AI-Powered NLP: The Evolution of Machine Intelligence From Machine Learning

With the advent of deep learning techniques, MI objectives like automated real-time question-answering, emotional connotation, fighting spam, and more are achieved.

by Tuhin Chattopadhyay · Oct. 19, 17 · AI Zone

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This article will illustrate the transition of the NLP landscape from a machine learning paradigm to the realm of machine intelligence and walk the readers through a few critical applications along with their underlying algorithms. Nav Gill's blog on the stages of AI and their role in NLP presents a good overview of the subject. A number of research papers have also been published to explain how to take traditional ML algorithms to the next level. Traditionally, classical machine learning techniques like support vector machines (SVM), neural networks, naïve Bayes, Bayesian networks, Latent Dirichlet Allocation (LDA), etc. are used for text mining to accomplish sentiment analysis, topic modeling, TF–IDF, NER, etc.

However, with the advent of open-source APIs like TensorFlow, Stanford's CoreNLP suite, Berkeley AI Research's (BAIR) Caffe, Theano, Torch, Microsoft's Cognitive Toolkit (CNTK), and licenced APIs like api.ai, IBM's Watson Conversation, Amazon Lex, Microsoft's Cognitive Services APIs for speech (Translator Speech API, Speaker Recognition API, etc.), and language (Linguistic Analysis API, Translator Text API, etc.), classical text mining algorithms have evolved into deep learning NLP architectures like recurrent and recursive neural networks. Google Cloud, through its Natural Language API (REST), offers sentiment analysis, entity analysis, entity sentiment analysis, syntactic analysis, and content classification. Before diving further into the underlying deep learning algorithms, let'stake a look at some of the interesting applications that AI contributes to the field of NLP.

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To start with the craziest news, artificial intelligence is writing the sixth book of *A Song of Ice and Fire*. Software engineer Zack Thoutt is using a recurrent neural network to help wrap up George R. R. Martin's epic saga. Emma, created by Professor Aleksandr Marchenko, is an AI bot for checking plagiarism that amalgamates NLP, machine learning, and stylometry. It helps in defining the authorship of write-ups by studying the way people write. Android Oreo has the ability to recognize text as an address, email ID, phone number, URL, etc. and take the intended action intelligently. The smart text selection feature uses AI to recognize commonly copied words as a URL or business name. IBM Watson Developer Cloud's Tone Analyzer is capable of extracting the tone of any documents like tweets, online reviews, email messages, interviews, etc. The analysis output is a dashboard with visualizations of the presence of multiple emotions (anger, disgust, fear, joy, sadness), language style (analytical, confident, tentative), and social tendencies (openness, conscientiousness, extraversion, agreeableness, emotional range). The tool also provides sentence-level analysis to identify the specific components of emotions, language style, and social tendencies embedded in each sentence.

ZeroFox is leveraging AI on NLP to bust Twitter's spam bot problem and protect social and digital platforms for enterprises. Google Brain is conducting extensive research on understanding natural language and came up with unique solutions like autocomplete suggestions, autocomplete for doodles, and automatically answered e-mails, as well as the RankBrain algorithm to transform Google search. Google's Neural Machine Translation reduces translation errors by an average of 60% compared to Google's older phrase-based system. Quora

conducted a Kaggle competition to detect duplicate questions where the modelers reach 90% accuracy. Last but not least, seamless question-answering is accomplished through a number of artificially intelligent natural language processors like Amazon's Alexa Voice Service (AVS), Lex, and Polly, along with api.ai, archie.ai, etc. that can be embedded in devices like Echo and leveraged for virtual assistance through chatbots.

Thus, the shift in gears from machine learning to machine intelligence is achieved through automated real-time question-answering, emotional analysis, spam prevention, machine translation, summarization, and information extraction. While the focus of ML is natural language understanding (NLU), MI is geared up for natural language generation (NLG) that involves text planning, sentence planning, and text realization. Conventionally, Markov chains are used for text generation through the prediction of the next word from the current word. A classic example of a Markov chain is available at SubredditSimulator.

However, with the advent of deep learning models, a number of experiments were conducted through embedded words and recurrent neural networks to generate text that can keep the style of the author intact. The same research organization, Indigo Research, published a blog recently that demonstrates the application of long short-term memory (LSTM) in generating the text through "memories" of a priori information. A number of research and development initiatives are currently going on the artificial natural language processing to match the human processing of language and eventually improve it.

The Stanford Question Answering Dataset (SQuAD) is one such initiative, with 100,000+ question-answer pairs on 5,222,300+ articles which were also shared

in a Kaggle competition. Dynamic Co-attention Network (DCN), which combines a co-attention encoder with a dynamic pointing decoder, gained prominence as the highest performer (Exact Match 78.7 and F1 85.6) in SQuAD and in automatically answering questions about documents. Other applications of deep learning algorithms that generate machine intelligence in the NLP space include bidirectional long short-term memory (biLSTM) models for non-factoid answer selection, convolutional neural networks (CNNs) for sentence classification, recurrent neural networks for word alignment models, word embeddings for speech recognition, and recursive deep models for semantic compositionality. Yoav Goldberg's magnum opus and all the dedicated courses (Stanford, Oxford, and Cambridge) on the application of deep learning on NLP further bear testimony to the paradigm shift from ML to MI in the NLP space.

With the evolution of human civilization, technological advancements continue to complement the increasing demands of human life. Thus, the progression from machine learning to machine intelligence is completely in harmony with the direction and pace of the development of the human race. A few months ago, Nav Gill's blog on the stages of AI and their role in NLP observed that we have reached the stage of machine intelligence, and the next stage is machine consciousness. Of late, AI has created a lot of hype by some who see it as the greatest risk to civilization. However, like any technology, AI can do more good for society than harm — when used correctly. Instead of the predicted cause of the apocalypse, AI may turn out to be the salvation of civilization with a bouquet of benefits, from early cancer detection to better farming.

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