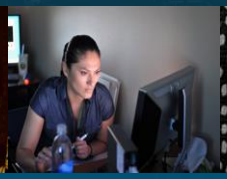
SAND2019-4006PE

Sandia National Laboratories

I could see your lips move.



PRESENTED BY

JD Doak from Sandia National Laboratories at UTSA on 4/11/19

U.S. DEPARTMENT OF ENERGY | NNSA

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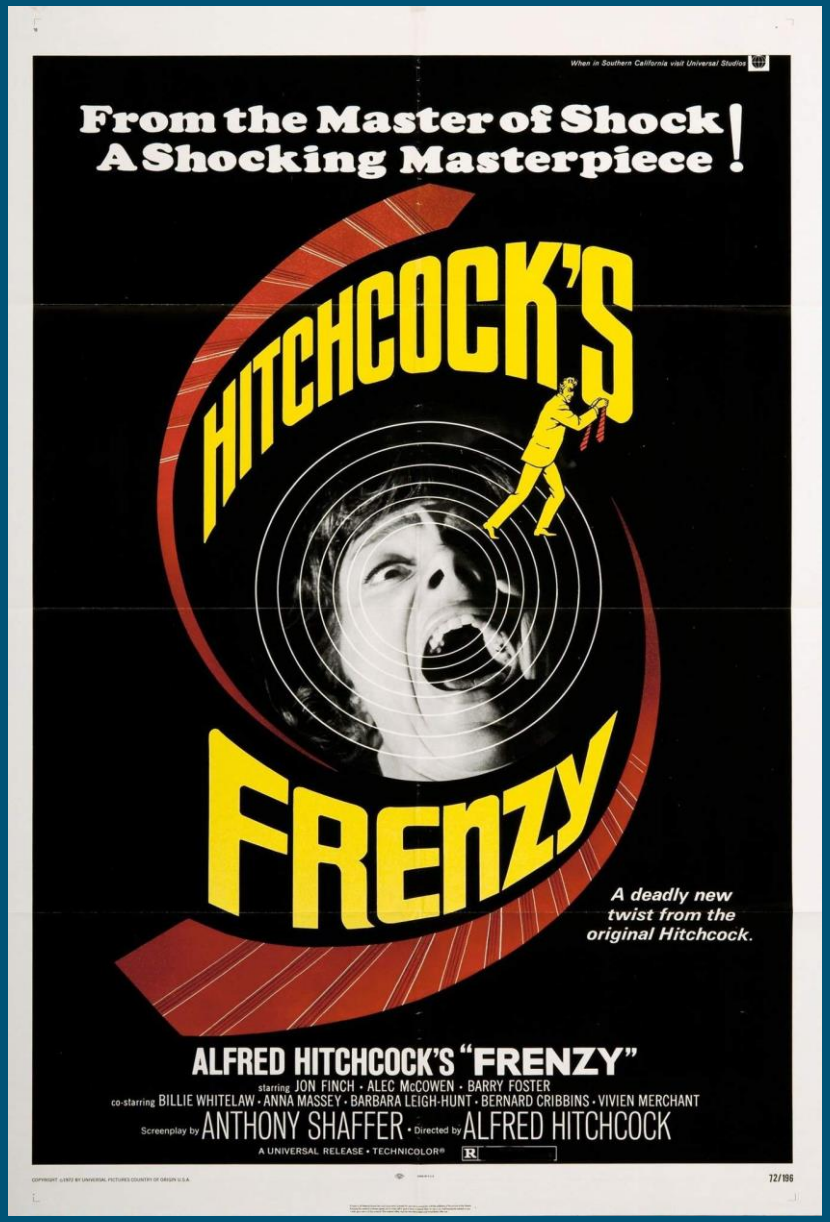
FRNSE, Framework for Responding to Network Security Events



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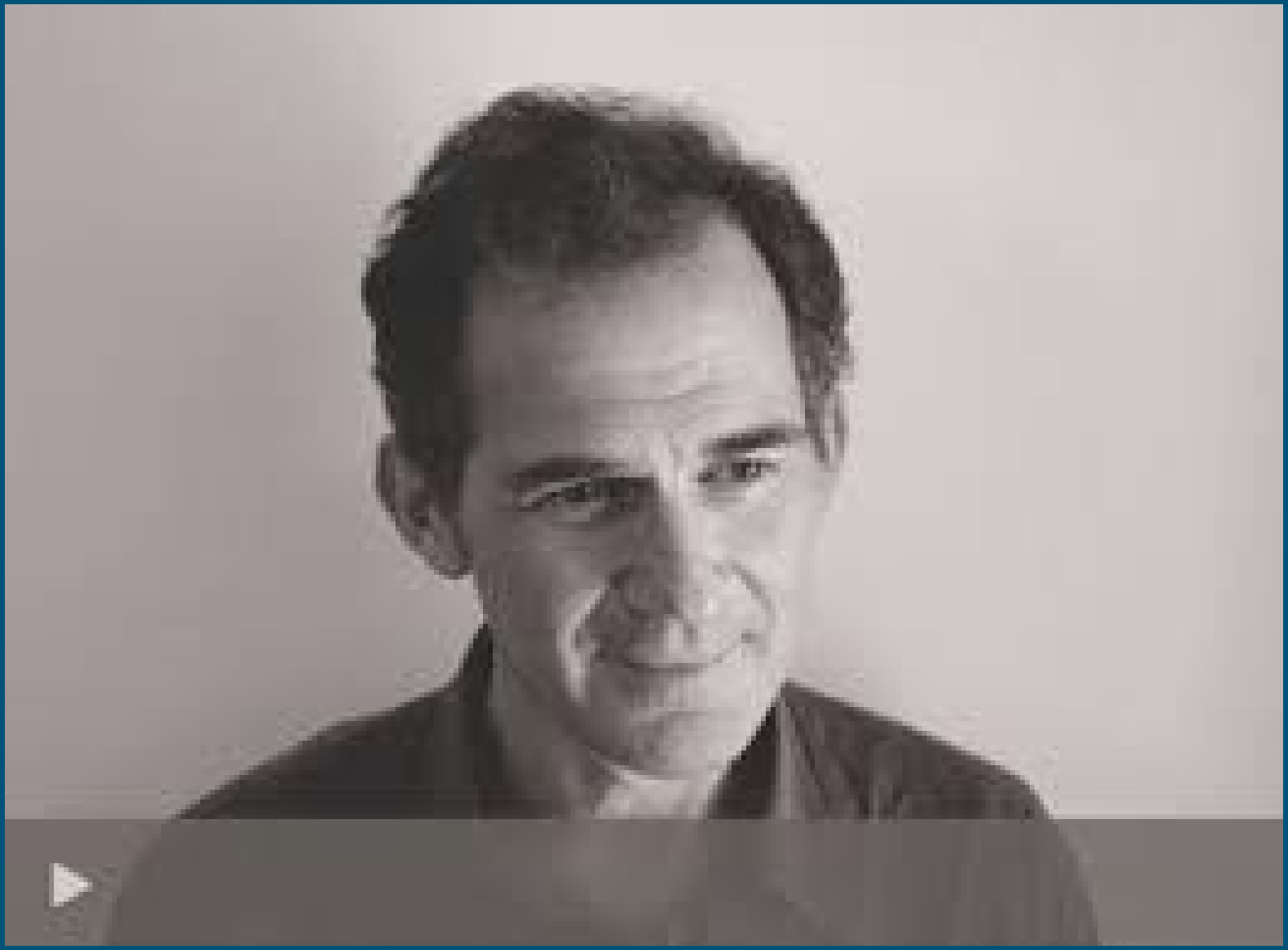

