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Peningkatan Kinerja Chatbot NLP Asisten: Tinjauan Literatur tentang Metode dan Akurasi dalam Aplikasi Berbasis Percakapan

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Abstract

Chatbots have been widely used in various industries such as e-commerce, banking, healthcare, and education to improve efficiency and provide 24/7 services to users. In the field of education, NLP chatbot brings the potential to improve soft skills and hard skills through online learning. This research aims to find suitable methods from previous research to be used in the creation of a conversational chatbot for supporting services of an application system. The research method used is Systematic Literature Review, with comprehensive journal search steps using appropriate keyword search strategies. The research results include 20 articles relevant to the topic of chatbot NLP assistants. The various methods identified in the research include machine learning, deep learning, rule-based approaches, and the use of third-party applications such as Dialogflow and IBM Watson. The analysis results show that the Dynamic Memory Network (DMN) method has the best performance with 91% accuracy. DMN combines the advantages of LSTM and Memory Network with a dynamic attention mechanism, allowing the model to focus on the most relevant information in sequential data. Although this study provides interesting findings, further research is needed to deal with the different characteristics and availability of data in various real-world scenarios. Thus, this article highlights the importance of continuously developing NLP chatbot technology for better applications and improved service quality for users. It is hoped that this article can contribute to the development of research related to NLP chatbot assistants in better and more efficient application systems.

Keywords: NLP Chatbot, Virtual Assistant, Chatbot Conversation Method, Dynamic Memory Network, Support System

Abstrak

Chatbot telah digunakan secara luas dalam berbagai industri seperti e-commerce, perbankan, kesehatan, dan pendidikan untuk meningkatkan efisiensi dan memberikan layanan 24/7 kepada pengguna. Dalam bidang pendidikan, chatbot NLP membawa potensi untuk meningkatkan soft skill dan hard skill melalui pembelajaran online. Penelitian ini bertujuan untuk mencari metode yang cocok dari penelitian sebelumnya untuk digunakan dalam pembuatan chatbot percakapan untuk layanan pendukung sebuah sistem aplikasi. Metode penelitian yang digunakan adalah Systematic Literature Review, dengan langkah-langkah pencarian jurnal yang komprehensif menggunakan strategi pencarian kata kunci yang tepat. Hasil penelitian mencakup 20 artikel yang relevan dengan topik chatbot NLP asisten. Berbagai metode yang diidentifikasi dalam penelitian meliputi machine learning, deep learning, pendekatan rule-based, dan penggunaan aplikasi pihak ketiga seperti Dialogflow dan IBM Watson. Hasil analisis menunjukkan bahwa metode Dynamic Memory Network (DMN) memiliki performa terbaik dengan akurasi mencapai 91%. DMN menggabungkan kelebihan LSTM dan Memory Network dengan mekanisme attention dinamis, sehingga model dapat fokus pada informasi yang paling relevan dalam data sekuensial. Meskipun penelitian ini memberikan temuan yang menarik, penelitian lebih lanjut diperlukan untuk menghadapi perbedaan karakteristik dan ketersediaan data pada berbagai skenario di dunia nyata. Dengan demikian, artikel ini menyoroti pentingnya terus mengembangkan teknologi chatbot NLP untuk aplikasi yang lebih baik dan peningkatan kualitas layanan bagi pengguna. Diharapkan artikel ini dapat memberikan kontribusi dalam pengembangan penelitian terkait dengan chatbot NLP asisten dalam sistem aplikasi yang lebih baik dan efisien.

Kata kunci: Chatbot NLP, Asisten Virtual, Metode Percakapan Chatbot, Dynamic Memory Network, Sistem Pendukung.

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1. Pendahuluan

Dalam beberapa tahun terakhir, salah satu inovasi teknologi yang muncul dan menarik perhatian adalah chatbot Natural Language Processing (NLP) asisten [1]. Teknologi ini telah banyak digunakan dalam berbagai industri, seperti e-commerce, perbankan, kesehatan, bidang pendidikan, dan lain-lain [2][12]. Dalam bidang Pendidikan, pembelajaran online dinilai dapat meningkatkan soft skill maupun hard skill [14]. Adapun system pelengkap yang akan mengoptimalkan pembelajaran tersebut akan membuat semakin baik. Chatbot NLP asisten telah terbukti menjadi solusi yang efektif dalam memenuhi kebutuhan pengguna untuk layanan 24/7, meningkatkan efisiensi, mempercepat waktu respons, dan mengurangi biaya pengelolaan pelanggan [3]. Teknologi ini memanfaatkan kecerdasan buatan dan NLP untuk merespon dan berinteraksi dengan pengguna melalui pesan teks [4]. Chatbot ini dilaporkan memiliki akurasi yang tinggi dalam menjawab pertanyaan pengguna, mengambil data dari sumber lain, atau menjalankan fungsi lain yang diperlukan [5].

