**Presentation Outline**

**(**More than one group member presents counterarguments**)**

**Class: EAP 28**

**Group Members (Name and SID):** CHEN Kai, HU Haoyu, ZHU Keyu

**Title:** Big Data Analytics: Powering Systematic Strategies

**Specific Purpose:** To explain to the audience how big data analytics tools enable organizations to develop structured and efficient strategies.

**Thesis:** Big data analytics tools have become essential for crafting systematic strategies.

1. **Introduction** (by ZHU Keyu)
2. **Attention Getter:**

Every day, 402.74 quintillion bytes of data are generated worldwide. (Duarte, 2025). Human teams cannot manually analyze terabytes of unstructured data (e.g., IoT sensor streams, social media sentiment) that modern systems generate daily (Ren, 2022).

1. **Thesis Statement:**

Big data analytics tools have become essential for crafting systematic strategies.

1. **Preview of Main points:**

Big data analytics not only helps uncover previously unnoticed patterns but also powers personalized recommendation systems across industries

1. **Body**
2. **(First Main Point)** Big data analytics tools can discover complex patterns and hidden correlations. (by CHEN Kai)
   1. Traditional methods reliant on linear regression or expert intuition fail to identify non-linear correlations in multidimensional supply chain data (e.g., supplier delays ↔ production bottlenecks) (Ren, 2022).
   2. Machine learning identifies non-obvious relationships (e.g., weather patterns influencing logistics delays) across disparate datasets (Ren, 2022).
3. **(Second Main Point)** Big data analytics tools enable personalized experiences by powering recommendation systems across industries. (by HU Haoyu)
4. E-commerce platforms leverage behavioral analytics for precision marketing

• Collaborative filtering algorithms analyze browsing/purchase history to improve conversion rates by 78.8% (Luo, 2024).

• RFM (Recency, Frequency, Monetary) models segment users dynamically, enabling targeted promotions (Luo, 2024).

1. Cross-industry applications drive tailored outcomes

• AI-driven curricula adapt to learning styles via cognitive pattern analysis in education (Thimmanna et al., 2024).

• Clinical data mining identifies BRCA1/BRCA2 mutations for personalized cancer risk mitigation (Estape et al., 2016).

• Pharmacogenomic algorithms optimize drug responses (e.g., CYP2D6-guided dosing) to reduce adverse effects (Estape et al., 2016).

1. **(First Counterargument)** (by CHEN Kai)

• A significant privacy risk associated with deploying machine learning models lies in privacy-sensitive applications (Fredrikson et al. 2013). For example, model inversion attacks that exploit confidence values in machine learning models could reveal sensitive user information from the training data.

• However, mature technologies exist for privacy protection in big data analytics:

1. Differential Privacy (DP) frameworks, including variants and Differentially Private Machine Learning (DPML), have matured with practical deployments, showcasing established privacy mechanisms (Das & Mishra, 2024).
2. Specific techniques like Function Secret Sharing (FSS) enable complex private tasks, such as neural network training/inference in frameworks like AriaNN, using low-interaction protocols (Ryffel et al., 2022). These privacy techniques are optimized for core computational blocks (e.g., ReLU, MaxPool) to enhance practical efficiency and reduce overhead.
3. Therefore, the combination of established theories (DP), advanced techniques (FSS), and practical optimizations forms a mature toolkit for addressing privacy concerns in big data analytics.
4. **(Second Counterargument)** (by HU Haoyu)

• Computational complexity and resource constraints limit practical deployment (Alrayes et al., 2025):

1. Algorithmic Complexity Hinders Scalability: Advanced optimization algorithms, such as the Improved Marine Predator Algorithm (IMPA), exhibit exponentially increasing computational demands as data scales. This complexity creates bottlenecks in processing high-dimensional IoT data, delaying critical decision-making in time-sensitive applications.
2. Prohibitive Deployment Costs: High-accuracy models like PPSLOA-HDBDE require specialized hardware (e.g., GPU clusters) and excessive energy consumption for real-time operation. Researchers demonstrate that deploying such models on edge devices incurs 3-5× higher infrastructure costs compared to lightweight alternatives (Alrayes et al., 2025).

• Efficiency-Aware Alternatives: Recent advancements address these limitations through optimized designs:

1. MobileNetV3 reduces inference costs by 60% while maintaining competitive accuracy for IoT vision tasks (Alrayes et al., 2025).
2. Federated Learning frameworks minimize centralized computation by distributing model training across edge devices, cutting cloud dependency (Alrayes et al., 2025).
3. **Conclusion** (by ZHU Keyu)
4. **Summary of main points**:

By uncovering hidden insights and enabling intelligent personalization, big data analytics drives transformative innovation across industries.

1. **Re-State Thesis:**

Big data analytics tools have become essential for crafting systematic strategies.

1. **Concluding Remarks:**

From your morning coffee app suggestions to optimized commute routes, big data analytics quietly enhances daily life by uncovering hidden patterns and personalizing experiences across services we use.

**References**

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