

# Question Answering with Dynamic Memory Networks from Knowledge in Natural Language

*Scaling up Question Answering Systems with minimum human intervention through Deep Learning.*

## Introduction

- Question answering given a knowledge source is one of the most challenging tasks in NLP
- Needs plenty of human engineering → not easily expandable to unseen corpus
- Memory networks have shown promising results in question answering tasks on small dataset (Sable).

## Problem Statement

- Train a DNN model with question/answers from Wikipedia pages, given the whole page as the input.
- The model should be able to answer questions by inferring from a given Wikipedia page.
- Only single word answers are considered.

## Datasets

- Dataset 1 (S1): 7.5k question-answer pairs for training (train), 571 for validation (val), 558 for test. The data includes only the top 1000 urls with most QAs.
- Dataset 2 (S2): 14,305 train, 1,879 val, and 1,136 test. all-urls, split 80:10:10 with no shared urls between train/val/test. Splitting is done to make sure the urls are exclusive among the train/val/test sets.
- Dataset 3 (S3): 1,111 train, 138 val, 365 test. Only tuples with answers occurring more than 10 times over all the data were chosen.

## Methods

- Baseline: find the most similar sentence in the input facts (Wikipedia page) to the given question. This yields 5% accuracy with a window size of 5.
- Dynamic Memory Network trained End-to-End. Highest accuracy achieved: 89% train, 30% validation, 17% test.

## Findings

- Data sparsity is a major issue. Not many questions/answers per page → Model learns to map input facts to answers regardless of the question.
- Partially improved by only using samples with multiple questions per answer.
- Attention mechanism is not very efficient. This needs to be improved to be able to focus on important facts in a long page.

## Future Directions

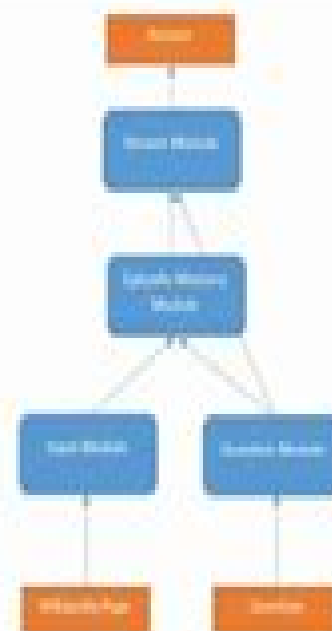
- Getting more question-answers per page.
- Extending to multi-word answers, to be able to generate human-readable answer text.
- Pre-filtering the input facts to allow only the relevant information be fed into the input module.

## References

[1] J. Weston, J. Cho, and K. Bordes. Memory networks in knowledge-based question answering.

## Example datapoint

Question: when was the world cup won?  
Answer: spain  
Accompanying facts (ex. Wikipedia page removed):  
[1]  
1. spain defeated the netherlands one - one with a goal from andres iniesta four minutes from the end of extra time.  
• spain's victory followed a path not intended to offend the match, which was marked by an unusually high number of yellow cards.  
2. with both the netherlands and spain attempting to win their first the world cup.  
[2]



*We leveraged Wikipedia's natural language knowledge.*

# Dynamic Memory Network On Natural Language Question Answering

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Cheng, Liang Wang, Qingshan Liu, Xiang  
Bai, Deyu Meng**

## **Dynamic Memory Network On Natural Language Question Answering:**

Visual Question Answering Qi Wu, Peng Wang, Xin Wang, Xiaodong He, Wenwu Zhu, 2022-05-13 Visual Question Answering VQA usually combines visual inputs like image and video with a natural language question concerning the input and generates a natural language answer as the output This is by nature a multi disciplinary research problem involving computer vision CV natural language processing NLP knowledge representation and reasoning KR etc Further VQA is an ambitious undertaking as it must overcome the challenges of general image understanding and the question answering task as well as the difficulties entailed by using large scale databases with mixed quality inputs However with the advent of deep learning DL and driven by the existence of advanced techniques in both CV and NLP and the availability of relevant large scale datasets we have recently seen enormous strides in VQA with more systems and promising results emerging This book provides a comprehensive overview of VQA covering fundamental theories models datasets and promising future directions Given its scope it can be used as a textbook on computer vision and natural language processing especially for researchers and students in the area of visual question answering It also highlights the key models used in VQA

