A look at

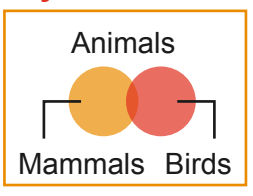
Machine learning evolution

Overview

For decades, individual "tribes" of artificial intelligence researchers have vied with one another for dominance. Is the time ripe now for tribes to collaborate? They may be forced to, as collaboration and algorithm blending are the only ways to reach true artificial general intelligence (AGI). Here's a look back at how machine learning methods have evolved and what the future may look like.

What are the five tribes?

Symbolists



Use symbols, rules, and logic to represent knowledge and draw logical inference

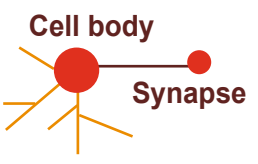
Favored algorithm
Rules and decision trees

Bayesians

Assess the likelihood of occurrence for probabilistic inference

Favored algorithm
Naive Bayes or Markov

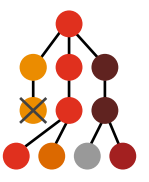
Connectionists



Recognize and generalize patterns dynamically with matrices of probabilistic, weighted neurons

Favored algorithm
Neural networks

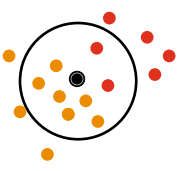
Evolutionaries



Generate variations and then assess the fitness of each for a given purpose

Favored algorithm
Genetic programs

Analogizers



Optimize a function in light of constraints ("going as high as you can while staying on the road")

Favored algorithm
Support vectors

Source: Pedro Domingos, *The Master Algorithm,* 2015

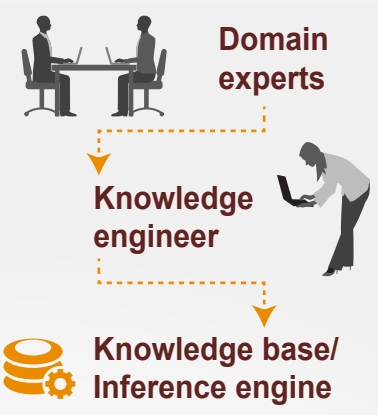
Phases of evolution

1980s

Predominant tribe
Symbolists

Architecture
Server or mainframe

Predominant theory
Knowledge engineering



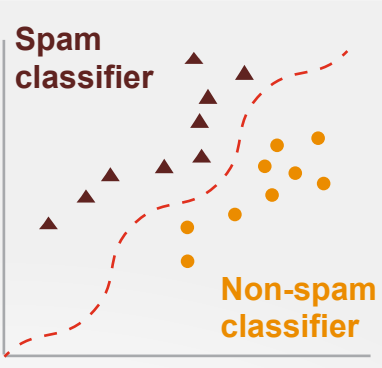
Basic decision logic:
Decision support systems with limited utility

1990s to 2000

Predominant tribe
Bayesians

Architecture
Small server clusters

Predominant theory
Probability theory



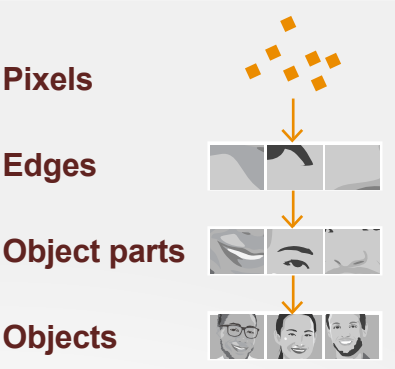
Classification:
Scalable comparison and contrast that's good enough for many purposes

Early to mid-2010s

Predominant tribe
Connectionists

Architecture
Large server farms (the cloud)

Predominant theory
Neuroscience and probability



Recognition:
More precise image and voice recognition, translation, sentiment analysis, etc.

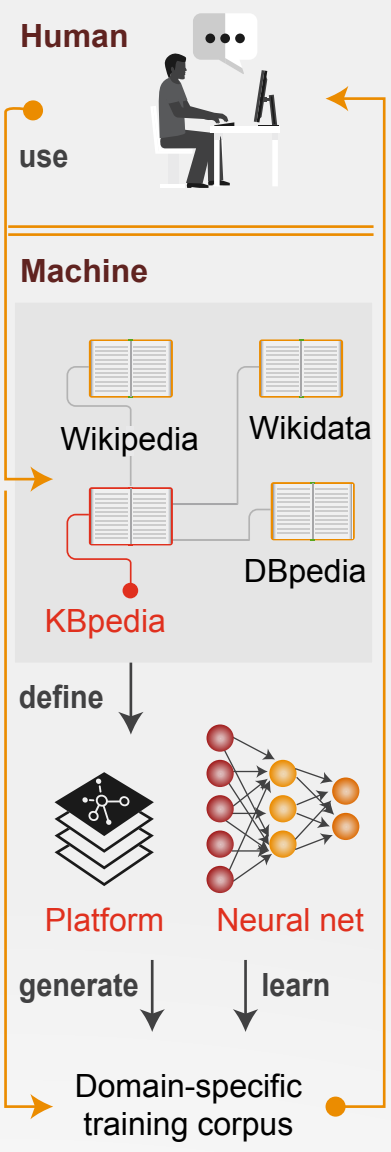
The tribes see fit to collaborate and blend their methods

