Will ML & AI change the way we design and operate communications networks?

ITU Workshop on "Machine Learning for 5G and beyond"
Presented by Sue Rudd, Director Service Provider Analysis
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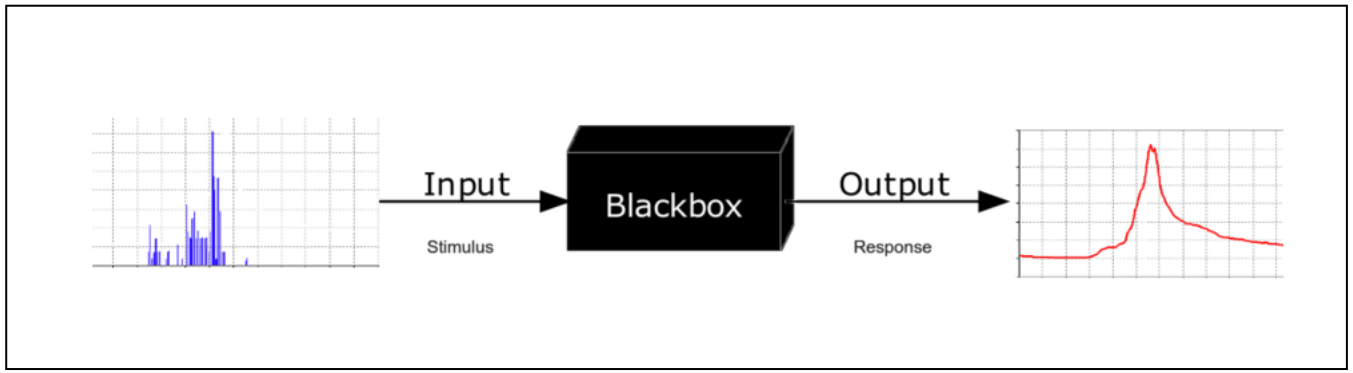
STRATEGY ANALYTICS

Will ML & AI change the way we design and operate communications networks?

- Broad Issues for Machine Learning and AI
- Implications for Network Design of Machine Learning & AI everywhere
- Implications for Network Operations
- Risk Management