*Representation Learning for Natural Language Processing* Zhiyuan Liu, Yankai Lin, Maosong Sun, 2020-07-03 This open access book provides an overview of the recent advances in representation learning theory algorithms and applications for natural language processing NLP It is divided into three parts Part I presents the representation learning techniques for multiple language entries including words phrases sentences and documents Part II then introduces the representation techniques for those objects that are closely related to NLP including entity based world knowledge sememe based linguistic knowledge networks and cross modal entries Lastly Part III provides open resource tools for representation learning techniques and discusses the remaining challenges and future research directions The theories and algorithms of representation learning presented can also benefit other related domains such as machine learning social network analysis semantic Web information retrieval data mining and computational biology This book is intended for advanced undergraduate and graduate students post doctoral fellows researchers lecturers and industrial engineers as well as anyone interested in representation learning and natural language processing

**Computer Vision - ECCV 2018** Vittorio Ferrari, Martial Hebert, Cristian Sminchisescu, Yair Weiss, 2018-10-08 The sixteen volume set comprising the LNCS volumes 11205 11220 constitutes the refereed proceedings of the 15th European Conference on Computer Vision ECCV 2018 held in Munich Germany in September 2018 The 776 revised papers presented were carefully reviewed and selected from 2439 submissions The papers are organized in topical sections on learning for vision computational photography human analysis human sensing stereo and reconstruction optimization matching and recognition video attention and poster sessions

**Computer Vision - ECCV 2016** Bastian Leibe, Jiri Matas, Nicu Sebe, Max Welling, 2016-09-16 The eight volume set comprising LNCS volumes 9905 9912 constitutes the refereed proceedings of the 14th European Conference on Computer Vision ECCV 2016 held in Amsterdam The Netherlands

in October 2016 The 415 revised papers presented were carefully reviewed and selected from 1480 submissions The papers cover all aspects of computer vision and pattern recognition such as 3D computer vision computational photography sensing and display face and gesture low level vision and image processing motion and tracking optimization methods physicsbased vision photometry and shape from X recognition detection categorization indexing matching segmentation grouping and shape representation statistical methods and learning video events activities and surveillance applications They are organized in topical sections on detection recognition and retrieval scene understanding optimization image and video processing learning action activity and tracking 3D and 9 poster sessions

**Computer Vision** Jinfeng Yang, Qinghua Hu, Ming-Ming Cheng, Liang Wang, Qingshan Liu, Xiang Bai, Deyu Meng, 2017-11-29 This three volume set CCIS 771 772 773 constitutes the refereed proceedings of the CCF Chinese Conference on Computer Vision CCCV 2017 held in Tianjin China in October 2017 The total of 174 revised full papers presented in three volumes were carefully reviewed and selected from 465 submissions The papers are organized in the following topical sections biological vision inspired visual method biomedical image analysis computer vision applications deep neural network face and posture analysis image and video retrieval image color and texture image composition image quality assessment and analysis image restoration image segmentation and classification image based modeling object detection and classification object identification photography and video robot vision shape representation and matching statistical methods and learning video analysis and event recognition visual salient detection

**RITA 2018** Anwar P. P. Abdul Majeed, Jessnor Arif Mat-Jizat, Mohd Hasnun Arif Hassan, Zahari Taha, Han Lim Choi, Junmo Kim, 2019-06-15 This book gathers the Proceedings of the 6th International Conference on Robot Intelligence Technology and Applications RITA 2018 Reflecting the conference's main theme Robotics and Machine Intelligence Building Blocks for Industry 4.0 it features relevant and current research investigations into various aspects of these building blocks The areas covered include Instrumentation and Control Automation Autonomous Systems Biomechatronics and Rehabilitation Engineering Intelligent Systems Machine Learning Robotics Sensors and Actuators and Machine Vision as well as Signal and Image Processing A valuable asset the book offers researchers and practitioners a timely overview of the latest advances in robot intelligence technology and its applications

