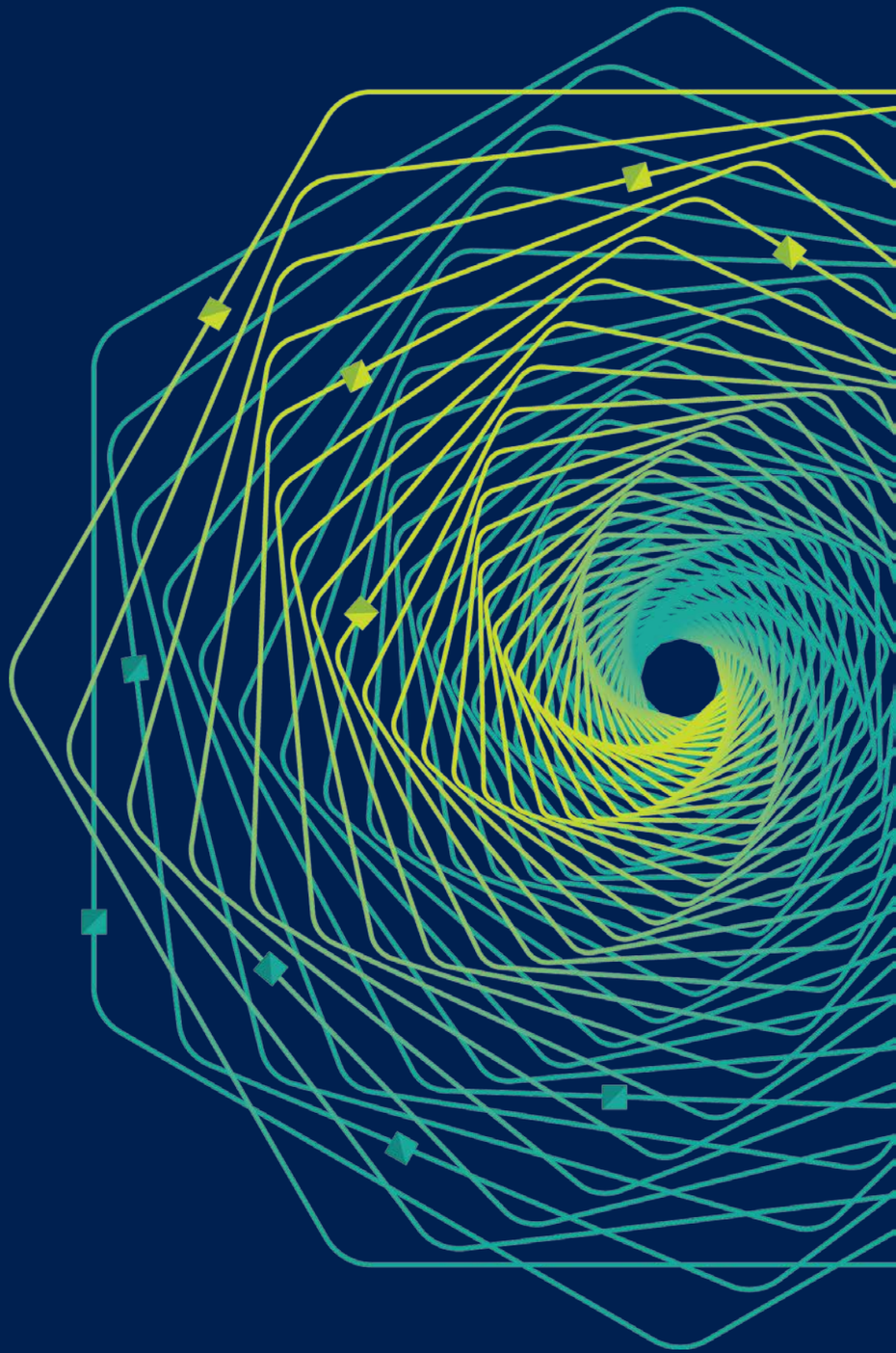
Microsoft

Research Faculty Summit 2018

Systems | Fueling future disruptions



