors and summarizes the lessons learned that have been distilled from the case studies in Part II. The section can be viewed as a meta-study on data science across a broad range of domains, viewpoints and fields. Moreover, it provides answers to the question of what the mission-critical factors for success in different data science undertakings are. The book targets professionals as well as students of data science: first, practicing data scientists in industry and academia who want to broaden their scope and expand their knowledge by drawing on the authors' combined experience. Second, decision makers in businesses who face the challenge of creating or implementing a data-driven strategy and who want to learn from success stories spanning a range of industries. Third, students of data science who want to understand both the theoretical and practical aspects of data science, vetted by real-world case studies at the intersection of academia and industry.

princeton university data science: *Roundtable on Data Science Postsecondary Education* National Academies of Sciences, Engineering, and Medicine, Division of Behavioral and

Social Sciences and Education, Division on Engineering and Physical Sciences, Board on Science Education, Computer Science and Telecommunications Board, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences and Analytics, 2020-09-02 Established in December 2016, the National Academies of Sciences, Engineering, and Medicine's Roundtable on Data Science Postsecondary Education was charged with identifying the challenges of and highlighting best practices in postsecondary data science education. Convening quarterly for 3 years, representatives from academia, industry, and government gathered with other experts from across the nation to discuss various topics under this charge. The meetings centered on four central themes: foundations of data science; data science across the postsecondary curriculum; data science across society; and ethics and data science. This publication highlights the presentations and discussions of each meeting.

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