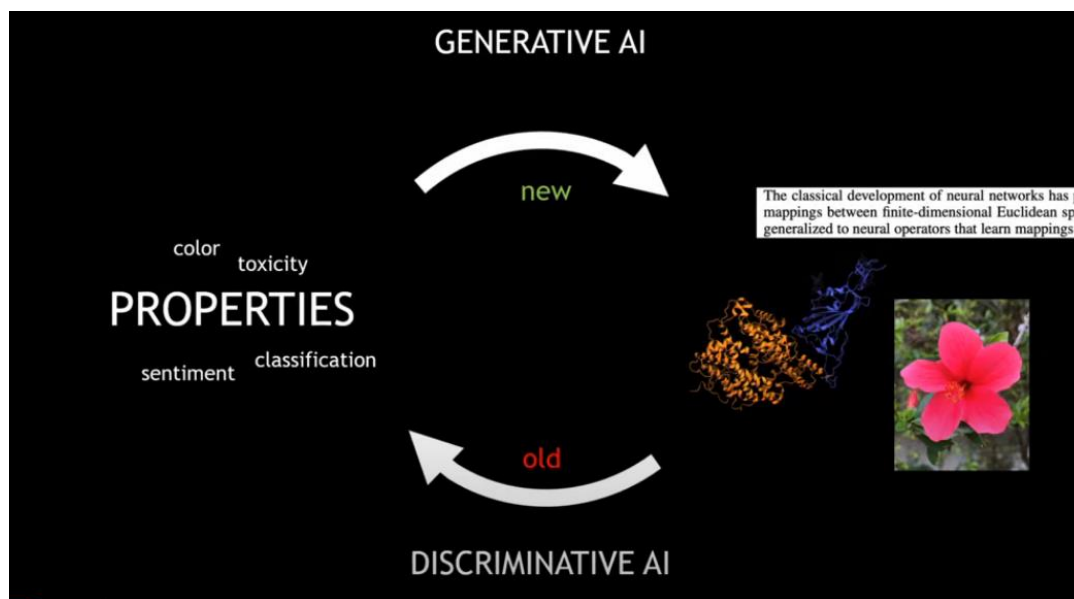


PCAST: Discussion of AI Enabling Science and AI Impacts on Society

1. Anima Anandkumar

主题：AI+Science

(1)描述生成式 AI 和判别式 AI 的区别



(2)介绍 Anima Anandkumar 提出的 FNO 模型

Fourier Neural Operator for Parametric Partial Differential Equations

Zongyi Li*, Nikola Kovachki*, Kamyar Azizzadenesheli†, Burigede Liu*,
Kaushik Bhattacharya*, Andrew Stuart*, Anima Anandkumar*

October 20, 2020

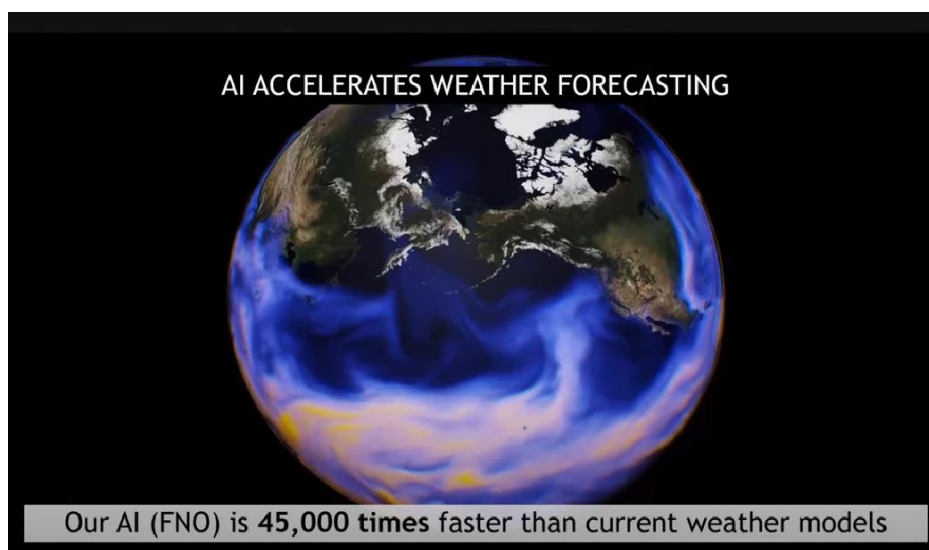
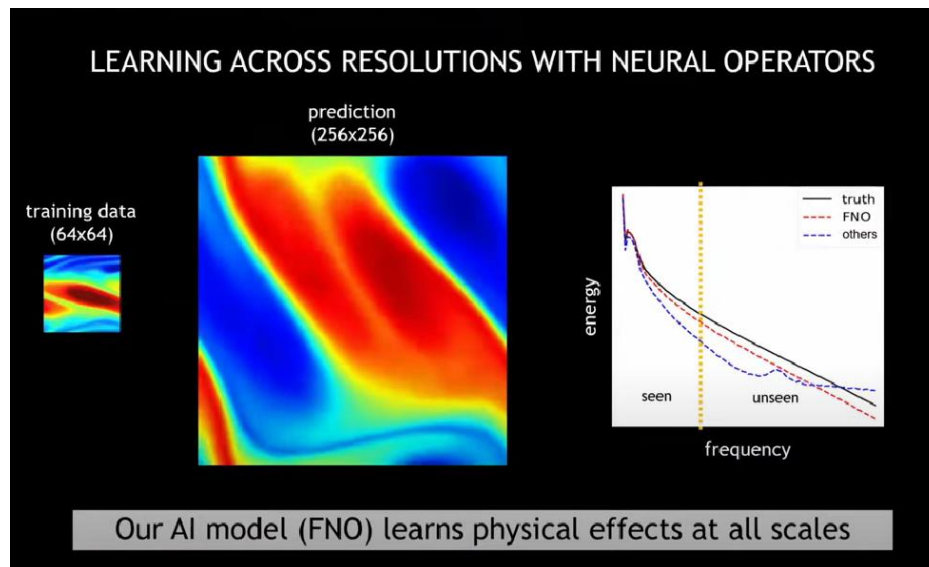
Abstract