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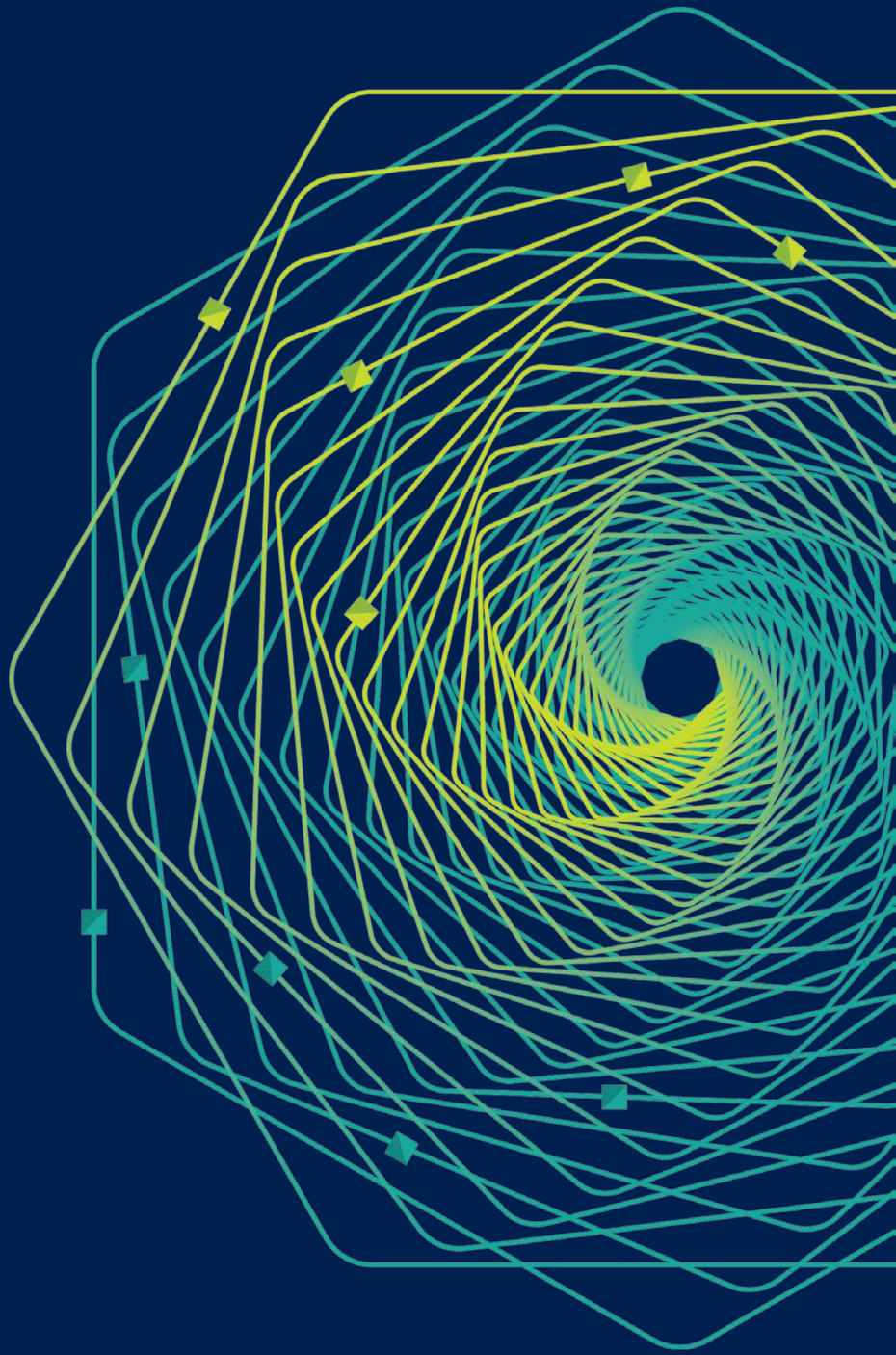