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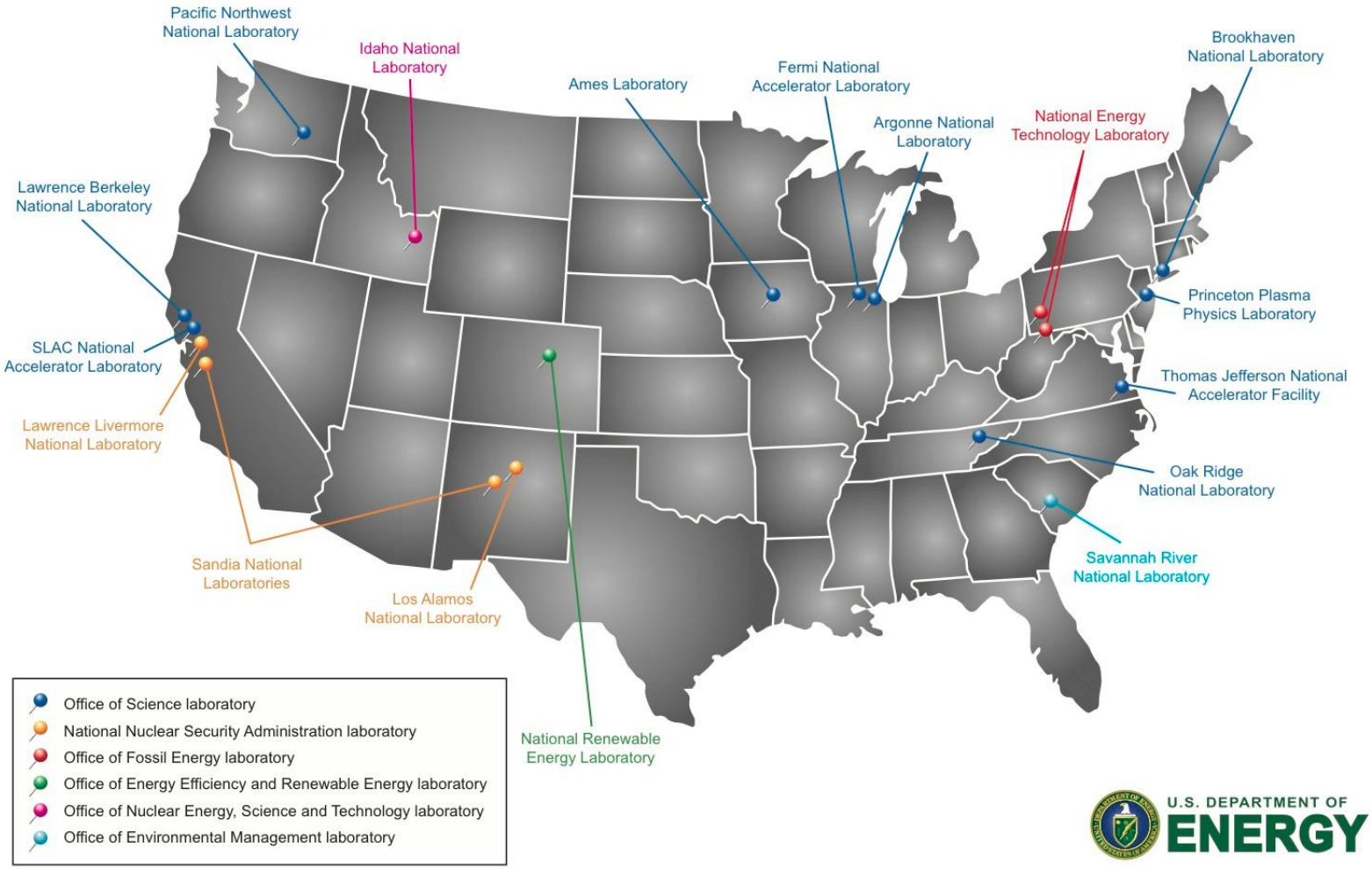
Department of Energy National Laboratories



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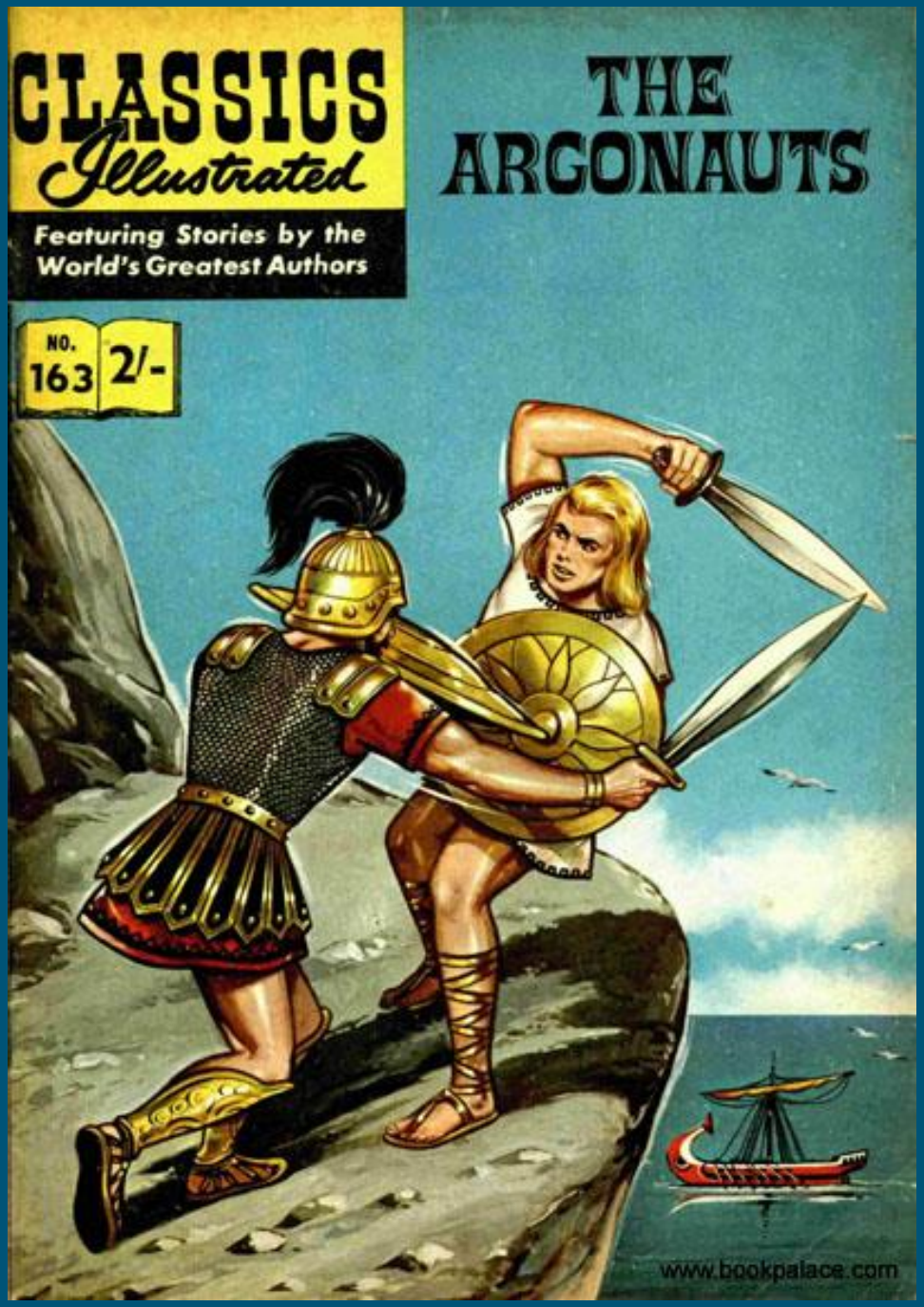

