Accelerating Science: A Grand Challenge for AI

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18 November, 2016
Allen Institute for AI (AI2)

Founded by Paul Allen in 2014
Now 70 people and growing

AI for the Common Good
Moore’s Law of Scientific Publication

The number of scientific papers has doubled every nine years since World War II
Learning in science: A comparison of deep and surface approaches
C Chin, DE Brown - Journal of research in science teaching, 2000 - Wiley Online Library
Abstract The purpose of this study was to explore in greater depth what has been called by previous researchers, a deep versus surface approach to learning science. Six Grade 8 students judged as typically using learning approaches ranging from deep to surface were ...
Cited by 397  Related articles  All 5 versions  Cite  Save

Why does unsupervised pre-training help deep learning?
D Erhan, Y Bengio, A Courville, PA Manzagol - ... of Machine Learning ..., 2010 - jmlr.org
Abstract Much recent research has been devoted to learning algorithms for deep architectures such as Deep Belief Networks and stacks of auto-encoder variants, with impressive results obtained in several areas, mostly on vision and language data sets. ...
Cited by 722  Related articles  All 27 versions  Cite  Save

[PDF] Multimodal deep learning
J Ngiam, A Khosla, M Kim, J Nam... - ... machine learning ( ..., 2011 - machinelearning.wustl.edu
Abstract Deep networks have been successfully applied to unsupervised feature learning for single modalities (eg, text, images or audio). In this work, we propose a novel application of deep networks to learn features over multiple modalities. We present a series of tasks for ...
Cited by 519  Related articles  All 29 versions  Cite  Save  More
Information Overload

**Challenge**: Researchers are swamped; Virtually impossible to read all papers

**Opportunity**: Leverage AI to combat information overload
Cut through the clutter.
Home in on key papers, citations, and results.

Find it fast

Try:  Open information extraction  POS tagging  Dependency parsing

Computer Science and (recently) Neuroscience research articles
Faceted Search

**INSIGHT-1 at SemEval-2016 Task 5: Deep Learning for Multilingual Aspect-based Sentiment Analysis**

Sebastian Ruder, Parsa Ghafari, John G. Breslin · SemEval@NAACL-HLT · 2016

This paper describes our deep learning-based approach to multilingual aspect-based sentiment analysis as part of SemEval 2016 Task 5. We use a convolutional neural network (CNN) for both aspect extraction and aspect-based sentiment analysis. We cast aspect extraction as a multi-label classification problem, outputting probabilities over aspects... (More)

Mentioned in 18 tweets:

- arXiv CS-CL

**Deep learning.**

Yann LeCun, Yoshua Bengio, Geoffrey E. Hinton · Nature · 2015

Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction. These methods have dramatically improved the state-of-the-art in speech recognition, visual object recognition, object detection and many other domains such as drug discovery and genomics. Deep... (More)

**Deep Learning in Neural Networks: An Overview**

Jürgen Schmidhuber · Neural Networks · 2015

In recent years, deep artificial neural networks (including recurrent ones) have won numerous contests in pattern recognition and machine learning. This historical survey compactly summarizes relevant work, much of it from the previous millennium. Shallow and Deep Learners are distinguished by the depth of their credit assignment paths, which are chains of... (More)
Faceted Search

Automatically extracted using statistical models
Domain Adaptation for Large-Scale Sentiment Classification: A Deep Learning Approach

Xavier Glorot, Antoine Bordes, Yoshua Bengio - ICML - 2011

Abstract
The exponential increase in the availability of online reviews and recommendations makes sentiment classification an interesting topic in academic and industrial research. Reviews can span so many different domains that it is difficult to gather annotated training data for all of them. Hence, this paper studies the problem of domain adaptation for sentiment classifiers, whereby a system is trained on labeled reviews from one source domain but is meant to be deployed on another. We propose a deep learning approach which learns to extract a meaningful representation for each review in an unsupervised fashion. Sentiment classifiers trained with this high-level feature representation clearly outperform state-of-the-art methods on a benchmark composed of reviews of 4 types of Amazon products. Furthermore, this method scales well and allowed us to successfully perform domain adaptation on a larger industrial-strength dataset of 22 domains.