OpenPAI: The Open Source Initiative for AI Platform in China

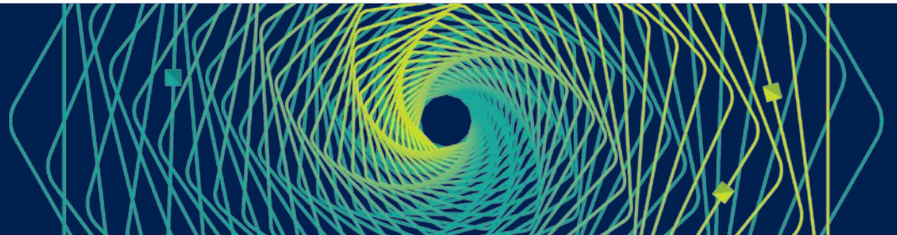
Fan Yang

Microsoft Research Asia

Background and Motivation

- Artificial Intelligence (AI) becomes one major focus and heated across academia and industries

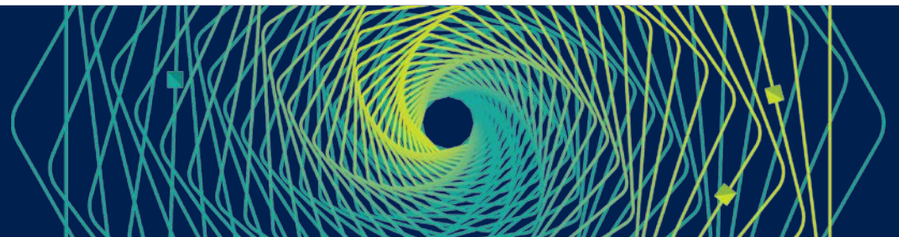
- Major opportunity to democratize AI through innovations on AI infrastructure
  - Lower the entry bar for new comers
  - Facilitate AI education
  - Speed up AI research
  - Accelerate the penetration of AI across industries



Current Status and Challenges of AI Platform

- Still in early stage: ad hoc ways to build/deploy an AI platform
  - It is easy to build small-scale platforms with a narrowed, specific purpose

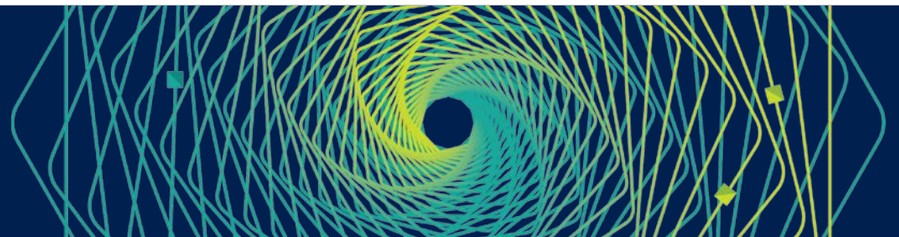
- Need an AI platform that works in different environment and application scenario
  - On-premise, cloud, and hybrid environment
  - Image/video, speech, language, vertical domain
  - High compatibility, extensibility, manageability, efficiency



The Importance of an AI Platform

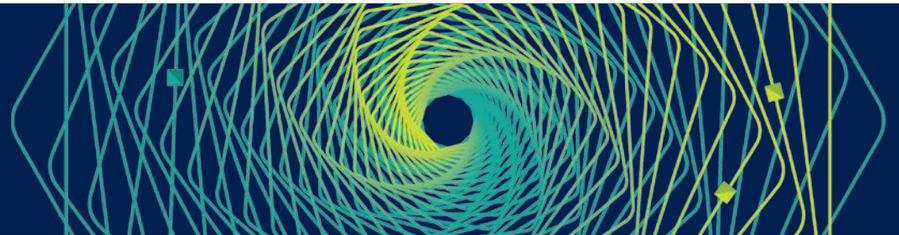
- Infrastructure support for the advance of artificial intelligence
  - Deep learning algorithms and frameworks run on
  - Manage hardware

- A platform to boost AI innovation and productivity
  - Allow researchers/practitioners to focus on AI innovation, instead of the hassles of infra. construction, deployment, management, and optimization
  - Enable results sharing, build a community for mutual learning/leveraging, and rapid innovation