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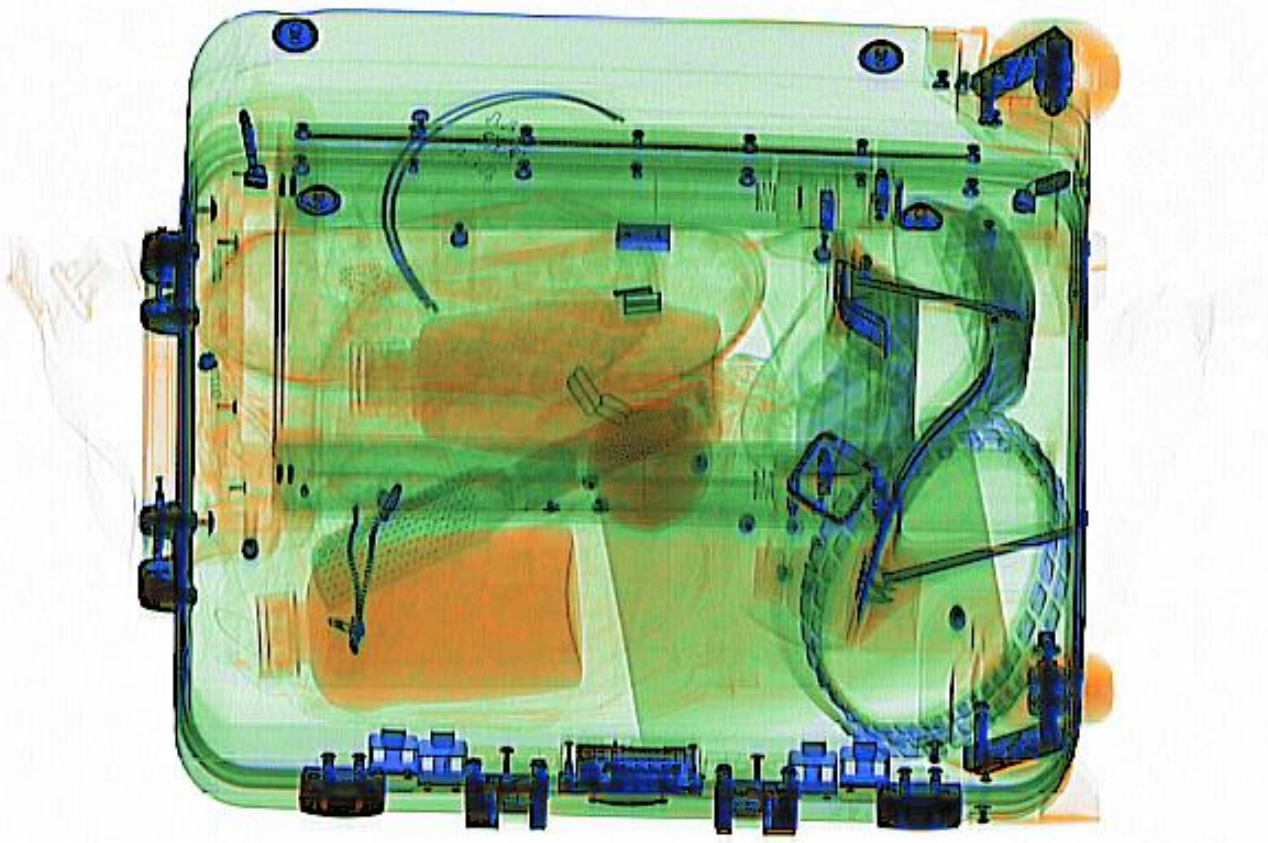