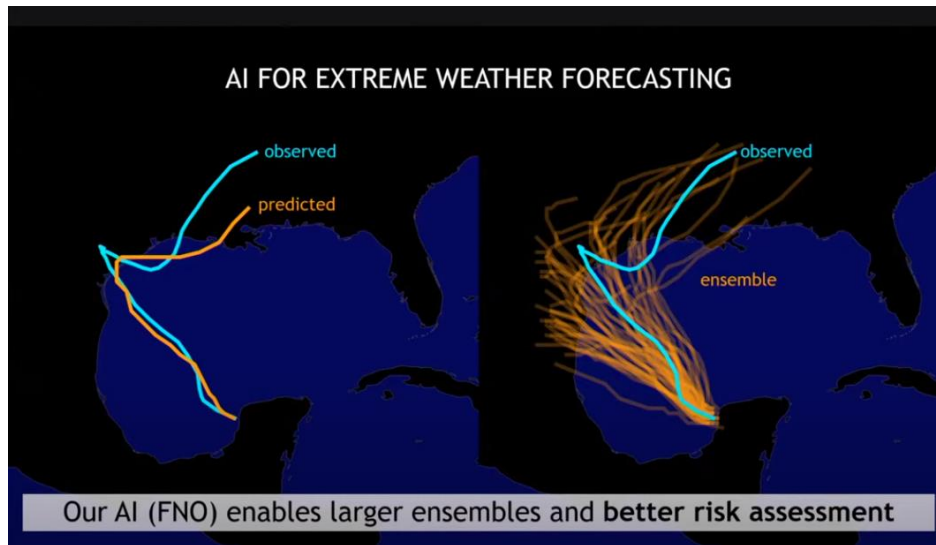
The classical development of neural networks has primarily focused on learning mappings between finite-dimensional Euclidean spaces. Recently, this has been generalized to neural operators that learn mappings between function spaces. For partial differential equations (PDEs), neural operators directly learn the mapping from any functional parametric dependence to the solution. Thus, they learn an entire family of PDEs, in contrast to classical methods which solve one instance of the equation. In this work, we formulate a new neural operator by parameterizing the integral kernel directly in Fourier space, allowing for an expressive and efficient architecture. We perform experiments on Burgers' equation, Darcy flow, and the Navier-Stokes equation (including the turbulent regime). Our Fourier neural operator shows state-of-the-art performance compared to existing neural network methodologies and it is up to three orders of magnitude faster compared to traditional PDE solvers.

