

Artificial Intelligence & Machine Learning

August 2, 2018

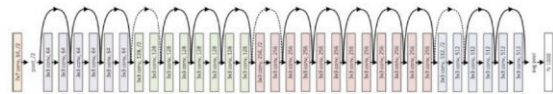
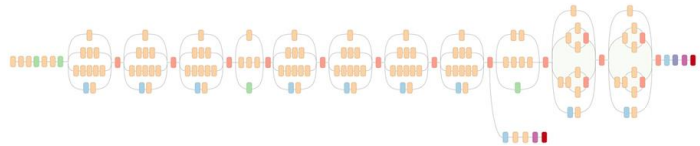
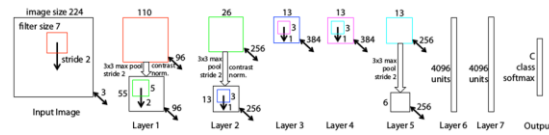
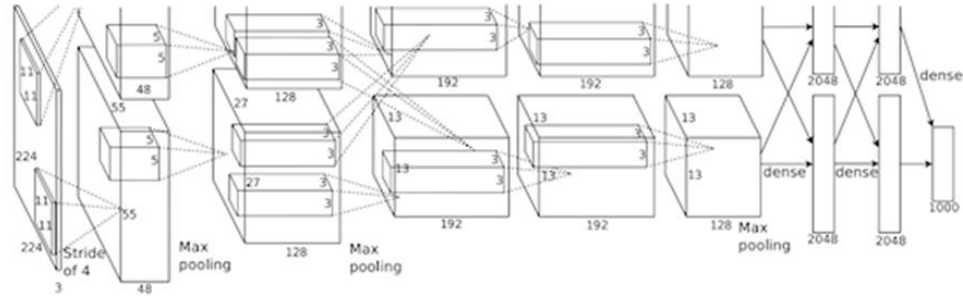
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Definitions

- Artificial Intelligence (AI): An academic field that studies and builds intelligent agents.
- Intelligent Agent: Anything that can perceive it's environment through sensors and act upon that environment through actuators to improve the likelihood of achieving goals.
- Machine Learning (ML): A sub-field of AI that uses statistical methods to progressively improve performance on a specific task, given data, without being explicitly programmed.
- Unsupervised Learning: ML methods that draw inference from unlabeled data. The most common is cluster analysis, used for exploratory purpose to find hidden patterns.
- Supervised Learning: ML methods that infers a function from labeled data to map new input data to desired output classes. Most common form of ML.