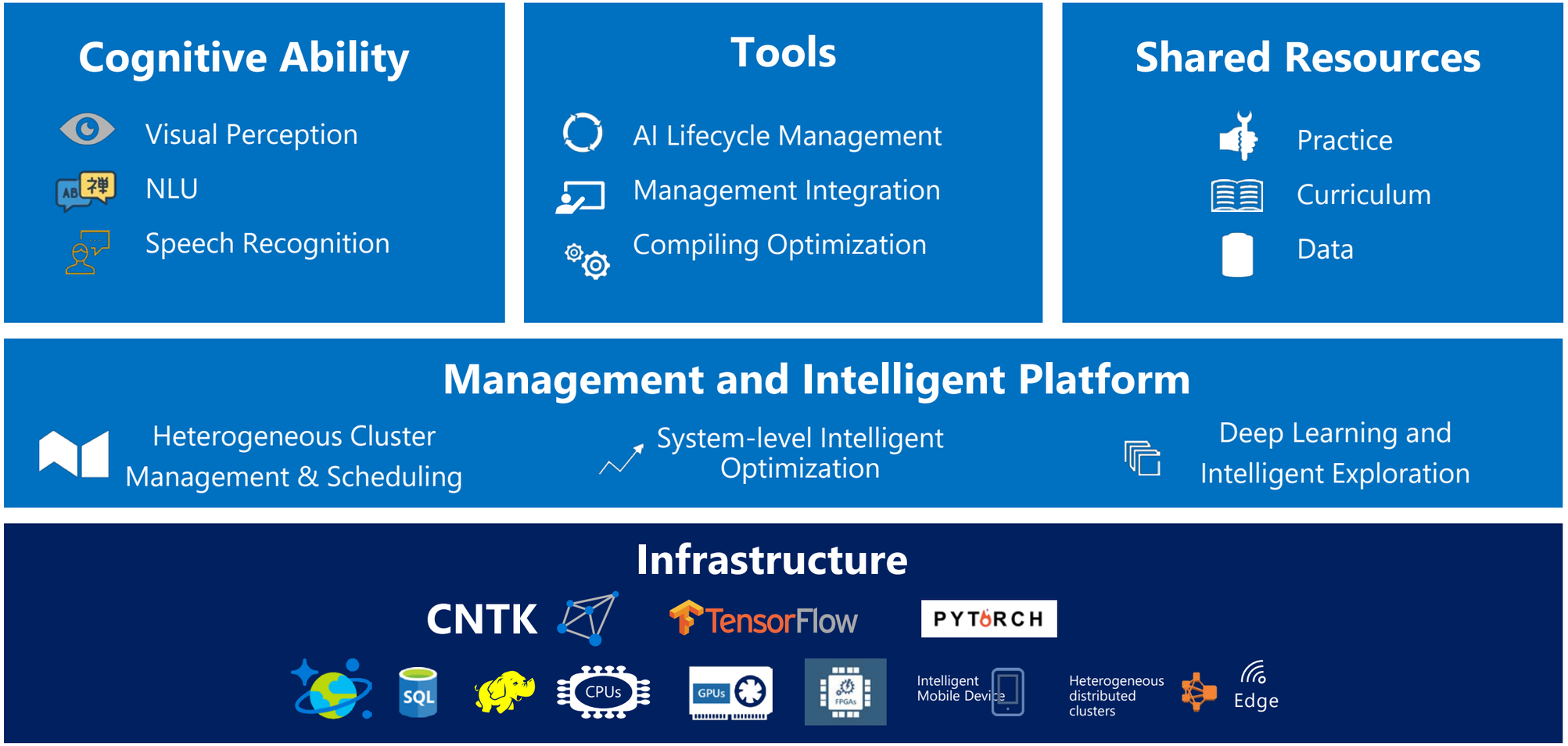


An Open Platform for AI R&D and Education

- The co-development of AI innovation, AI education, and AI platform evolution
  - Research, education, and production
- Design AI course project, perform training to grow AI talent pool
- Open source, result sharing, a community for collaborative innovation