**Hands-On Natural Language Processing with Python** Rajesh Arumugam, Rajalingappaa Shanmugamani, 2018-07-18 Foster your NLP applications with the help of deep learning NLTK and TensorFlow Key Features Weave neural networks into linguistic applications across various platforms Perform NLP tasks and train its models using NLTK and TensorFlow Boost your NLP models with strong deep learning architectures such as CNNs and RNNs Book Description Natural language processing NLP has found its application in various domains such as web search advertisements and customer services and with the help of deep learning we can enhance its performances in these areas Hands On Natural Language Processing with Python teaches you how to leverage deep learning models for performing various NLP tasks along with best practices in dealing with today's NLP challenges To begin with you will understand the

core concepts of NLP and deep learning such as Convolutional Neural Networks CNNs recurrent neural networks RNNs semantic embedding Word2vec and more You will learn how to perform each and every task of NLP using neural networks in which you will train and deploy neural networks in your NLP applications You will get accustomed to using RNNs and CNNs in various application areas such as text classification and sequence labeling which are essential in the application of sentiment analysis customer service chatbots and anomaly detection You will be equipped with practical knowledge in order to implement deep learning in your linguistic applications using Python's popular deep learning library TensorFlow By the end of this book you will be well versed in building deep learning backed NLP applications along with overcoming NLP challenges with best practices developed by domain experts What you will learn Implement semantic embedding of words to classify and find entities Convert words to vectors by training in order to perform arithmetic operations Train a deep learning model to detect classification of tweets and news Implement a question answer model with search and RNN models Train models for various text classification datasets using CNN Implement WaveNet a deep generative model for producing a natural sounding voice Convert voice to text and text to voice Train a model to convert speech to text using DeepSpeech Who this book is for Hands on Natural Language Processing with Python is for you if you are a developer machine learning or an NLP engineer who wants to build a deep learning application that leverages NLP techniques This comprehensive guide is also useful for deep learning users who want to extend their deep learning skills in building NLP applications All you need is the basics of machine learning and Python to enjoy the book

Advances in Knowledge Discovery and Data Mining Qiang Yang,Zhi-Hua Zhou,Zhiguo Gong,Min-Ling Zhang,Sheng-Jun Huang,2019-04-03 The three volume set LNAI 11439 11440 and 11441 constitutes the thoroughly refereed proceedings of the 23rd Pacific Asia Conference on Knowledge Discovery and Data Mining PAKDD 2019 held in Macau China in April 2019 The 137 full papers presented were carefully reviewed and selected from 542 submissions The papers present new ideas original research results and practical development experiences from all KDD related areas including data mining data warehousing machine learning artificial intelligence databases statistics knowledge engineering visualization decision making systems and the emerging applications They are organized in the following topical sections classification and supervised learning text and opinion mining spatio temporal and stream data mining factor and tensor analysis healthcare bioinformatics and related topics clustering and anomaly detection deep learning models and applications sequential pattern mining weakly supervised learning recommender system social network and graph mining data pre processing and feature selection representation learning and embedding mining unstructured and semi structured data behavioral data mining visual data mining and knowledge graph and interpretable data mining

**Intelligent Systems and Applications** Kohei Arai,2024-07-30 This volume is a collection of meticulously crafted insightful and state of the art papers presented at the Intelligent Systems Conference 2024 held in Amsterdam The Netherlands on 5 6 September 2024 The conference received an overwhelming response with a total of 535 submissions

After a rigorous double blind peer review process 181 papers were selected for presentation These papers span a wide range of scientific topics including Artificial Intelligence Computer Vision Robotics Intelligent Systems and more We hope that readers find this volume both interesting and valuable Furthermore we expect that the conference and its proceedings will inspire further research and technological advancements in these critical areas of study Thank you for engaging with this collection of works from the Intelligent Systems Conference 2024 Your interest and support contribute significantly to the ongoing progress and innovation in the field of intelligent systems

