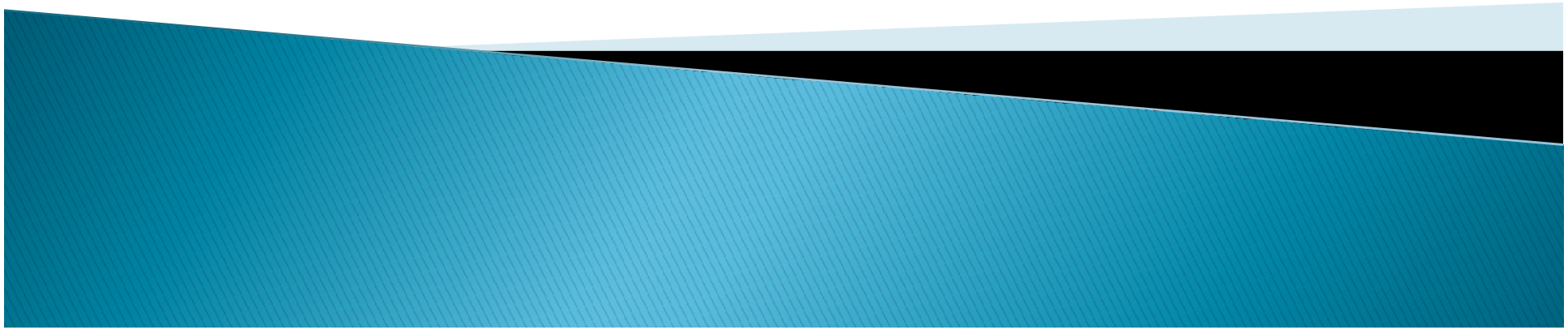
Future directions of Distributed Systems



Future Trends in Applications and Technology

Machine learning

- Machine learning enables extracting models from large data sets.
- Application of machine learning will continue to expand.
- The amount of data and computation required to train image classification problems has grown by three orders of magnitude over the past eight years.

Data analysis

- Data sets will continue to grow in scale, due to higher resolution, higher speed and lower cost of devices, but also by the increased connectivity of individuals and institutions.
- Benefits of data analysis in economical areas (e.g. Individual advertisement) but also scientific analysis (e.g. biosignatures and health record for large populations).
- Data amount might potentially rise into the zettabytes.

Simulation

- "Scientific simulation has expanded beyond traditional HPC simulations to also include high-throughput simulation campaigns to build large sets of simulated results, such as the Materials Genome Initiative and climate modeling studies"(Stoller et al., 2019).

Beyond Digital Computing

- End of Moore's Law is predicted by 2025, so other opportunities for expanding computation power is needed.

Stoller et al., 2019

Case study: Distributed architectures in Agriculture 4.0

- Argriculture 4.0: Smart Argriculture or Smart Farming
- Collecting and processing of huge amount of data through IoT for optimising input and output.
- Less concerns of privacy but increased priority of confidentiality.

Use cases:	Challenges:
Water Management	User Proximity
Plant Diseases	Latency & Jitter
Crop Management	Network stability
Livestock	Computation / throughput
	Reliability
	Scalability
	Cost-Effectiveness
	Maintainability

Debauche et al., 2021

Case study:
Distributed architectures in Agriculture 4.0

- **Architectures:**
  - Batch Architecture vs. Real-time Architecture

- **Distributed architectures:**
  - Fog Computing
  - Mobile Edge Computing

- **Trends:**
  - Microservice Architecture
  - Data Lake Architecture
  - Osmotic Computing
  - Dew Computing
  - Blockchain

- Transformation to Agriculture 5.0 → Robot integration and machine learning

Debauche et al., 2021; Martos et al., 2021

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