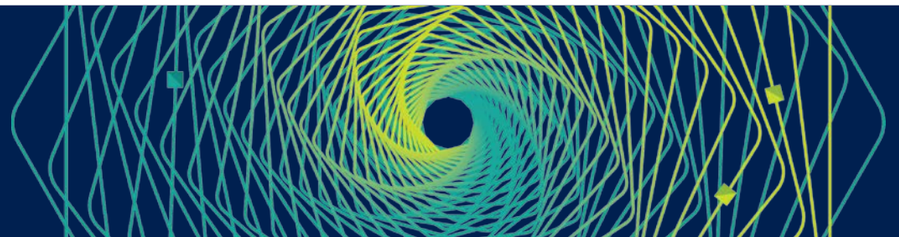


Overview

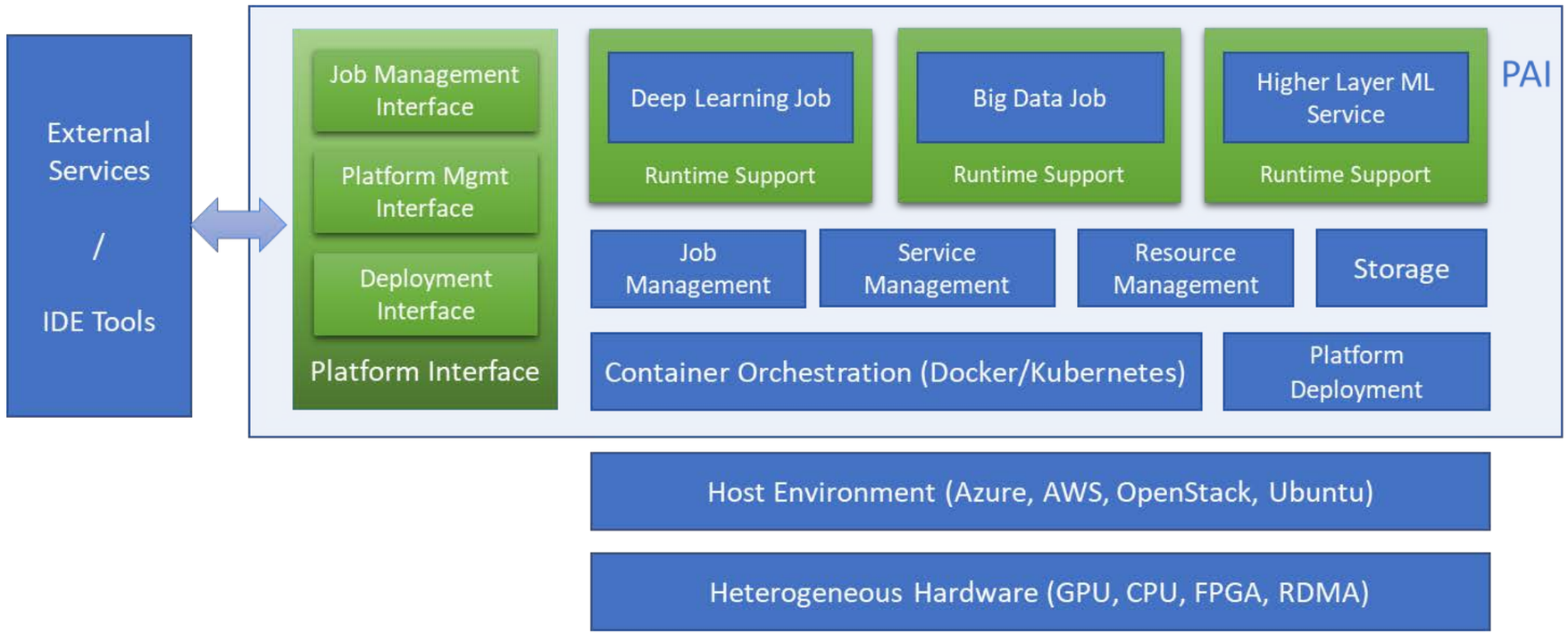

Cognitive Ability
Visual Perception
NLU
Speech Recognition
Tools
AI Lifecycle Management
Management Integration
Compiling Optimization
Shared Resources
Practice
Curriculum
Data
Management and Intelligent Platform
Heterogeneous Cluster Management & Scheduling
System-level Intelligent Optimization
Deep Learning and Intelligent Exploration
Infrastructure
CNTK
TensorFlow
PYTORCH
SQL
CPUs
GPUs
FPGAs
Intelligent Mobile Device
Heterogeneous distributed clusters
Edge

Open Platform for AI (OpenPAI)