The Machine Learning Competition



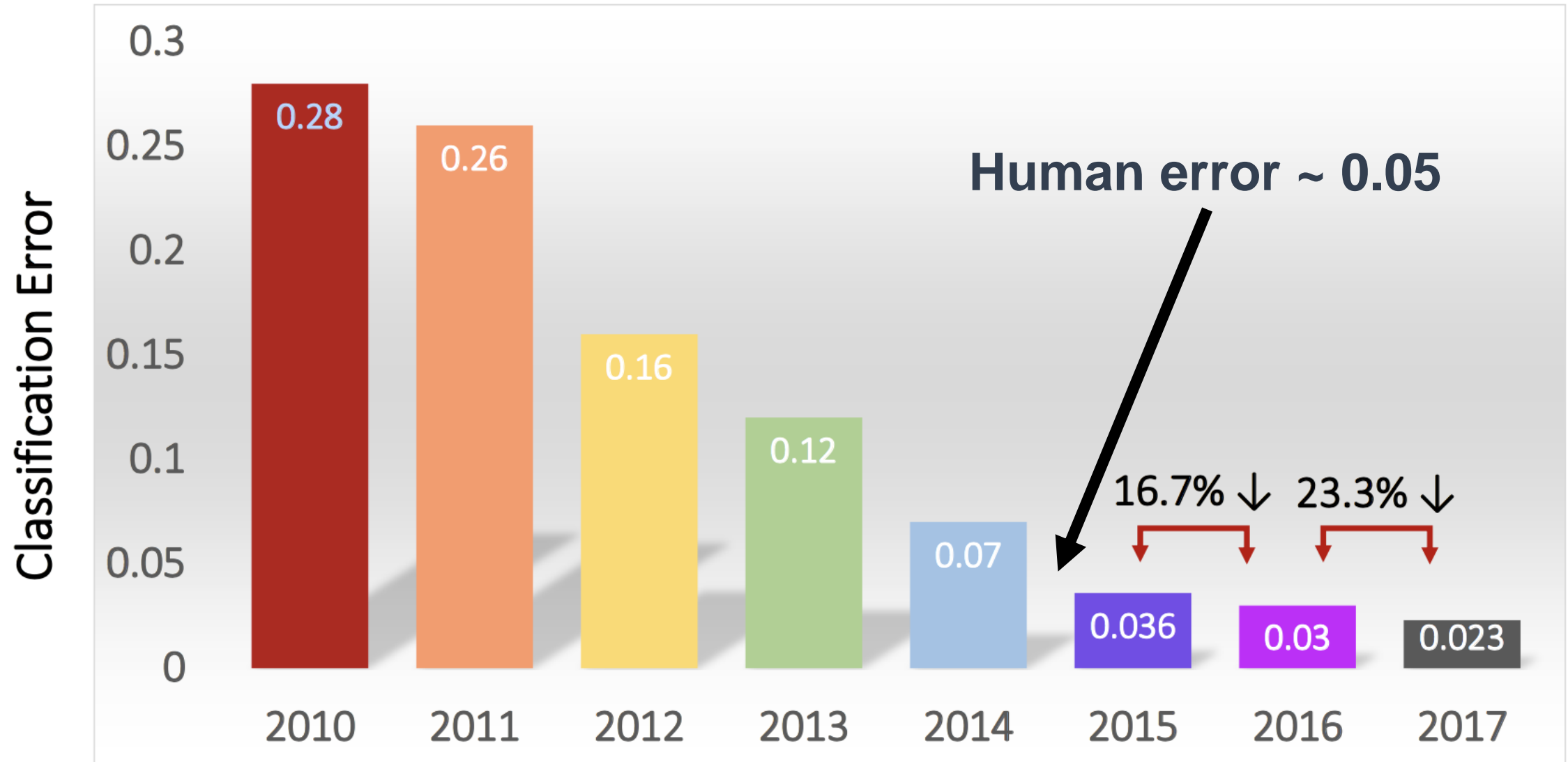
Name	Error Rate	TngSize	Time
AlexNet 2012	15.4%	15M Ann Img	5.5 Days
ZFNet 2013	11.2%	1.3M Ann Img	12 Days
GoogLeNet 2014	6.7%	1.3M Ann Img	1 Week
MS ResNet 2015	3.6%	1.3M Ann Img	2.5 Weeks
Trimps-Soushen 2016	2.9%	1.4M Ann Img	???
WMW 2017	2.3%	1.4M Ann Img	???

The competition is over!!!

No 2018 competition held

It is over...forever...done!