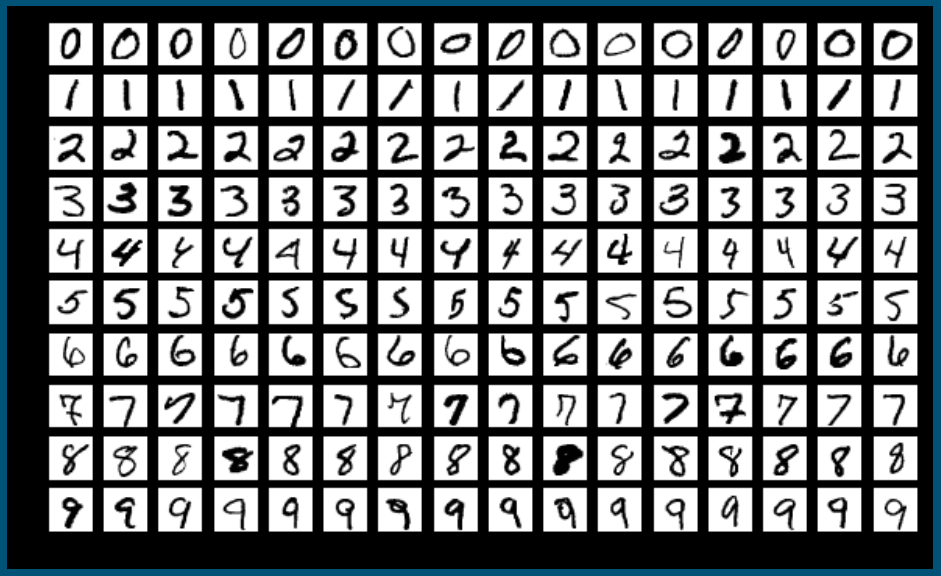

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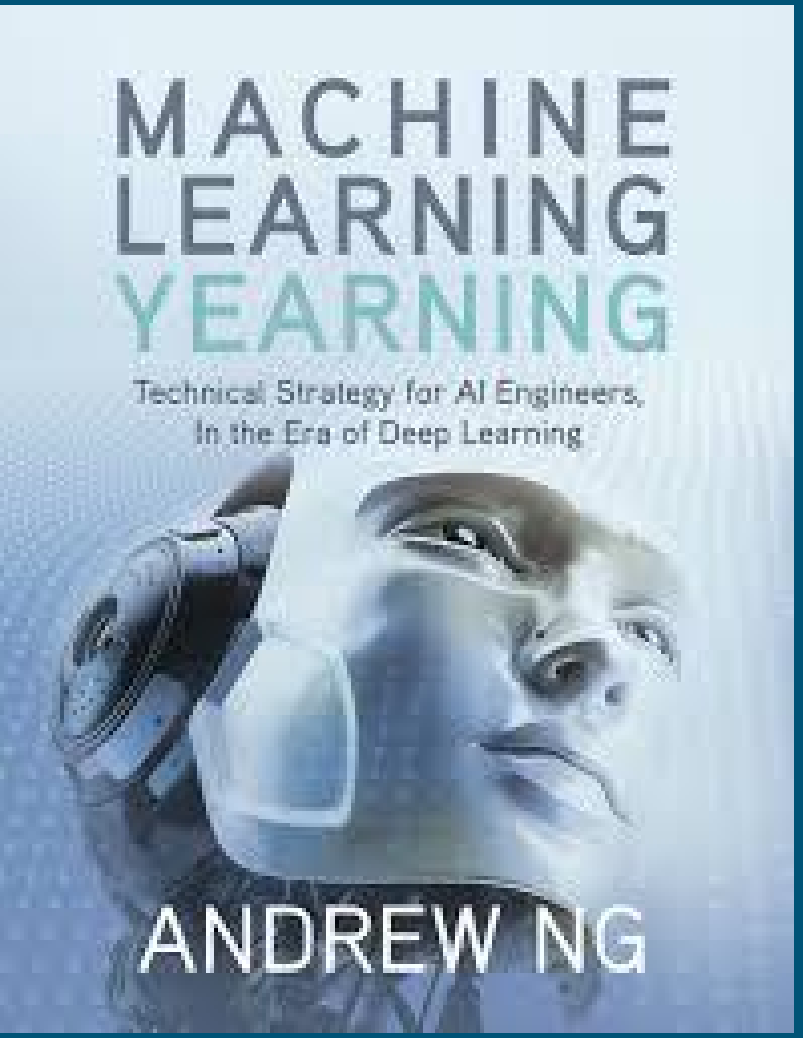

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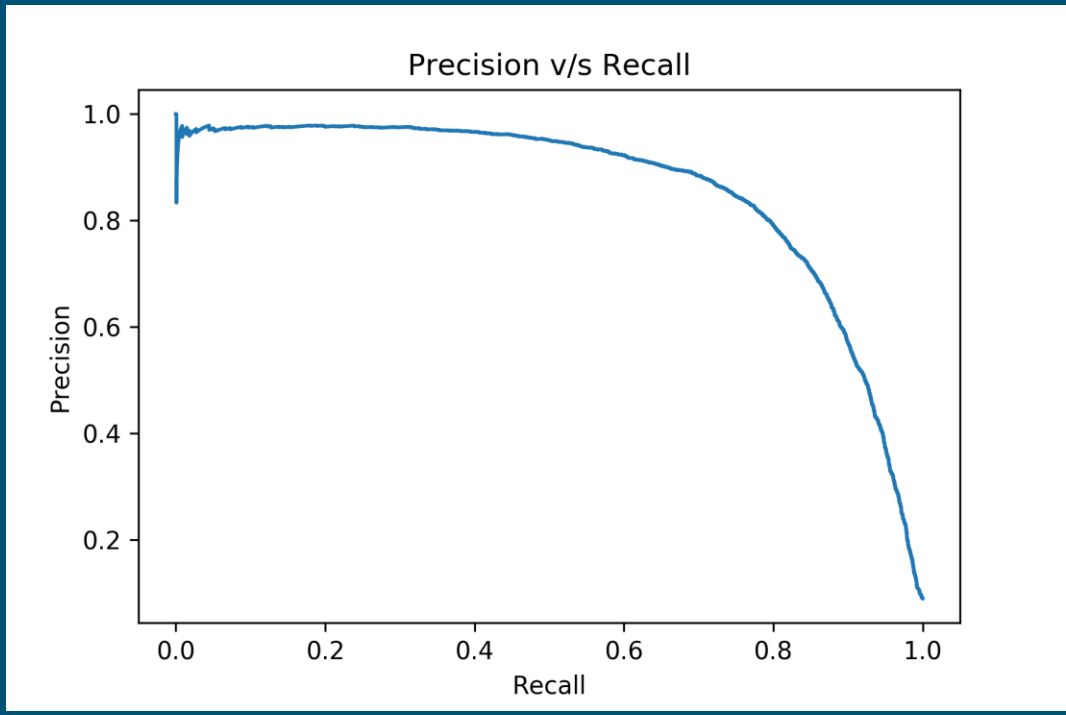