FNO模型：偏微分方程在天气预报、传染病扩散等场景应用广泛，但一些复杂的偏微分方程的求解通常依赖于超级计算机，有时甚至需要数百万个 CPU 小时才能求解出来一个结

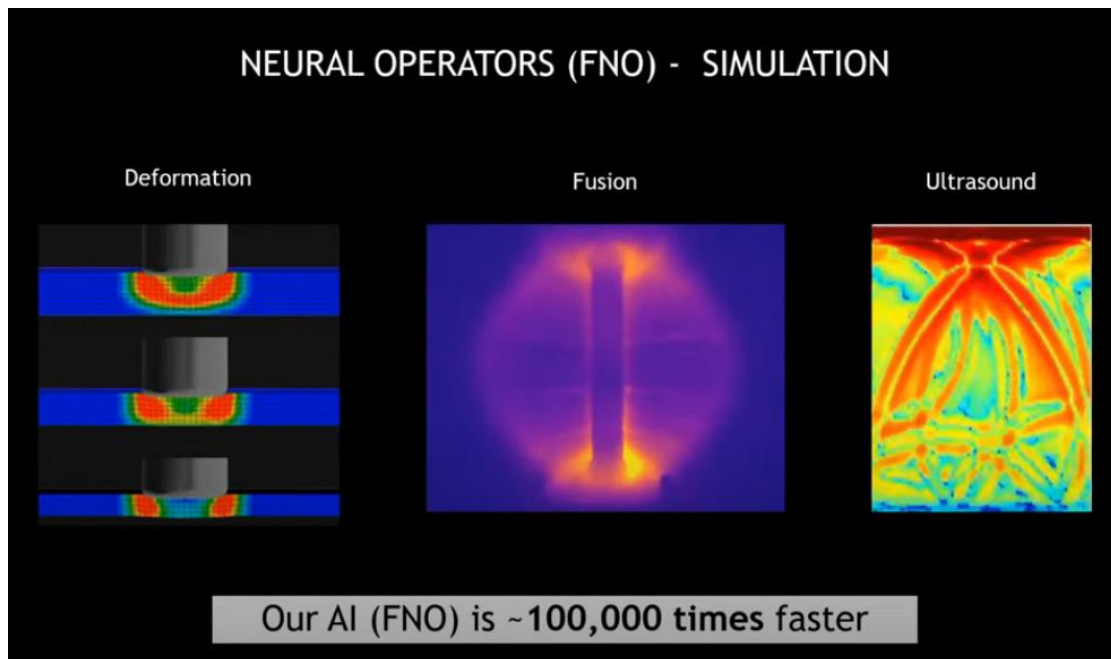
果，费时且昂贵。相比于传统的 PDE 求解方法，神经网络可找到一个通用的解决方案，训练一个模型就能解决一类偏微分方程。Anima Anandkumar 团队在 2020 年底提出了一种解决 PDE 方程的神经网络框架——FNO，比之前的深度学习方法准确率更高、速度更快。

例 1：天气预报。通过物理学知识，Anima Anandkumar 团队训练了傅里叶神经算子(FNO)深度学习模型，该模型能够准确有效地学习复杂的物理系统，以模拟大气动力学，并提前整整五天在全球范围内提供高保真的极端天气预报。该模型比传统的数值模型更快、更准确地预测地球系统的时空演化。





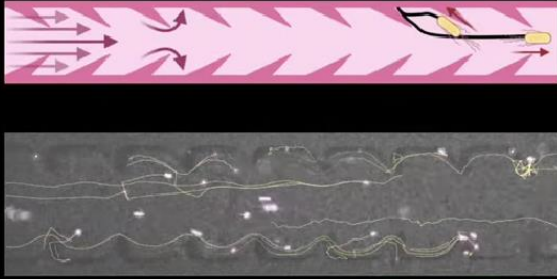
例 2. FNO 应用于材料变形、原子核聚变、超声波图像



例 3. FNO 应用于医学导管设计







NEURAL OPERATORS (FNO) - DESIGN

Catheter



Lithography

Epoch 4
AI: MSE 662336 EPE 69
ILT: MSE 717711 EPE 123

Design	Mask	Resist
		
		

Our AI (FNO) is **differentiable** and can do **inverse design**

2. Demis Hassabis

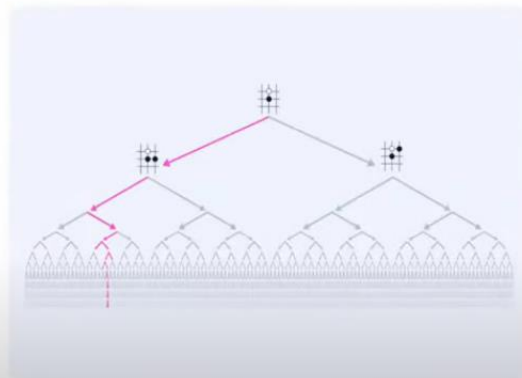
主题：Using AI to accelerate scientific discovery