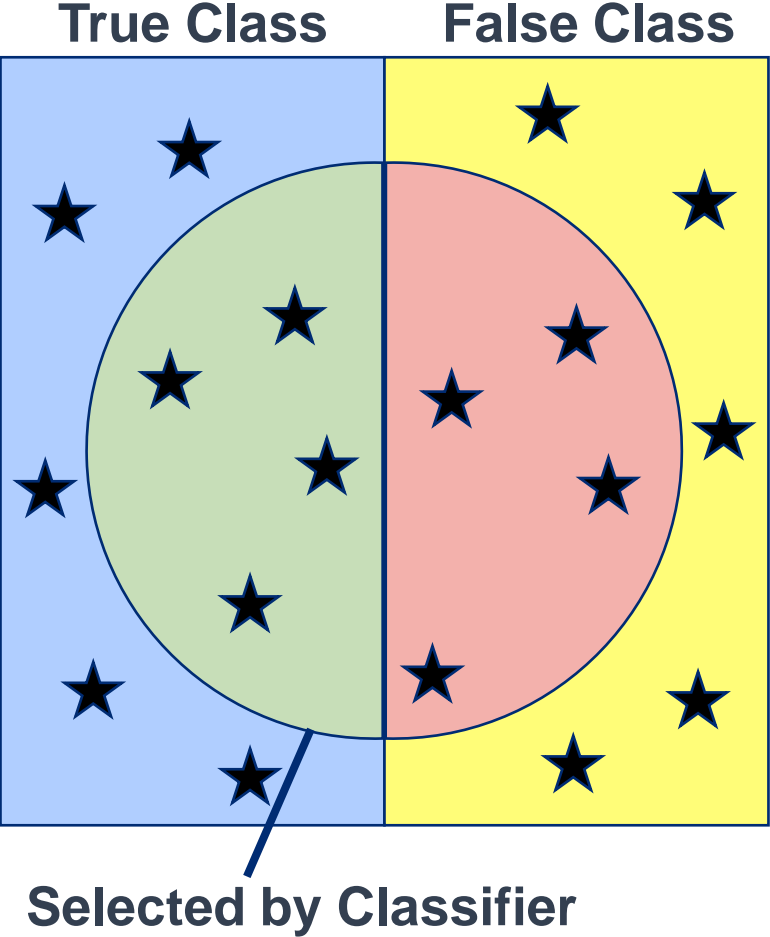
The Machine Learning Competition



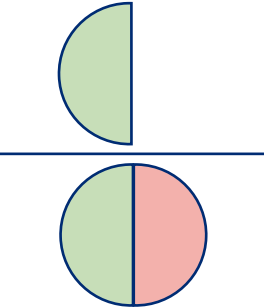
Many AI/ML Challenges

- Types of tasks: Classification, localization, detection, identification, etc...
- Types of media: Image, text, audio, video, etc...
- Ambiguity of the data/classes/objects
- Nature and quality of the training data and specificity of the learning task
- Measures of effectiveness: Accuracy, precision, recall, specificity, F-measure