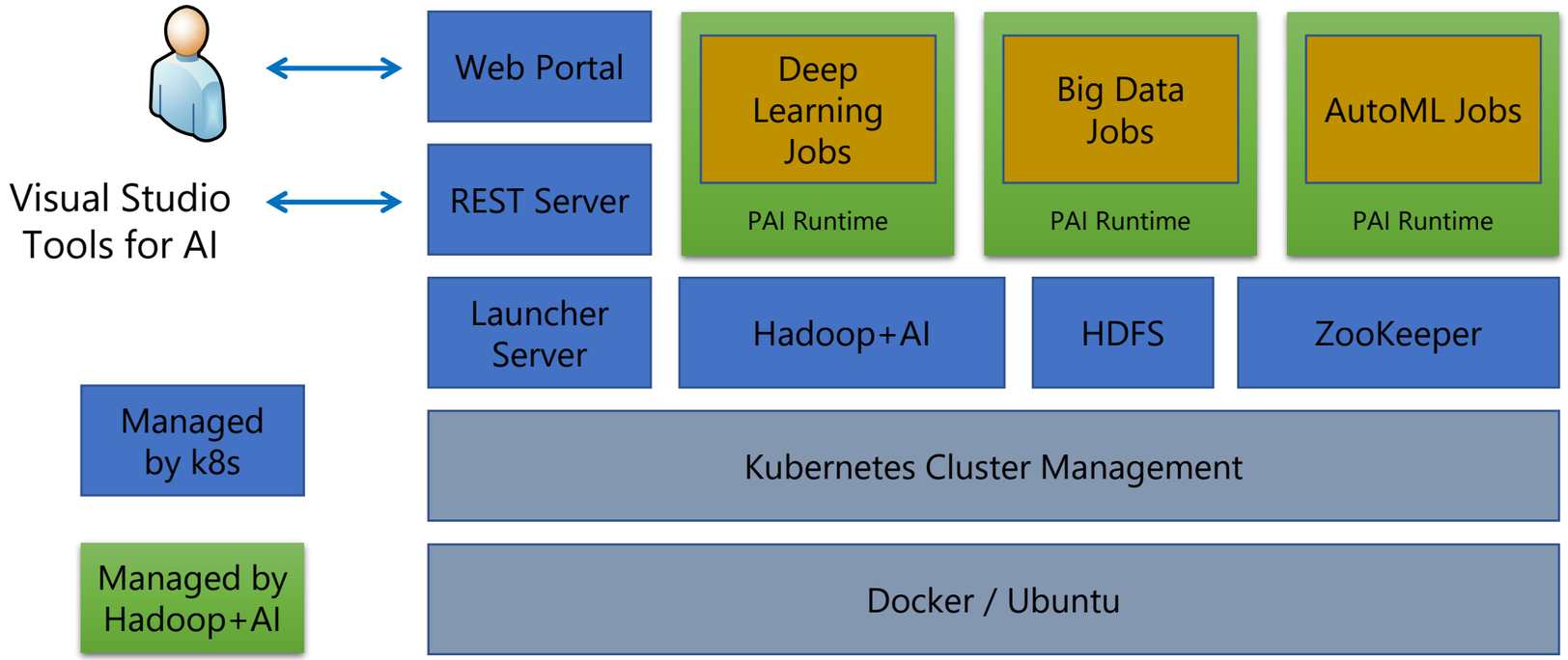
- A platform for GPU cluster management
  - Openness: open source (MIT), open collaboration model
  - Extensibility: support all deep learning frameworks, GPU/FPGA/ASIC
  - Modularity: micro-service, different component choice (storage, scheduler)
  - Efficiency: fine-grained GPU scheduling, support IB/RDMA
  - Manageability：job and platform monitoring, deployment, upgrade, etc.
  - Robust: fault tolerance
  - Practicability: leverage the mature design and practice in Microsoft



OpenPAI Architecture



Implementation



https://github.com/Microsoft/pai

An Open Ecosystem: Engage with China AI Community

China Open AI Platform Alliance

Case Study: School of Information Science and Technology of USTC

300 Researchers & Students vs. 400 GPUs

Previous Practice

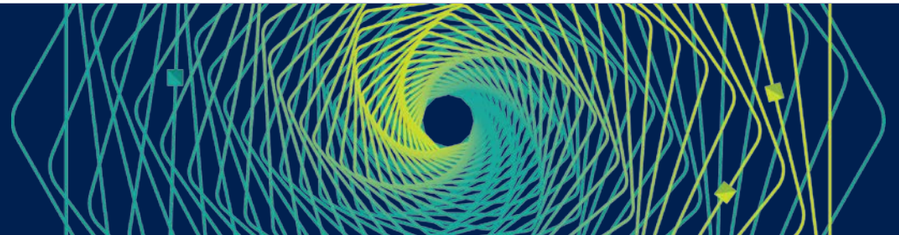
High operation overhead

High learning curve

Low GPU utilization (~60%)