Broad Issues for Machine Learning and AI

- **Black Box….Pattern Recognition..Data Correlation… Analytics**

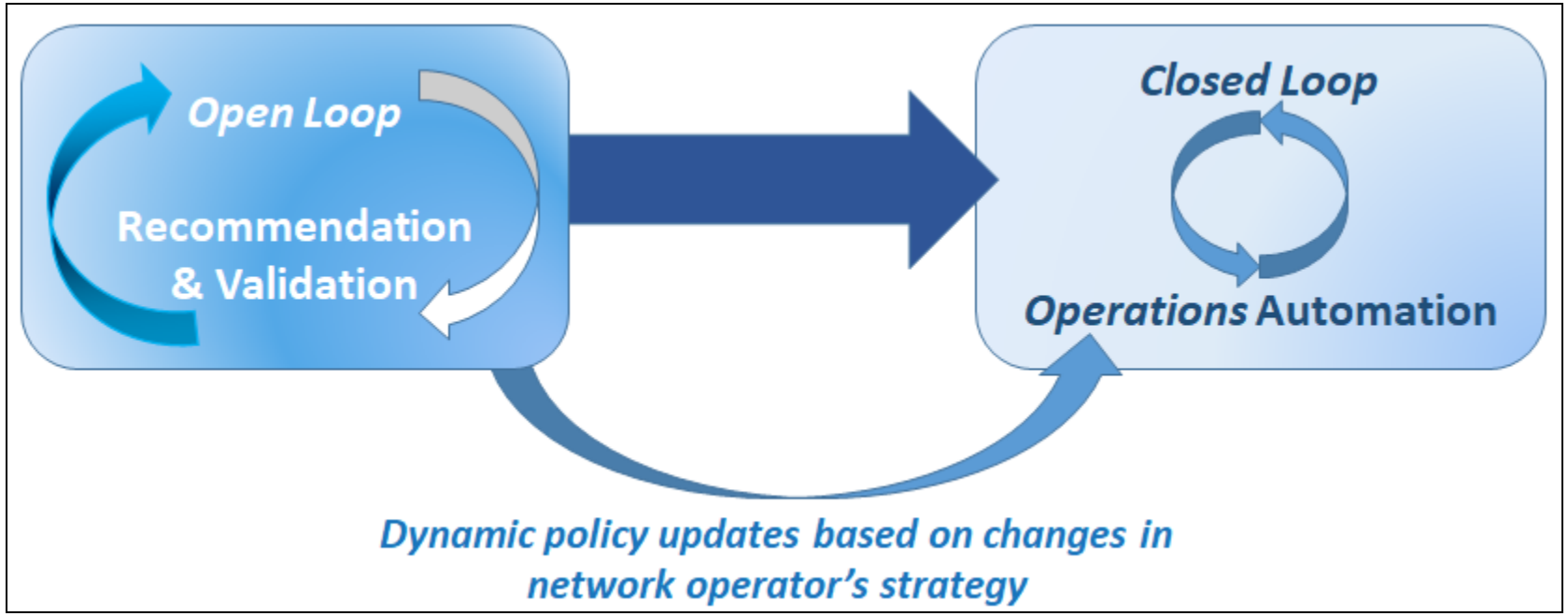


- **Neural Networks**
  - **Neural network involves a large number of processors operating in parallel and arranged in tiers. The first tier receives the raw input information -- analogous to optic nerves in human visual processing. Each successive tier receives the output from the tier preceding it, rather than from the raw input -- in the same way neurons further from the optic nerve receive signals from those closer to it. The last tier produces the output of the system.**
  - **Each processing node has its own small sphere of knowledge, but tiers are highly interconnected and tier *n* will be connected to many nodes in tier *n-1*-- its inputs -- and in tier *n+1,* which provides input for those nodes. Multiple nodes in the output layer, from which the answer it produces can be read.**
  - **Adaptive - modify themselves as they learn from initial training and subsequent inputs. Inputs contribute to getting right answers are weighted higher."** *(Source: Techtarget)*

- **Algorithms based on Computer Science and Theory of Networking**
  - Recommended reading '***Patterns in Network Architecture - A Return to Fundamentals***' John Day

Broad Issues for Machine Learning and AI (2)

- Open Loop evolving to Closed Loop?



Source: Strategy Analytics *'SON Powered Managed Services Leverage AI and Automation for Network Operations.'*

Implications for Network Design of Machine Learning & AI everywhere

- **Distributed Data Access**
  - Implies Distributed Database Architecture

- **Distributed Computing**
  - Implies IT architecture based on 1980s minicomputing and state aware processing NOT Client/Server *(Internet and Cloud)*
  - Micro Data Centers in Access Network (MEC)

Implications for Network Operations

- **Human Implications**
  - NOCC is most Risk Averse group in Telecoms – rewarded for zero failures
  - Lessons from Self-Organizing networks (SON)
  - Need ML and AI as New Tools and Support – Not Job displacement

- **'Lights Out' Operations**
  - Automation only within known Range of Operations
  - Identification of 'Rare' Events
  - Override Triggers

Risk Management

- **Managing Risk**
  - **Lessons from the Financial Industry:**
    - **Unique Disruptions e.g. Barings Bank - Nick Leeson**
      - **Trading Nikkei 225 futures contracts vs. other exchanges and Kobe Earthquake**
    - **Bear Stearns and others in 2008 Crash**
      - **Operating with assumed Range of 2 Standard Deviations not 3+ Deviations**
  - **Lessons from Oil Industry**
    - **BP Gulf Oil Spill 'Everyone assumed all other systems and subsystems were operating perfectly'**
      - **Redundancy was assumed – need Systems view of Subsystems performance**
- **Learning Algorithms**
  - **Learning Algorithms that Change Policy Parameters**
  - **Self-modifying Algorithms '*Dire Predictions for AI*'**
    - **HAL in '2001 Space Odyssey'**

Contact Information

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