Extracted Key Phrases
- Non-linearity
- SDA
- Encoder
- NLP
- Autoencoder

5 Figures and Tables
- Table 1
- Figure 1
- Figure 2
- Figure 3
- Figure 4
Staying up-to-date

Computer Science

Authors and titles for recent submissions, skipping first 205

- Thu, 17 Nov 2016
- Wed, 16 Nov 2016
- Tue, 15 Nov 2016
- Mon, 14 Nov 2016
- Fri, 11 Nov 2016

[ showing 25 entries per page: fewer | more | all ]

Tue, 15 Nov 2016 (showing first 25 of 158 entries)

[206] arXiv:1611.04581 [pdf, other]

How to scale distributed deep learning?
Peter H. Jin, Qiaochu Yuan, Forrest Iandola, Kurt Keutzer
Comments: Extended version of paper accepted at ML Sys 2016 (at NIPS 2016)
Subjects: Learning (cs.LG)
Staying up-to-date

• Idea: Daily feed of most relevant papers

• Research Challenges:
  • Identify topics in a document
  • Model user’s topic preference
  • Rank by relevance
Deeper Understanding of a Document

- Autoencoders
- CRF autoencoders
- CRF
- POS Induction
- Unsupervised structured prediction
- CoNLL 2007

Entity Extraction
Deeper Understanding of a Document

Method: Autoencoders, CRF autoencoders, CRF

Task: POS Induction, Unsupervised structured prediction

Dataset: CoNLL 2007

Type Identification
Deeper Understanding of a Document

- Autoencoders
- CRF autoencoders
- CRF
- POS Induction
- Unsupervised structured prediction
- CoNLL 2007

Relation Extraction

- subclass of
- uses
- addresses
Deeper Understanding of the Literature

Literature Graph

- Autoencoders
- CRF autoencoders
- CRF
- POS Induction
- Unsupervised structured prediction
- CoNLL 2007

subclass of
uses
addresses
Citeomatic: Who should I cite?

- Disseminating Research by Writing papers
- Comprehensive review of related work is challenging
Citeomatic: A brief overview

• Input:
  • The title and abstract of a query paper

• Output:
  • A list of related work, that should be reviewed, ordered by confidence
Citeomatic

Your Paper

- Source File: Multi-column-FINAL.pdf
- Title: Multi-column Deep Neural Networks for Image Classification
- Abstract: Traditional methods of computer vision and machine learning cannot match human performance on tasks such as the recognition of handwritten digits or traffic signs. Our biologically plausible, wide and deep artificial neural network architectures can. Small (often minimal) receptive fields of convolutional winner-take-all neurons yield large network depth, resulting in roughly as many sparsely connected neural layers as found... (More)
- Authors: Dan C. Ciresan, Ueli Meier, Jürgen Schmidhuber

Predicted Citations (19)

<table>
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<th>Title</th>
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<th>Year</th>
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<tr>
<td>Towards Biologically Plausible Deep Learning</td>
<td>Matthieu Devin, Quoc V. Le +6 others</td>
<td>2015</td>
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<td>Speech Recognition with Deep Recurrent...</td>
<td>Xavier Glorot, Yoshua Bengio</td>
<td>2011</td>
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<td>Extracting and composing robust features...</td>
<td>Dan Popovici, Hugo Larochelle</td>
<td>2014</td>
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<td>Multilayer feedforward networks are universal...</td>
<td>Ning Zhang, Eric Tzeng +1 other</td>
<td>2003</td>
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<td>Semi-supervised Learning Literature Survey</td>
<td>Ross B. Girshick +2 others</td>
<td>2012</td>
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Citeomatic: Network Architecture

\[ P(\text{Query cites Candidate}) \]

- **Embedding Layer**
  - Query Title
  - Candidate Title
  - Query Abstract
  - Candidate Abstract

- **Sigmoid Layer**
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Directions of Future Work

• Hypothesis Generation
  • *Method X has been found to be effective for task Y. Task Y and Z are related. Maybe X can be applied to Z*

• What’s at my knowledge-frontier?
  • *I know about X and Y, what should I know next?*

• Topic dependencies
  • *I want to learn X, what are its pre-requisites?*
Scientific Research is facing tremendous Information Overload

Advances in AI, ML and NLP can help!

“No human could possibly read the entirety of medical literature, personal health records, and case file histories that might inform a doctor’s professional opinion when trying to save a cancer patient’s life. But a machine can.”

- fortune.com on Nov 2, 2016
Thank You!

Please visit: semanticscholar.org