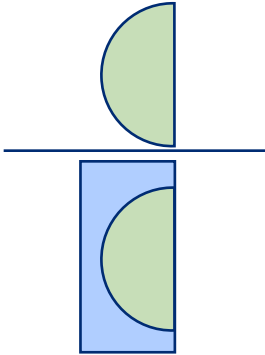
Measures of Effectiveness



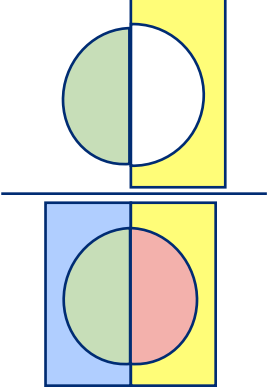
- Precision



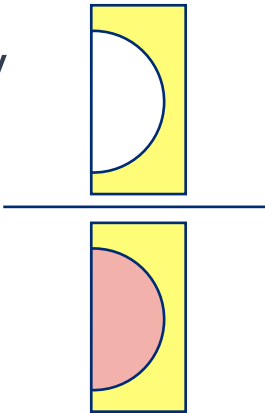
- Recall



- Accuracy



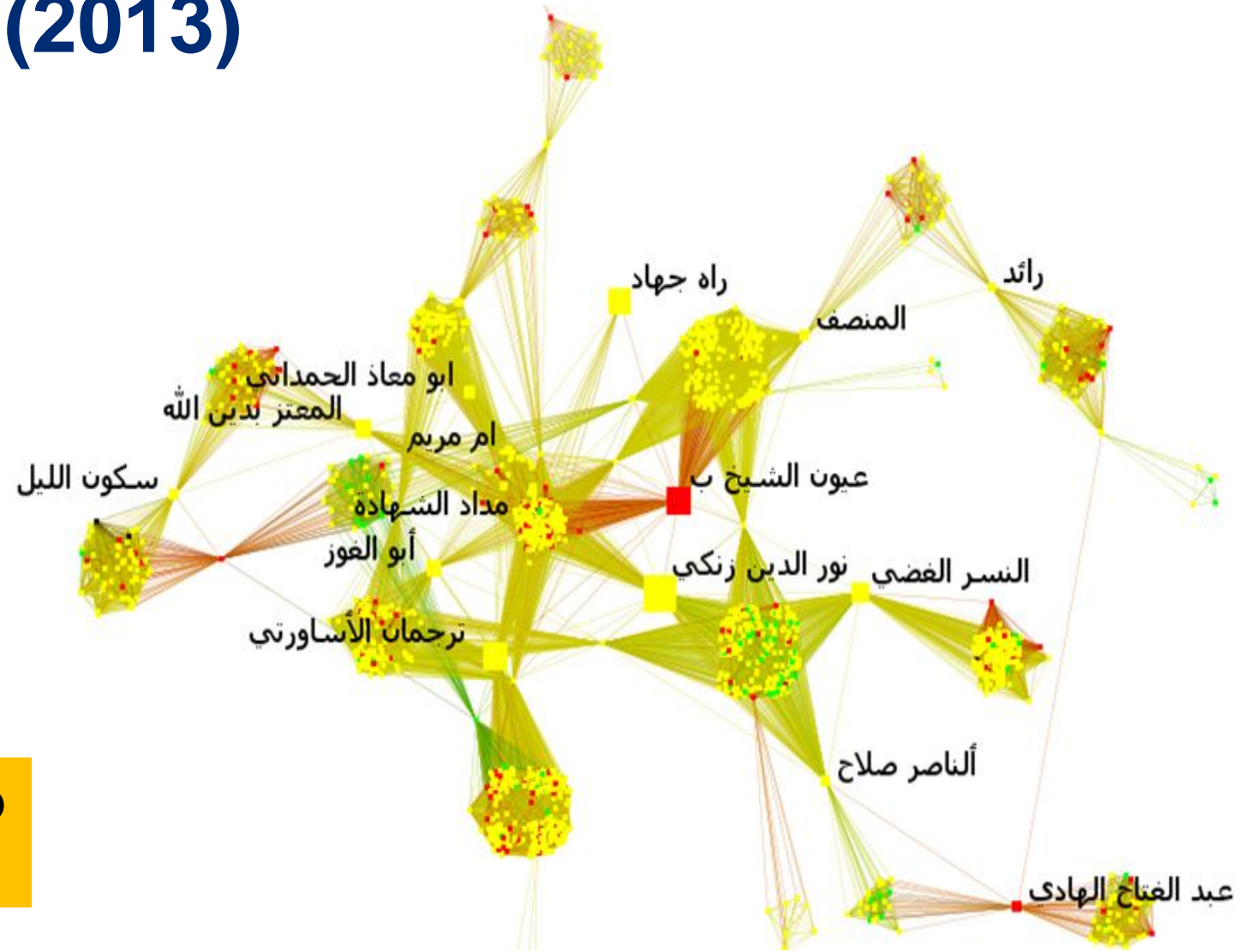
- Specificity



$$F\text{-measure} = \frac{\text{precision} \times \text{recall}}{\text{precision} + \text{recall}}$$

Example – WEBOPS (2013)

- \$4M/yr in labor to assess
- Hybrid NB-SVM 64% accuracy
- Human agreement 68%



How can non-experts develop and validate classifiers?

Monitoring Annotation Efforts – SME Input

	K-alpha	K-Vitality	K-alpha, without B and F
All tags, Equal Type	0.638		.671
Without Annotator A	0.623	0.015	
Without Annotator B	0.640	-0.002	
Without Annotator C	0.620	0.018	
Without Annotator D	0.604	0.034	
Without Annotator E	0.609	0.029	
Without Annotator F	0.664	-0.026	
All tags, Common_Ancestor	0.702		.726
Without Annotator A	0.677	0.025	
Without Annotator B	0.705	-0.003	
Without Annotator C	0.686	0.016	
Without Annotator D	0.678	0.024	
Without Annotator E	0.678	0.024	
Without Annotator F	0.717	-0.015	

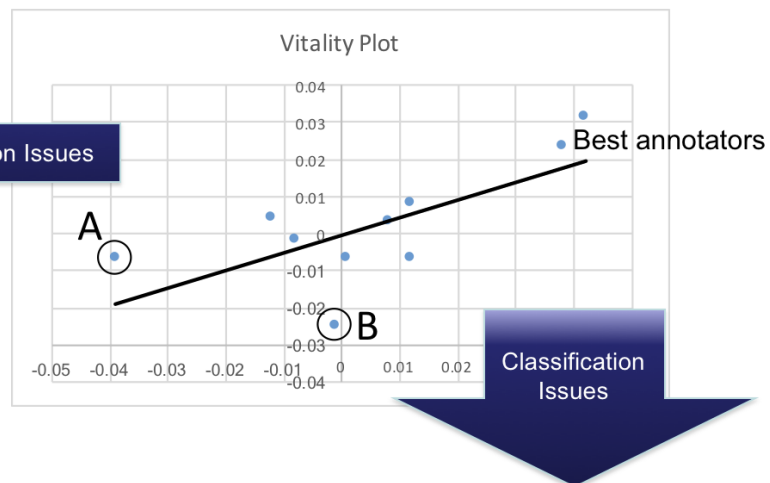
Quality Metrics

- Recognition
- Low-Data-By-Class
- Scale Complexity
- Within Rater Reliability
- Between Rater Reliability

Performance Metrics

- Number of documents
- Average words per documents
- Average labels per documents
- Total number of annotated n-grams
- Annotation density
- Document rate
- Labeling rate
- Average number annotators per doc
- Distraction rate
- Utilization

Vitality = K-Alpha – K-Alpha (without annotator *i*)



Current Efforts at Johns Hopkins University

- Developing annotation standards for classifying essential elements of influential narrative to detect and measure online propaganda.
- Application of annotation leadership within Project MAVEN
- Development gold-standard training data for a DoD organization and potentially inter-agency organizations.

Conclusion

- The NDS rightly directs DoD to implement AI/ML to support decision making
- The next advances in AI/ML have less to do with math and algorithms and more to do with human experts and leadership!
- DoD cannot rely on outsourcing AI/ML needs to commercial vendors!
- The REAL CHALLENGE is integrating:
 - Operational Requirements
 - Subject Matter Expertise
 - Understanding of the Technical State-of-Art



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