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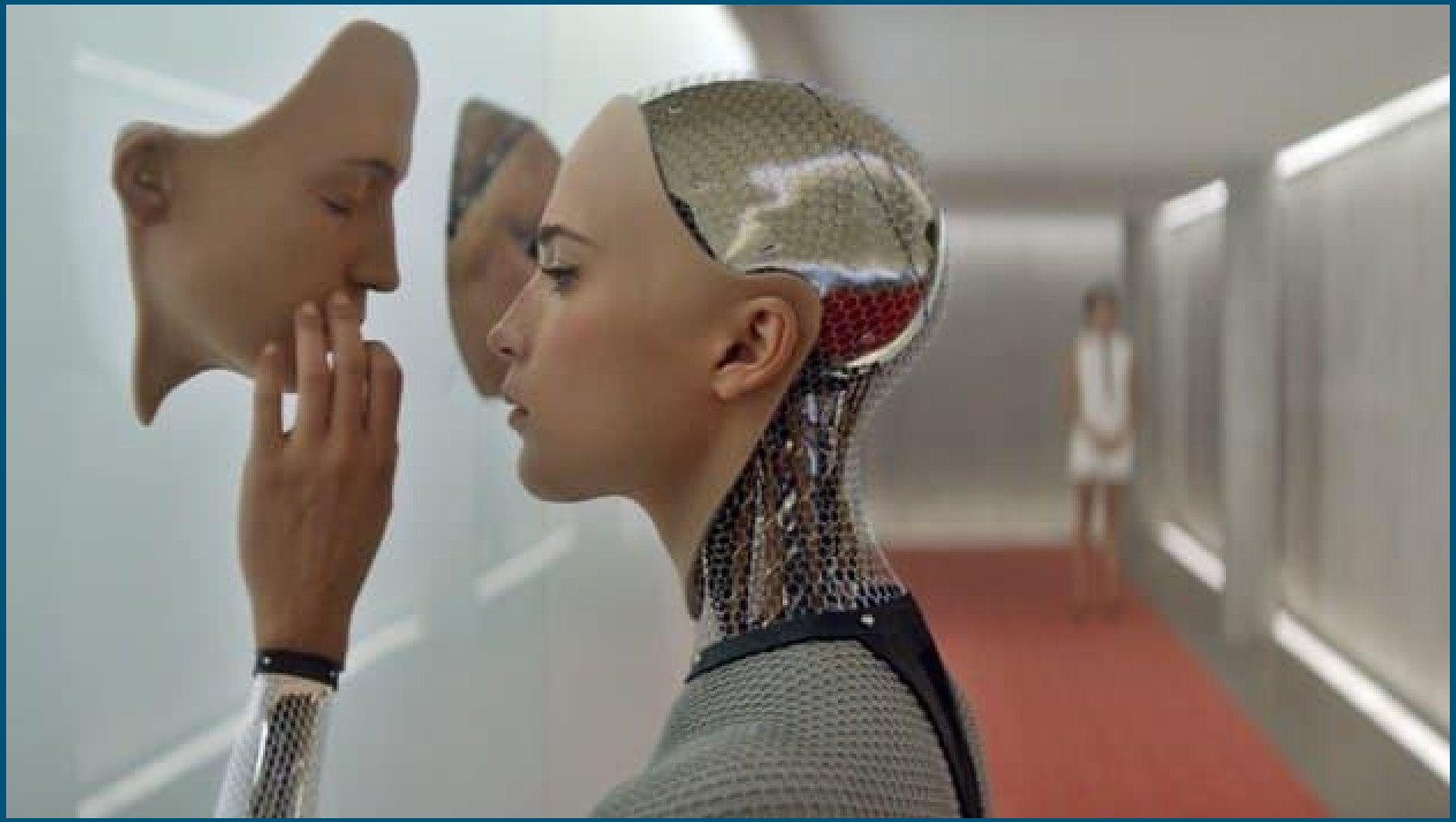

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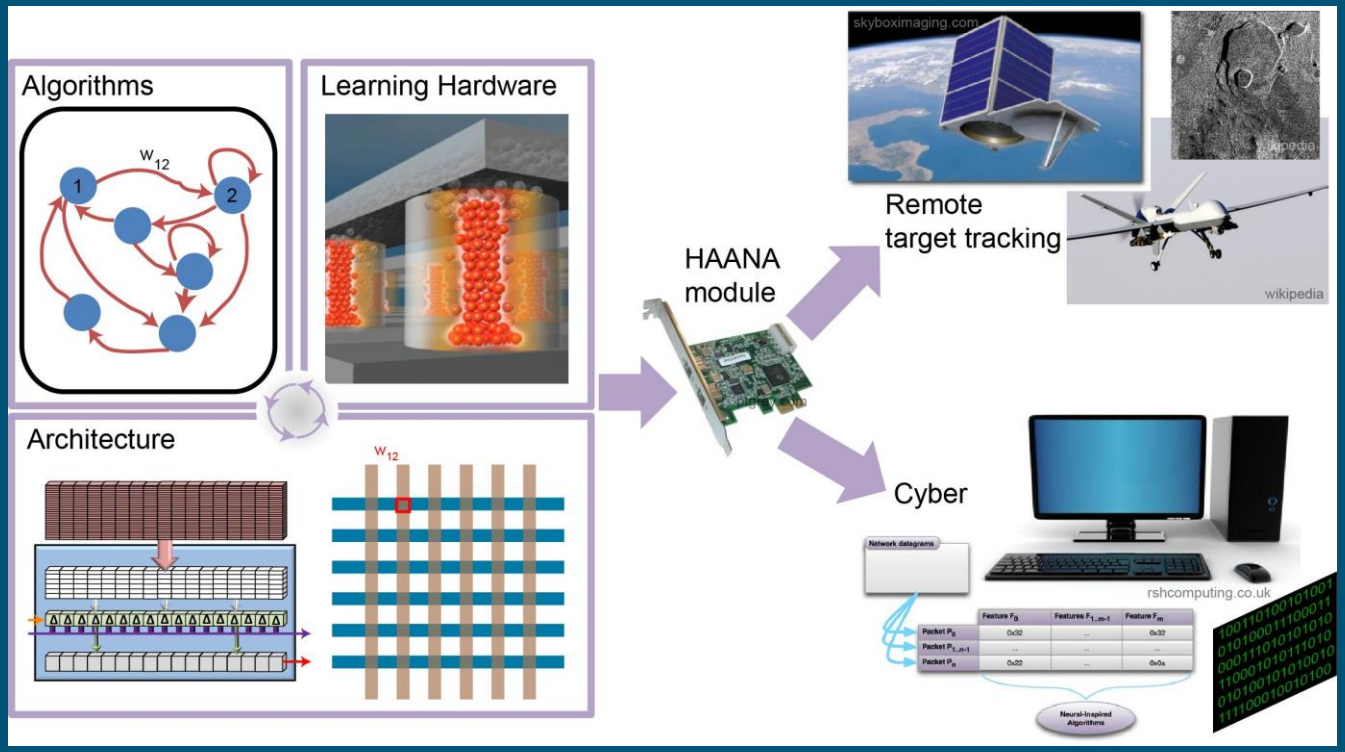
Hardware Acceleration of Adaptive Neural Algorithms (HAANA)