USTC OpenPAI Deployment

- Cluster management through OpenPAI's WebUI
- Lower learning curve for AI researchers
  - Research result shared across teams through Docker images and job config files
  - New user jumpstarts with pre-built Docker images
- Improved GPU cluster utilization (>75%)



OpenPAI Boosts AI Innovation

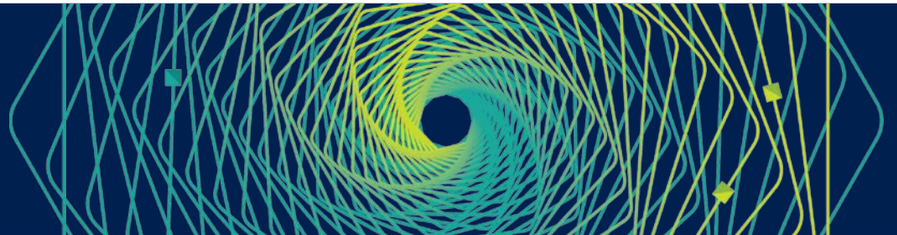
- Winner Award of NTIRE@CVPR 2018

254 1392x1300x31 hi-def images
200+ layers deep neural model

Challenge on Spectral Reconstruction from RGB Images

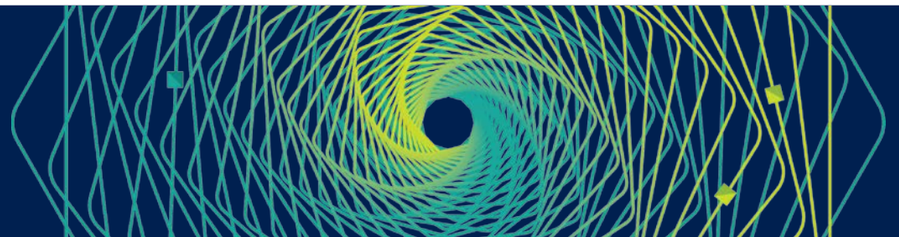
A Platform for AI Innovation

- A much needed playground for AI R&D
  - A realistic, production environment where AI research should target at
- Hassle-free platform for non-professionals
  - Low ops overhead (deployment, maintenance)
  - 100% WebUI-based job management
  - Enable AI researchers to focus on AI research itself
- Easy result sharing and reproducing
  - Strong portability through standard API support
- Enable system research for AI



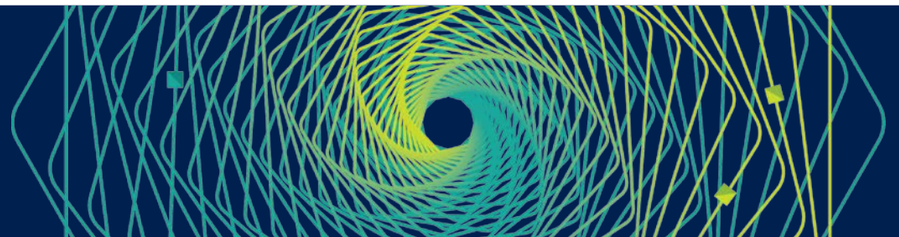
Some Research Opportunities on AI Infrastructure

- System primitives for deep learning scheduling
  - MapReduce task, DAG scheduling vs. process time-sharing, migration
- Memory management abstraction
  - Virtual memory, memory compression, etc.
- Joint consideration of cluster scheduling and AutoML
  - Optimization goal changed from one job to a group of job
- Cross job optimization
  - Common subexpression elimination, etc.
- Fairness, sharing incentives



Conclusion

- Facilitate the research on artificial intelligence
- Provide an efficient, ease-of-use AI infrastructure
  - Platform support to put AI research into practice
- Open to collaboration
  - Develop the platform together
  - An open community: welcome future collaboration



Thank you!

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