*Soft Computing Systems* Ivan Zelinka, Roman Senkerik, Ganapati Panda, Padma Suresh Lekshmi Kanthan, 2018-09-24 This book CCIS 837 constitutes the refereed proceedings of the Second International Conference on Soft Computing Systems ICSCS 2018 held in Sasthamcotta India in April 2018 The 87 full papers were carefully reviewed and selected from 439 submissions The papers are organized in topical sections on soft computing evolutionary algorithms image processing deep learning artificial intelligence big data analytics data mining machine learning VLSI cloud computing network communication power electronics green energy

*Machine Learning and Knowledge Discovery in Databases* Peggy Cellier, Kurt Driessens, 2020-03-27 This two volume set constitutes the refereed proceedings of the workshops which complemented the 19th Joint European Conference on Machine Learning and Knowledge Discovery in Databases ECML PKDD held in W rzburg Germany in September 2019 The 70 full papers and 46 short papers presented in the two volume set were carefully reviewed and selected from 200 submissions The two volumes CCIS 1167 and CCIS 1168 present the papers that have been accepted for the following workshops Workshop on Automating Data Science ADS 2019 Workshop on Advances in Interpretable Machine Learning and Artificial Intelligence and eXplainable Knowledge Discovery in Data Mining AIMLAI XKDD 2019 Workshop on Decentralized Machine Learning at the Edge DMLE 2019 Workshop on Advances in Managing and Mining Large Evolving Graphs LEG 2019 Workshop on Data and Machine Learning Advances with Multiple Views Workshop on New Trends in Representation Learning with Knowledge Graphs Workshop on Data Science for Social Good SoGood 2019 Workshop on Knowledge Discovery and User Modelling for Smart Cities UMCIT 2019 Workshop on Data Integration and Applications Workshop DINA 2019 Workshop on Machine Learning for Cybersecurity MLCS 2019 Workshop on Sports Analytics Machine Learning and Data Mining for Sports Analytics MLSA 2019 Workshop on Categorising Different Types of Online Harassment Languages in Social Media Workshop on IoT Stream for Data Driven Predictive Maintenance IoTStream 2019 Workshop on Machine Learning and Music MML 2019 Workshop on Large Scale Biomedical Semantic Indexing and Question Answering BioASQ 2019

[Deep Learning for Natural Language Processing](#) Stephan Raaijmakers, 2022-12-06 Explore the most challenging issues of natural language processing and learn how to solve them with cutting edge deep learning Deep learning has advanced natural language processing to exciting new levels and powerful new applications For the first time computer systems can achieve human levels of summarizing making connections and other tasks that require comprehension and context Deep Learning for Natural Language Processing reveals

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**Computational Intelligence, Communications, and Business Analytics** Jyotsna Kumar Mandal,Somnath Mukhopadhyay,Paramartha Dutta,Kousik Dasgupta,2019-06-25 The two volume set CCIS 1030 and 1031 constitutes the refereed proceedings of the Second International Conference on Computational Intelligence Communications and Business Analytics CICBA 2018 held in Kalyani India in July 2018 The 76 revised full papers presented in the two volumes were carefully reviewed and selected from 240 submissions The papers are organized in topical sections on computational intelligence signal processing and communications microelectronics sensors and intelligent networks data science intelligent data mining and computational forensics privacy and security *Chinese Computational Linguistics and Natural Language Processing Based on Naturally Annotated Big Data* Maosong Sun,Ting Liu,Xiaojie Wang,Zhiyuan Liu,Yang Liu,2018-10-11 This book constitutes the proceedings of the 17th China National Conference on Computational Linguistics CCL 2018 and the 6th International Symposium on Natural Language Processing Based on Naturally Annotated Big Data NLP NABD 2018 held in Changsha China in October 2018 The 33 full papers presented in this volume were carefully reviewed and selected from 84 submissions They are organized in topical sections named Semantics machine translation knowledge graph and information extraction linguistic resource annotation and evaluation information retrieval and question answering text classification and summarization social computing and sentiment analysis and NLP applications **Neural Information Processing** Derong Liu,Shengli Xie,Yuanqing Li,Dongbin Zhao,El-Sayed M. El-Alfy,2017-11-07 The six volume set LNCS 10634 LNCS 10635 LNCS 10636 LNCS 10637 LNCS 10638 and LNCS 10639 constituts the proceedings of the 24rd International Conference on Neural Information Processing ICONIP 2017 held in Guangzhou China in November 2017 The 563 full papers presented were carefully reviewed and selected from 856 submissions The 6 volumes are organized in topical sections on Machine Learning Reinforcement Learning Big Data Analysis Deep Learning Brain Computer Interface Computational Finance Computer Vision Neurodynamics Sensory Perception and Decision Making Computational Intelligence Neural Data Analysis Biomedical Engineering Emotion and Bayesian Networks Data Mining Time Series Analysis Social Networks Bioinformatics Information Security and Social Cognition Robotics and Control Pattern Recognition