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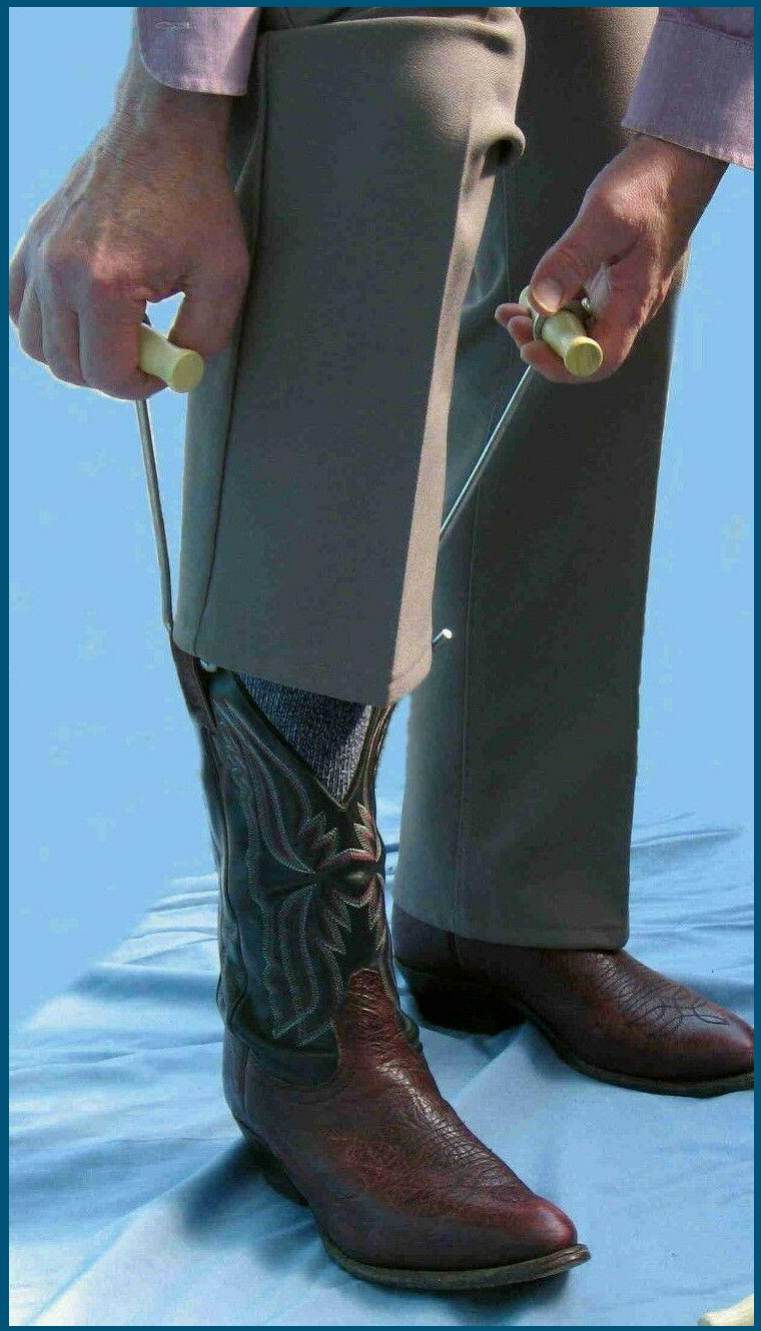

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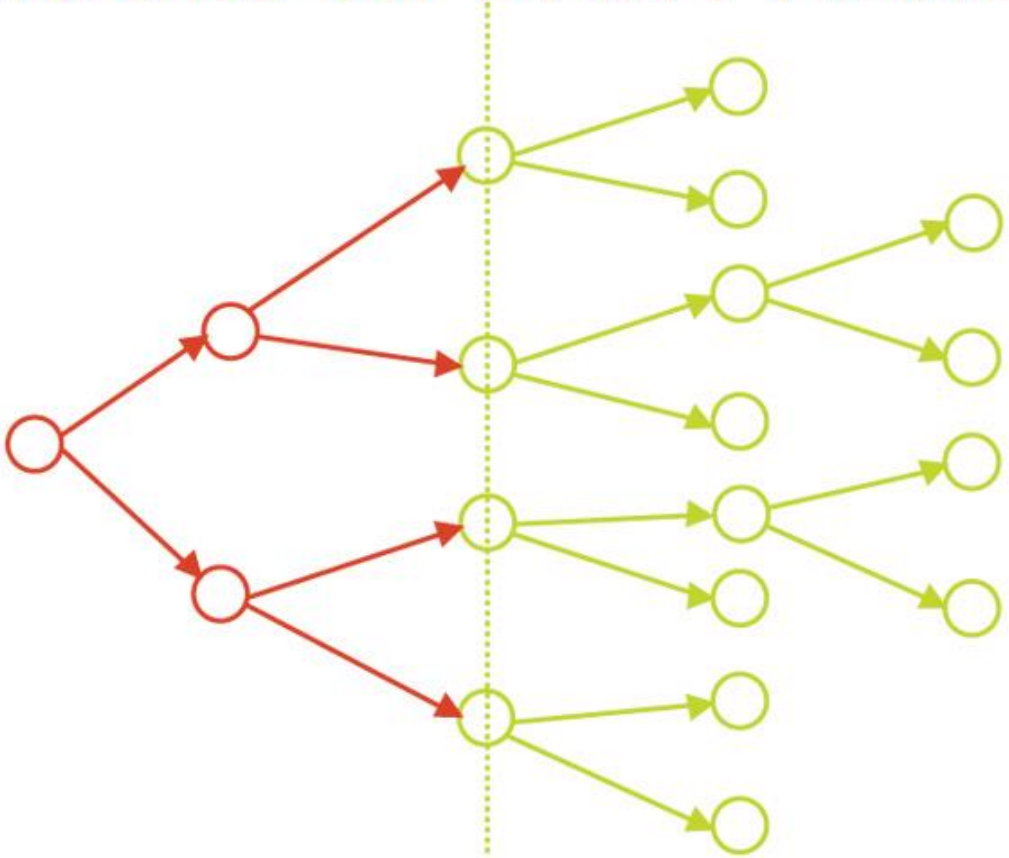
2015 SIAM International Conference on DATA MINING

April 30-May 2, 2015



Pinnacle Vancouver Harbourfront Hotel
Vancouver, British Columbia, Canada

https://archive.siam.org/meetings/sdm15/

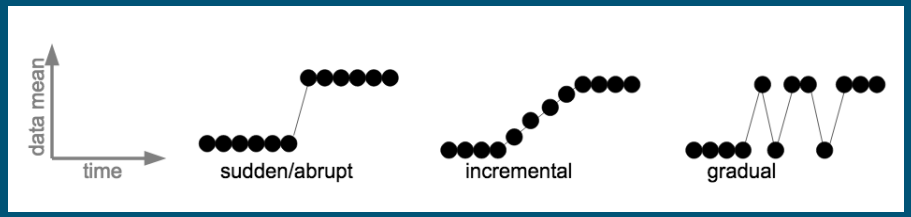
Concept Drift

- Concept drift – unforeseen changes in the relationships between input and output ("concepts") variables.
  - Can be detrimental to model performance.
  - Can be sudden or gradual.
  - Can be natural or adversarial.