Late 2010s

Predominant tribe
Connectionists + Symbolists

Architecture
Multiple clouds

Predominant theory
Memory neural networks, large-scale integration, and reasoning over knowledge



Source: Cognonto, 2016

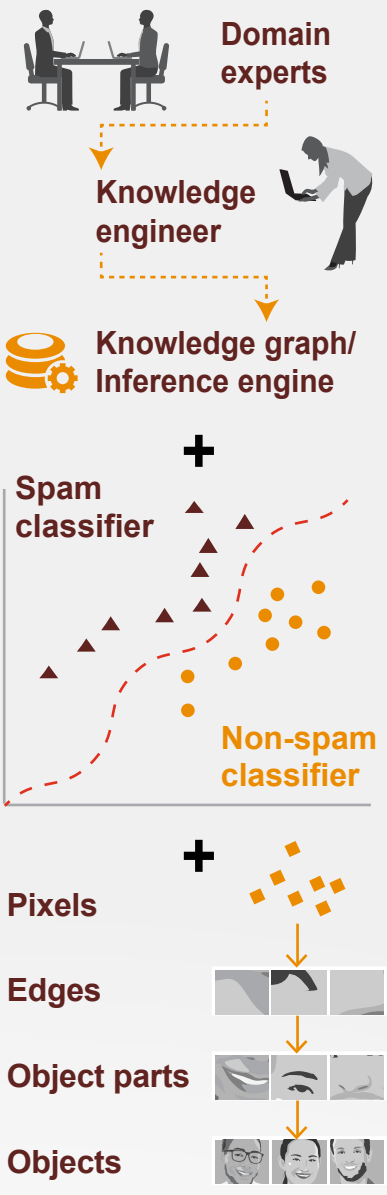
Simple question answering:
Narrow, domain-specific knowledge sharing

2020s+

Predominant tribe
Connectionists + Symbolists + Bayesians + ...

Architecture
Clouds and fog

Predominant theory
Networks when sensing, but rules when reasoning and acting



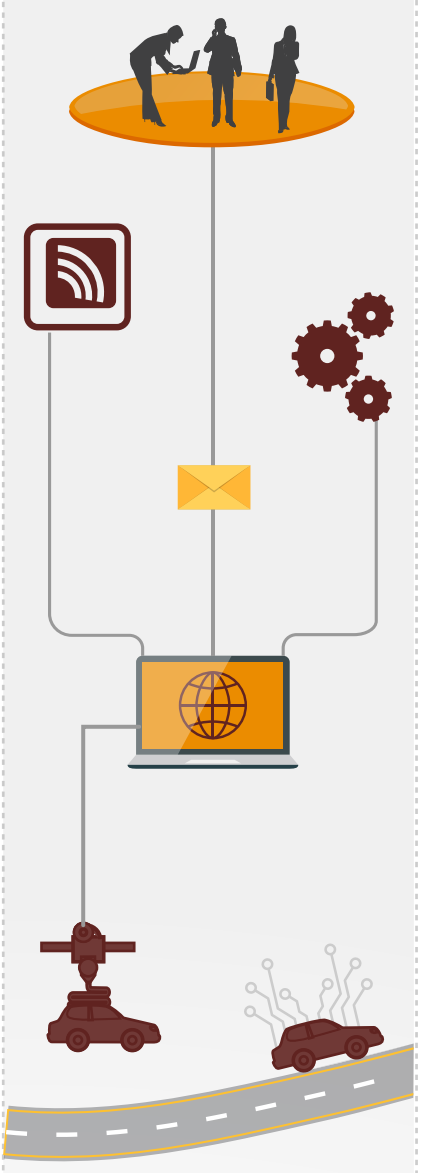
Simple sensing, reasoning, and actions: Bounded autonomy or human-machine interaction

2040s+

Predominant tribe
Algorithmic convergence

Architecture
Server ubiquity

Predominant theory
Best-of-breed meta-learning



Sensing and responding:
Act or answer based on knowledge or experience gained through various kinds of learning

Source: PwC, 2016

pwc.com/NextinTech