Impacts of Machine-learning in Future IC Design
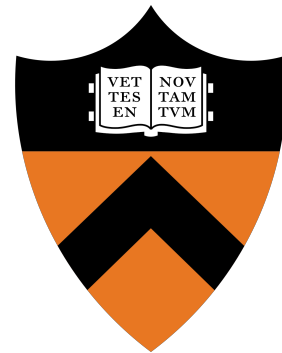
Naveen Verma

(nverma@princeton.edu)

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ML in IC design methodologies

- **ML will be (is already) involved in IC design and design methodologies…**
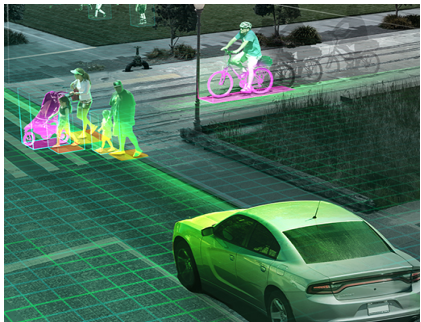
Today/Short-term

- Constraint solvers, non-linear optimization (placement, routing/pathfinding)
- Initial solutions, outlier detection (timing analysis, synthesis)
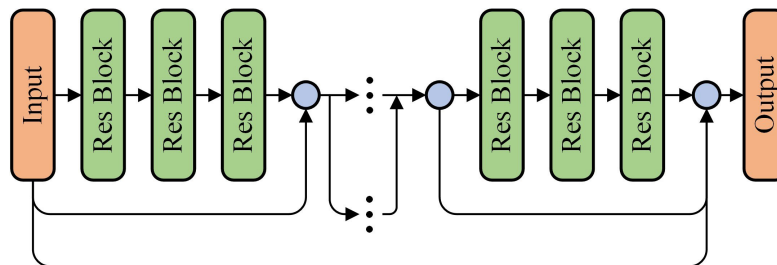
Future (?)

- Signal integrity analysis (parasitics + timing) [SLIP'15]
- Multi-physics analysis (temp + IR + glitching) [ASPDAC'16]
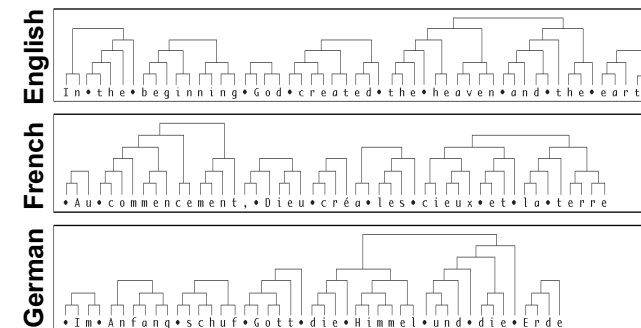
- **ML is not magic, it is (data) science…**
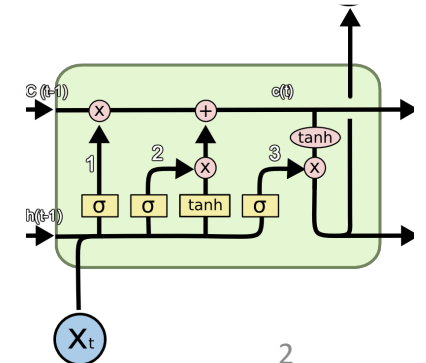
Vision: spatial encoding of sematics