Probability of input x, given output y

Model – what is output *y*, given input *x*

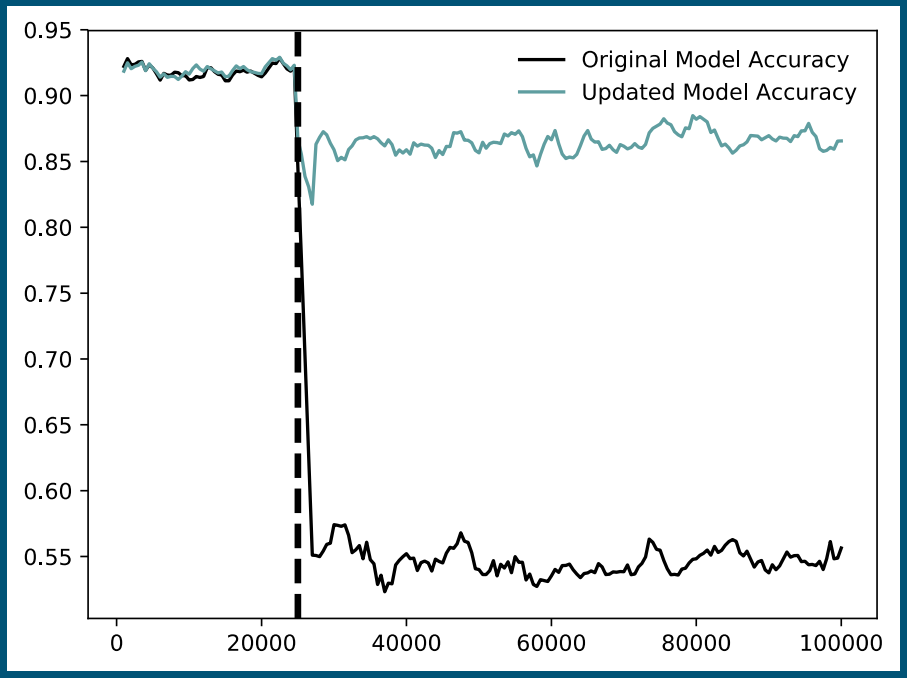
$$P(y|x) = \frac{P(x,y)}{P(x)} = \frac{P(x|y)P(y)}{P(x)}$$



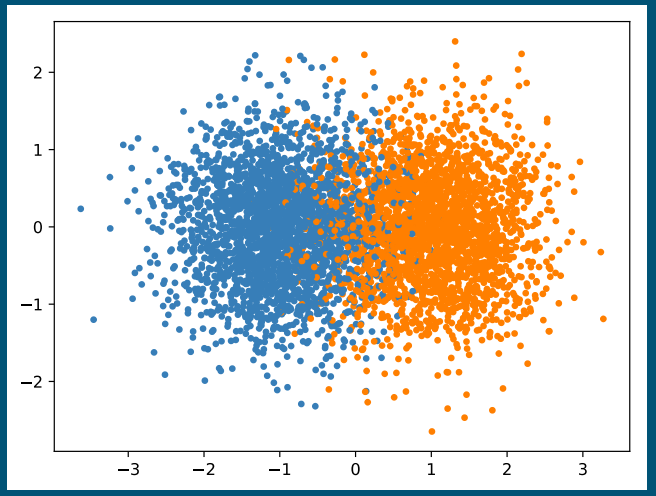
Different rates of concept drift

Effect of Concept Drift

- **Takeaway:** need to update or adapt models to maintain performance.



Performance under drift in *P(x|y)* over time



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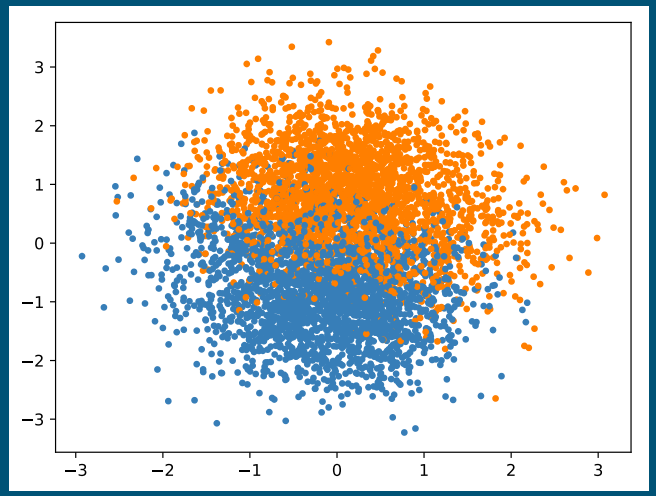

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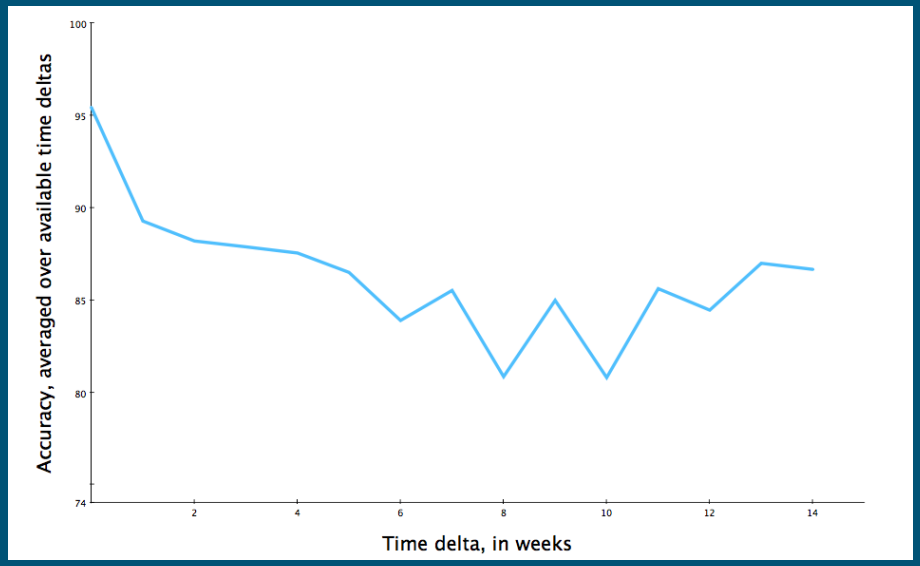
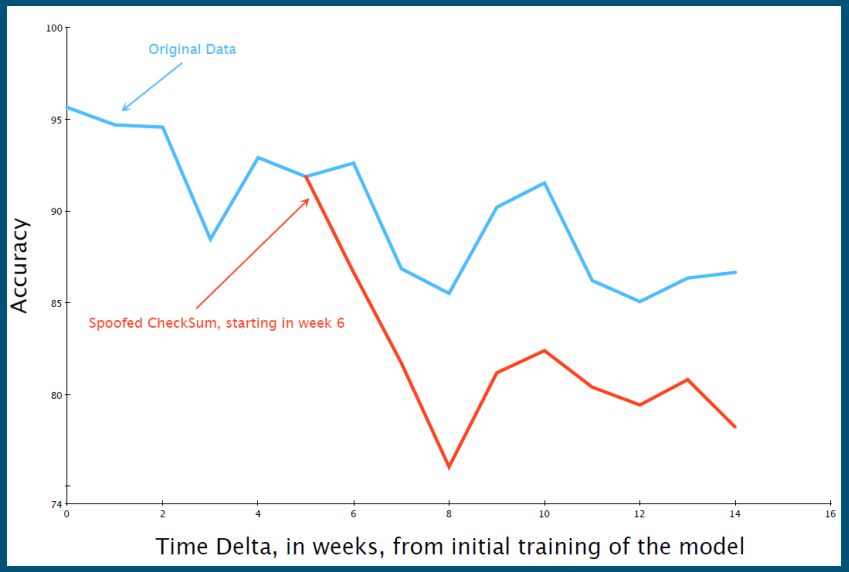
Example: Malware Detection

