

2025 ->: Technologists' View on Data & AI Revolution in Healthcare

The Data Explosion in HealthCare

"We process more medical data in a month than we did in all of 2015"

And Yet -> 80% of cancer data remains unstructured and underutilized



→ The convergence of distributed systems, AI, and biotech is creating an inflection point in cancer care.



The Data Foundation Revolution

Distributed Health Data

- Federated learning networks
- Real-world evidence platforms
- Privacy-preserving computation

Multimodal Integration

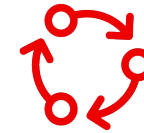
- Genomics + Imaging + Clinical
- Edge computing in medical devices
- Real-time analytics & insights

Impact of AI



Advanced Model Architectures

- Large Language Models for clinical decision support
- Multimodal foundation models for diagnosis
- Reinforcement learning for treatment optimization



Explainable AI & Validation

- Model interpretability techniques
- Regulatory compliance frameworks
- Clinical validation pipelines

Embeddings Vectors in Oncology



Embeddings Applications

- High-dimensional cancer phenotype mapping
- Similarity-based patient cohort identification
- Treatment response clustering
- Real-time similar case retrieval



Technical Implementation & Privacy

- Privacy-preserving data sharing via embeddings
- Irreversible transformation of sensitive health data
- Optimized ANN search for rapid retrieval
- Multi-modal embedding fusion
- Incremental learning capabilities
- Distributed vector storage

Custom Transformers for Healthcare Diagnostics



Self-Attention Mechanisms

- Long-range temporal correlations in patient histories
- Cross-modality attention for integrated diagnostics
- Biomarker relationship modeling
- Attention-guided feature importance



Healthcare Applications

- Early warning system development
- Treatment sequence optimization
- Multi-organ interaction modeling
- Temporal disease progression prediction

Geo-Specific Model Fine-Tuning



DNA Attributes

- Population-specific genetic variants
- Regional mutation patterns
- Environmental factor correlation
- Ancestry-aware risk assessment



Symptom Patterns

- Regional presentation variations
- Local healthcare practice alignment
- Cultural context integration
- Resource-aware recommendations

Clinical Impact & Implementation



Precision Oncology

- Real-time treatment adaptation
- Digital twins for simulation
- Population-level insights



Operational Excellence

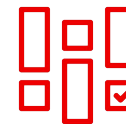
- Workflow automation
- Resource optimization
- Outcomes tracking

Efficient Model Deployment



Optimization Techniques

- Quantization: INT8/FP16 precision for faster inference
- Pruning: Remove redundant neural connections
- Knowledge Distillation: Smaller, efficient models
- Dynamic Batching: Optimize throughput



Resource Benefits

- 4-8x memory reduction with quantization
- 30-50% speedup with pruned models
- Edge deployment capabilities
- Lower infrastructure costs

Future Outlook & Challenges



Technical Challenges

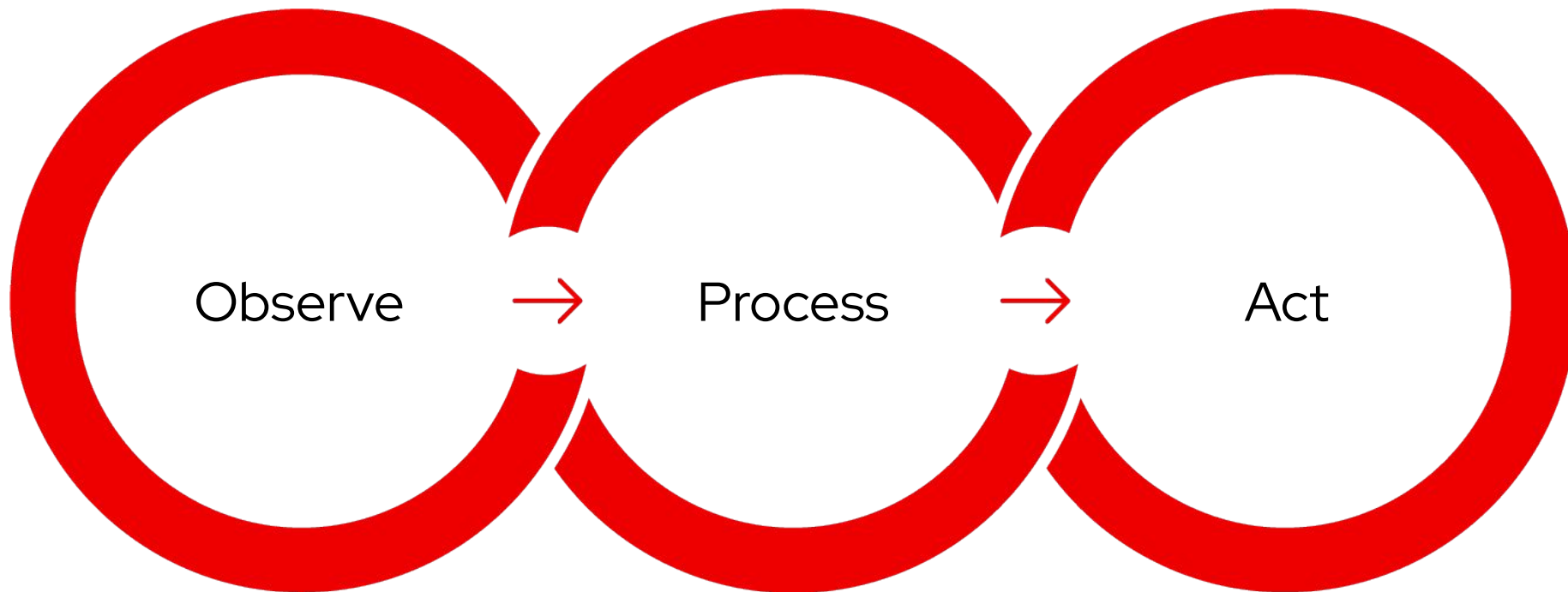
- Data quality and standardization
- Infrastructure scalability
- Model maintenance and drift



Implementation Challenges

- Clinical workflow integration
- Training and adoption
- Cost and access equity

Future is About: Big Fresh Fast Data -> Act On It!



Key Takeaways



Technology convergence is creating unprecedented opportunities

Success requires deep collaboration between technologists and clinicians



Focus on practical implementation alongside innovation

Thank you

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