Neuromorphic Hardware and Speech Processing      *Computer Vision - ECCV 2020* Andrea Vedaldi, Horst Bischof, Thomas Brox, Jan-Michael Frahm, 2020-11-03 The 30 volume set comprising the LNCS books 12346 until 12375 constitutes the refereed proceedings of the 16th European Conference on Computer Vision ECCV 2020 which was planned to be held in Glasgow UK during August 23-28 2020. The conference was held virtually due to the COVID-19 pandemic. The 1360 revised papers presented in these proceedings were carefully reviewed and selected from a total of 5025 submissions. The papers deal with topics such as computer vision machine learning deep neural networks reinforcement learning object recognition image classification image processing object detection semantic segmentation human pose estimation 3D reconstruction stereo vision computational photography neural networks image coding image reconstruction object recognition motion estimation.

**Computational Analysis and Understanding of Natural Languages: Principles, Methods and Applications**, 2018-08-27 Computational Analysis and Understanding of Natural Languages Principles Methods and Applications Volume 38 the latest release in this monograph that provides a cohesive and integrated exposition of these advances and associated applications includes new chapters on Linguistics Core Concepts and Principles Grammars Open Source Libraries Application Frameworks Workflow Systems Mathematical Essentials Probability Inference and Prediction Methods Random Processes Bayesian Methods Machine Learning Artificial Neural Networks for Natural Language Processing Information Retrieval Language Core Tasks Language Understanding Applications and more. The synergistic confluence of linguistics statistics big data and high performance computing is the underlying force for the recent and dramatic advances in analyzing and understanding natural languages hence making this series all the more important. Provides a thorough treatment of open source libraries application frameworks and workflow systems for natural language analysis and understanding. Presents new chapters on Linguistics Core Concepts and Principles Grammars Open Source Libraries Application Frameworks Workflow Systems Mathematical Essentials Probability and more.

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**Computer Vision - ECCV 2024** Aleš Leonardis, Elisa Ricci, Stefan Roth, Olga Russakovsky, Torsten Sattler, Gül Varol, 2024-10-24 The multi volume set of LNCS books with volume numbers 15059 up to 15147 constitutes the refereed proceedings of the 18th European Conference on Computer Vision ECCV 2024 held in Milan Italy during September 29 October 4 2024 The 2387 papers presented in these proceedings were carefully reviewed and selected from a total of 8585 submissions They deal with topics such as computer vision machine learning deep neural networks reinforcement learning object recognition image classification image processing object detection semantic segmentation human pose estimation 3d reconstruction stereo vision computational photography neural networks image coding image reconstruction motion estimation

**Intelligent Systems and Applications** Yaxin Bi, Rahul Bhatia, Supriya Kapoor, 2019-08-23 The book presents a remarkable collection of chapters covering a wide range of topics in the areas of intelligent systems and artificial intelligence and their real world applications It gathers the proceedings of the Intelligent Systems Conference 2019 which attracted a total of 546 submissions from pioneering researchers scientists industrial engineers and students from all around the world These submissions underwent a double blind peer review process after which 190 were selected for inclusion in these proceedings As intelligent systems continue to replace and sometimes outperform human intelligence in decision making processes they have made it possible to tackle a host of problems more effectively This branching out of computational intelligence in several directions and use of intelligent systems in everyday applications have created the need for an international conference as a venue for reporting on the latest innovations and trends This book collects both theory and application based chapters on virtually all aspects of artificial intelligence presenting state of the art intelligent methods and techniques for solving real world problems along with a vision for future research it represents a unique and valuable asset

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