- Developed model in 2012 to detect malicious software.
- Revisited in 2018 and updated model.
  - Updated (2018) model accuracy: 96%
  - Original (2012) model accuracy: 63%



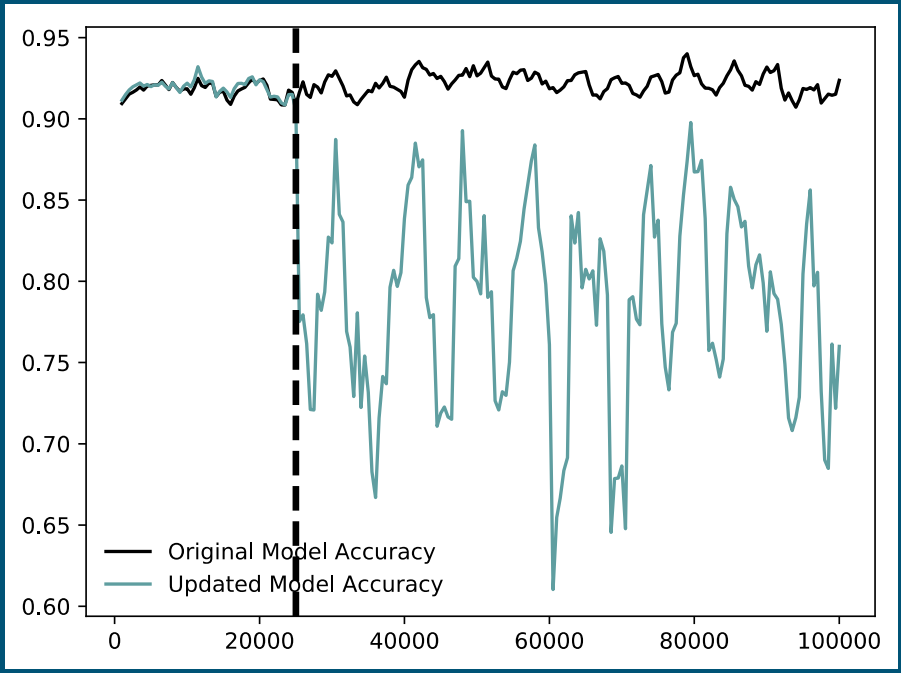
Natural concept drift



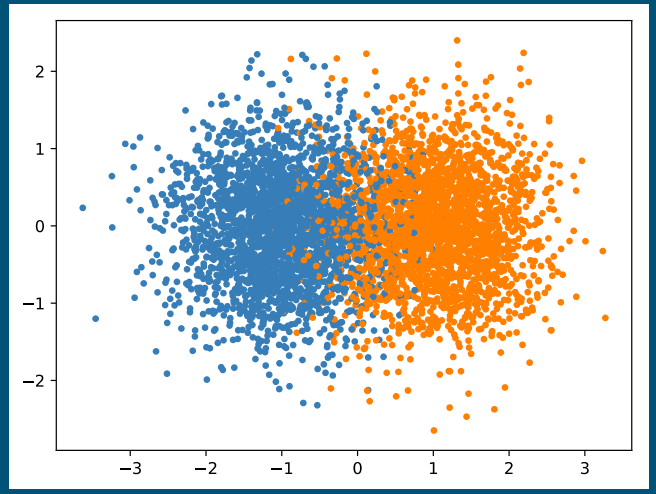
Adversarial concept drift

Effect of Label Noise

- Label noise – data is mislabeled.
- **Takeaway:** need to ***correctly*** update or adapt models to maintain performance.



Performance with label noise over time and no underlying drift



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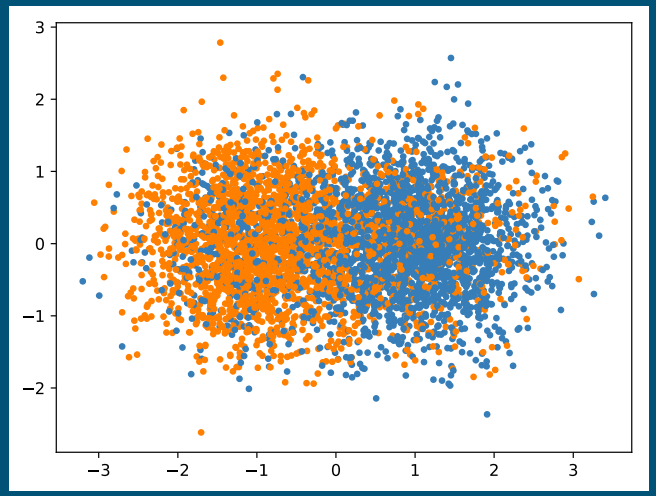

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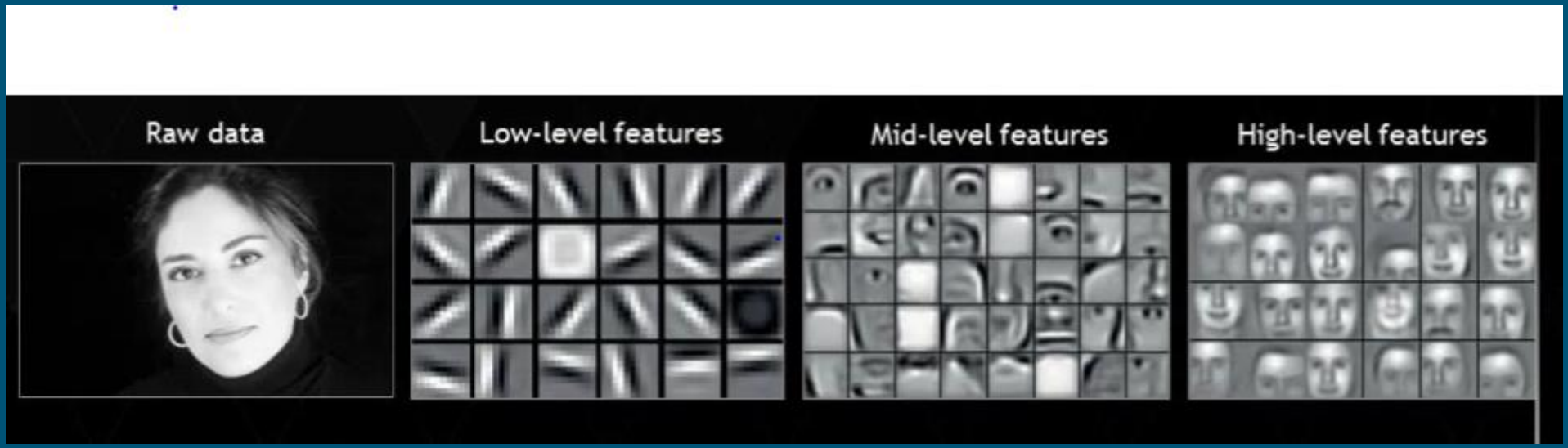

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Questions? Comments?