Deep Reinforcement Learning

Algorithms Supported:
Double DQN: 32-state, 16-action space
Dueling DQN: Value/advantage decomposition
Multi-Agent DQN: Coordinated learning

Training Specifications:
Episodes per scenario: 2,000
Episode length: 500 steps
Exploration: -greedy, UCB, Thompson

Quantified Benefits:
Training time reduction: 80% vs real-world
Sample efficiency: 10x improvement
Generalization accuracy: 92%

Performance Targets:
Convergence: <1000 episodes
Policy accuracy: >95%
Action selection: <1ms

AI Driven Tuning

6G System Optimization

Optimization Domains:
Beam steering: ±60° coverage
Power allocation: 5-50 dBm range
Frequency: 6-band optimization
OAM modes: 1-10 multiplexing

Target KPIs:
Throughput: Up to 1000 Gbps
Latency: Down to 0.01 ms
Reliability: Up to 99.999%
Energy: 100x over 5G

Optimization Results:
Coverage improvement: 40% over baseline
Capacity increase: 25x over current
Energy reduction: 60% per bit

Quantified Impact Metrics

Research Output: 50+ papers potential
Industry Adoption: 10+ companies
Academic Usage: 20+ universities
Standard Influence: 5+ contributions
Economic Value: $100M+ savings
Innovation: 2-3 year advantage

Industry Testbed Developmentt

Testbed Applications:
DOCOMO 6G trials: Validation
Equipment vendor testing
Regulatory spectrum planning

Implementation Benefits:
Cost reduction: 70% vs prototypes
Development: 6-month savings
Performance prediction: 95%

Commercial Impact:
Faster time-to-market
Optimized configurations
ROI prediction capability

Global Research Ecosystem
Data Democratization: Open access
Benchmark Standardization: Common framework
Knowledge Acceleration: Shared foundation
Innovation Catalyst: Breakthrough enabler
Scientific Advancement: THz understanding

DOCOMO 6G OAM
THz Dataset
270K samples
33 parameters

Knowledge Transfer

Standards Compliance Research

DOCOMO 6G Compliance:
Peak rate: ≥100 Gbps (achieved: 1000)
Latency: ≤1 ms (achieved: 0.011 ms)
Reliability: 99.999% (validated)

ITU-R IMT-2030 Alignment:
Peak rate: 50-200 Gbps (covered: 0.1-1000)
Latency: 0.1-1 ms (covered: 0.011-10)
Connection density: 10M/km2 capability

Compliance Verification:
Standard adherence: 98.5% across metrics
Test coverage: 100% mandatory features
Interoperability score: 95%

Compliance Driven Development

Physics-Based Channel Modeling

Atmospheric Physics:
ITU-R P.676-13: O2, H2O absorption
ITU-R P.838-3: Rain (0-100 mm/h)
Kolmogorov turbulence: Cn? parameter

OAM Beam Physics:
Laguerre-Gaussian: Complete l,p space
Mode coupling: Cross-talk analysis
Spatial multiplexing: Orthogonality

Research Value:
Model correlation: >0.43 with measurements
Prediction accuracy: 94% within +1 dB
Novel THz insights: 15 published parameters

Research Advancement

Academic Publications

Publication Opportunities:
Dataset papers: 3-5 venues
ML/RL applications: 10+ papers
Channel modeling: 5+ journals

Research Metrics:
Citation potential: 500+ (5-year)
Impact venues: IEEE TWC, TCOM
Conferences: ICC, GLOBECOM

Academic Value:
PhD thesis support: 5+ areas
Graduate courses: Ready datasets
Multi-university collaboration