- Convolutional network:
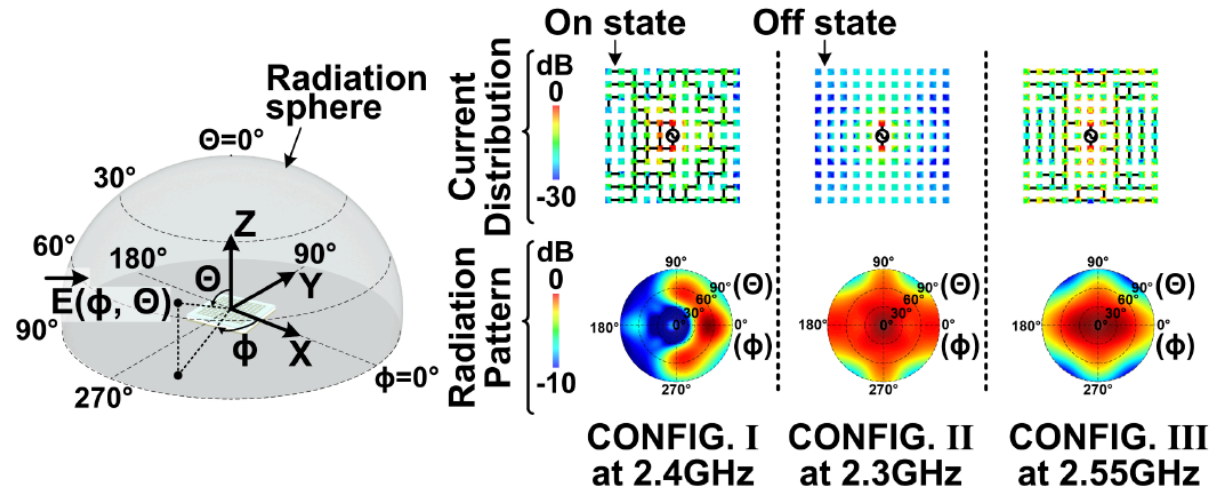

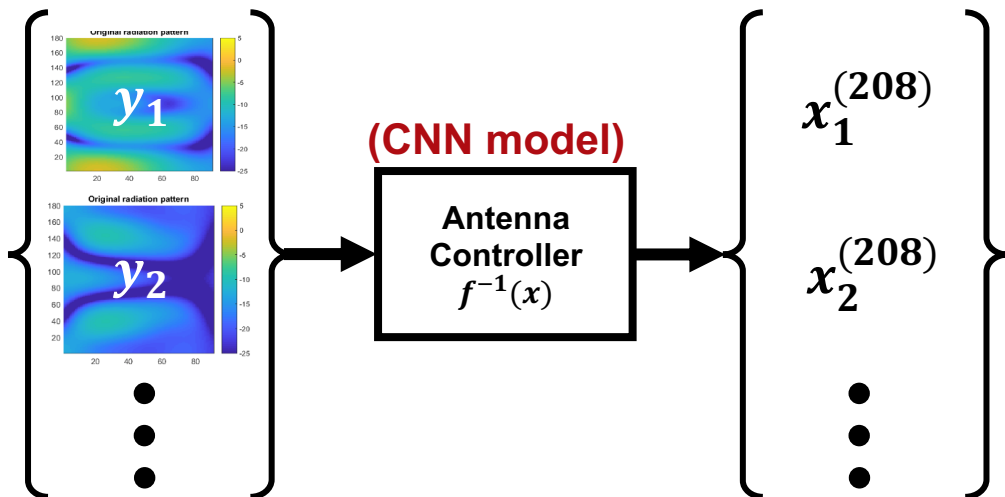**Language: seq. encoding of semantics**

- LSTM network:

This will/should be a co-design process

- **E.g., large-area reconfigurable antenna**

CONFIG. I at 2.4GHz   CONFIG. II at 2.3GHz   CONFIG. III at 2.55GHz
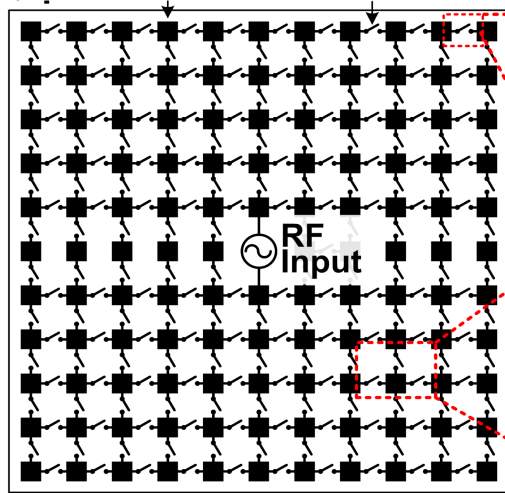
- **High-dimensional antenna control**

$$y_1, y_2, \ldots \xrightarrow{\text{(CNN model) Antenna Controller } f^{-1}(x)} x_1^{(208)}, x_2^{(208)}, \ldots$$

Example Patterns from Controller

Target → From Antenna   Target → From Antenna