例 1：AlphaGo

AI breakthroughs in games laid the foundation for scientific applications



AlphaGo - mastering Go through self-learning



Guiding the search with the model

例 2：AlphaFold——蛋白质 3D 结构预测

AlphaFold is accelerating progress on a range of important problems

See more [#Unfolded](#) stories at unfolded.deepmind.com



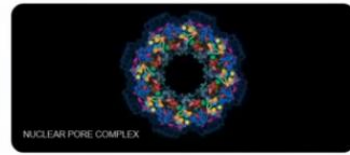
Plastic pollution

Designing plastic eating enzymes
McGeehan et al. (Portsmouth)



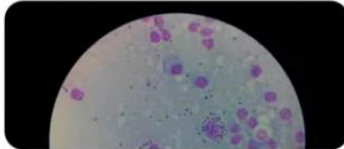
Antibiotic resistance

Blocking antibiotic resistance mechanisms
Sousa & Mitchell (Colorado)



Structural biology

Determined structure of nuclear pore complex
Fontana et al., Mosalaganti, et al. (Science)



Neglected diseases

Accelerating drug discovery in Leishmaniasis
Benjamin Perry (DNDi)



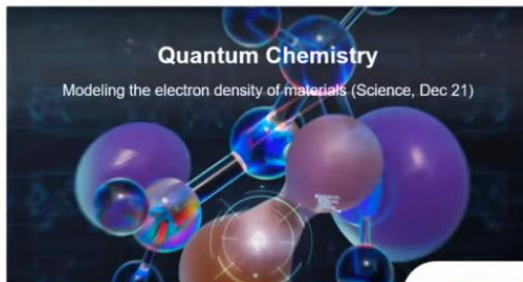
Malaria vaccine

Designing a more effective malaria vaccine
Matthew Higgins (Oxford)



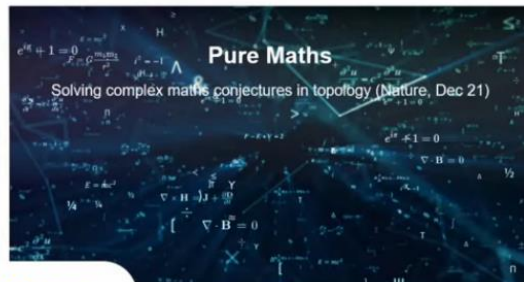
Drug delivery

Molecular syringe for protein delivery
Feng Zhang (Broad Institute)



Quantum Chemistry

Modeling the electron density of materials (Science, Dec 21)



Pure Maths

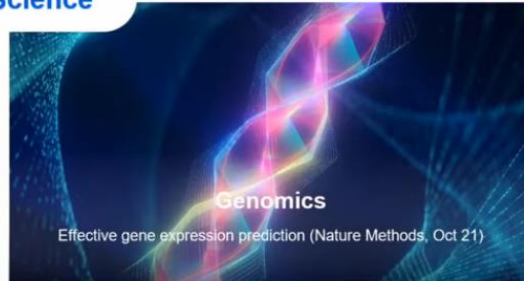
Solving complex maths conjectures in topology (Nature, Dec 21)

AI for Science



Fusion

Magnetic control of plasmas in fusion reactors (Nature, Feb 22)



Genomics

Effective gene expression prediction (Nature Methods, Oct 21)

Pioneering Responsibly

We need to be bold **and** responsible. Transformative technology deserves exceptional care

AI has incredible potential to help with humanity's greatest challenges like science and medicine

But AI must be built responsibly and safely, and be used for the benefit of everyone

Ethics and safety has been central to our mission from the beginning - evolved into Google's AI Principles

We continue to provide responsible thought leadership on AI strategy, risks, ethics and safety for the community

3. 李飞飞

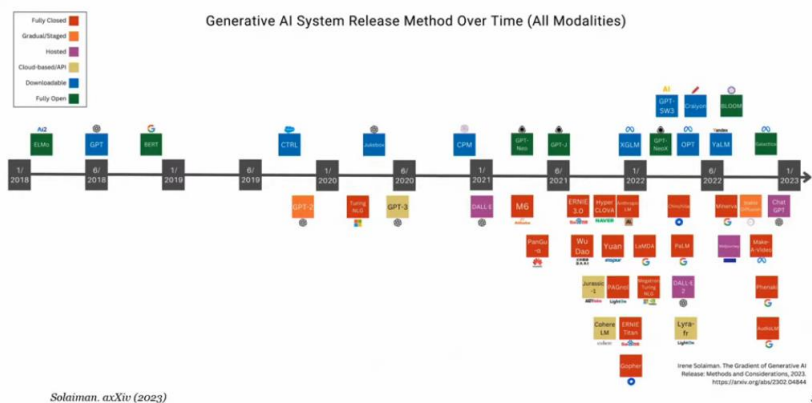
主题：Artificial Intelligence: the Human Impact & Responsibility

主要论点：

- (1) Inflection point
- (2) Large Language Models are just the beginning
- (3) AI can augment humans
- (4) Proflund social impact
- (5) Policy:ensuring a better tomorrow

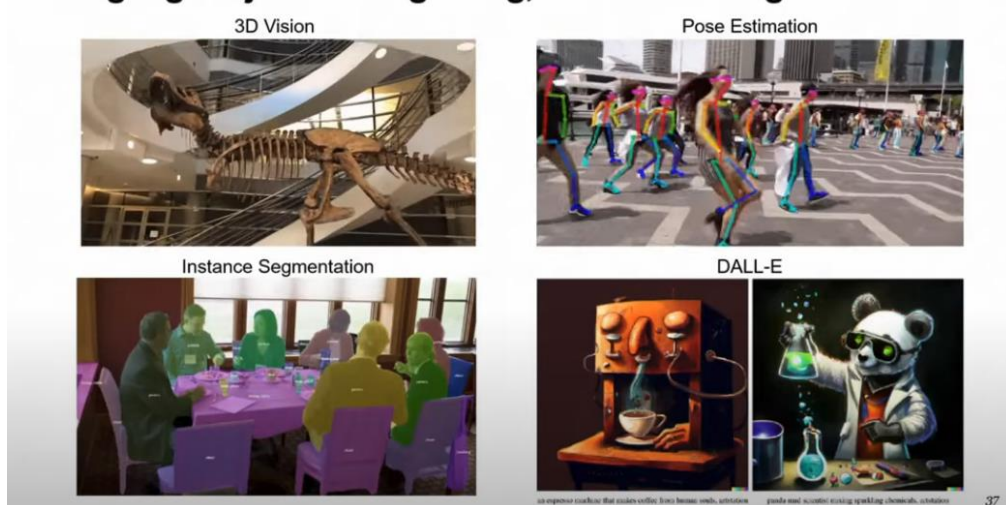
(1) Inflection point

Sharp increase in the number of generative AI systems



(2) Large Language Models are just the beginning

Language is just the beginning, more is coming



(3) AI can augment humans

例 1: 传感器部署在病房内, 可以捕获患者、临床医生和访客的对话和身体动作, 收集数据, 对不同的病人预测不同的治疗方案。

Ambient Intelligence for Healthcare

Use smart sensors and ML algorithm to glean health-critical insights



Yeung, Downing, Fei-Fei, Milstein. *New England Journal of Medicine* (2018); Haque, Milstein, Fei-Fei. *Nature* (2020) 40

例 2: 将 AI 植入智能家庭, 可以随时监控家庭里的病患和老年人, 通过人的言语提示和上身运动来识别其精神状态, 通过步态分析识别慢性疾病, 并将收集到的数据用于以后可能的治疗。

AI for Aging in place

- > Predict and Prevent Unsafe Events
- > Monitor Patients with Mild Symptoms
- > Manage Chronic Conditions

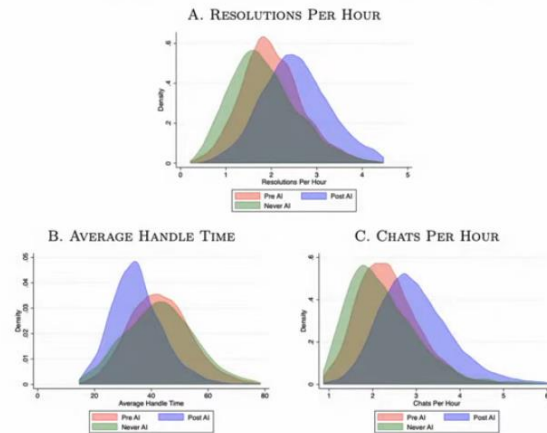


Bedside Computer Vision - Moving Artificial Intelligence from Driver Assistance to Patient Safety, Yeung et al., *New England Journal of Medicine (NEJM)* 2018

(4) Proflund social impact

Generative AI boosts worker productivity by 14% in first real-world study

FIGURE 3: RAW PRODUCTIVITY DISTRIBUTIONS, BY AI TREATMENT



Generative AI systems continue to perpetuate bias

Midjourney when prompted
"someone who is intelligence"



Stable Diffusion when prompted
"Assertive, CEO"



(5) Policy: ensuring a better tomorrow

Rejuvenating a healthy AI ecosystem between government, academia, and industry