Literatur, chatbot NLP asisten sering disebut sebagai AI assistant, digital assistant, atau virtual assistant [3]. Pengembangan teknologi chatbot dimulai pada tahun 1960-an, ketika Joseph Weizenbaum dari Massachusetts Institute of Technology (MIT) mengembangkan program ELIZA, yang bisa berbicara dengan pengguna berdasarkan aturan tertentu [7]. Pada tahun 1990-an, dengan munculnya internet, chatbot dikembangkan sebagai alat interaktif yang memungkinkan pengguna berkomunikasi dengan sistem melalui pesan teks. Salah satu contoh chatbot pada saat itu adalah SmarterChild, sebuah chatbot yang dapat menjawab pertanyaan dan memberikan informasi umum [11].

Seiring dengan perkembangan teknologi, chatbot NLP asisten terus dikembangkan dengan berbagai teknologi canggih, seperti menggunakan pendekatan machine learning dan deep learning, untuk meningkatkan kemampuan dalam memproses bahasa manusia secara alami dan meningkatkan performa [13]. Mengingat penggunaan chatbot NLP asisten yang semakin luas, penelitian ini bertujuan untuk mencari metode yang cocok dari penelitian sebelumnya untuk digunakan dalam pembuatan conversational atau percakapan chatbot untuk layanan pendukung sebuah sistem aplikasi.

2. Metode Penelitian

Systematic Literature Review bertujuan untuk mengidentifikasi dan menganalisis tren, topik, dataset, dan metode [14]. Metode yang digunakan meliputi beberapa langkah penting, yaitu melakukan sistematis literature review dengan pencarian jurnal secara komprehensif menggunakan strategi pencarian kata kunci yang tepat, memilih basis data yang relevan, serta memilih artikel berdasarkan kriteria inklusi dan eksklusi tertentu [8]. Peneliti menggunakan metode PRISMA dalam melakukan sistematis literature review, harus dipenuhi dalam penyusunan sistematis literature review [9] mulai dari tahap identifikasi hingga penulisan kesimpulan [10].

Untuk mencari jurnal terkait, menggunakan meta-data Google Scholar dan memilih jurnal yang dipublikasikan di basis data yang relevan seperti Scopus, Elsevier, ACM, IEEE Xplore, Web of Science, database ERIC, perpustakaan Wiley, dan perpustakaan universitas kelompok penelitian. Setelah memilih jurnal yang relevan, langkah terakhir adalah membuat tinjauan literature dengan merangkum hasil penelitian, metodologi, temuan, dan kesimpulan dari setiap artikel yang dipilih.

Dalam seluruh proses sistematis literature review, mengutamakan keakuratan dan keobjektifan dalam memilih dan menganalisis artikel, sehingga tinjauan literatur yang dihasilkan dapat memberikan kontribusi dalam pengembangan penelitian terkait dengan topik yang dibahas.

2.1. Pertanyaan Penelitian

Dalam fase perencanaan, pertanyaan penelitian tertentu diidentifikasi. Dalam penelitian ini, fokus pada kontribusi penelitian dicapai dengan menjawab pertanyaan-pertanyaan penelitian berikut :

1. Metode atau algoritma apa yang bisa diimplementasikan dalam percakapan chatbot asisten?
2. Selain metode tersebut ada apa saja tools yang bisa dijadikan alternatif untuk pembuatan chatbot asisten?

2.2. Strategi Pencarian

Setelah menentukan pertanyaan penelitian, langkah selanjutnya adalah menentukan istilah pencarian dan sumber data yang akan digunakan. Dalam penelitian ini, kami menganalisis pertanyaan penelitian dan mengembangkan beberapa string pencarian yang meliputi *"Chatbot", "Chatbot NLP", "Chatbot Conversation" "Website", "Support System",* dan *"Education"*. Untuk melakukan pencarian yang lebih komprehensif, kami menggunakan operator Boolean "OR" dan "AND" untuk mencari semua kombinasi mungkin dari istilah-istilah tersebut. Namun, kami hanya memfokuskan penelitian pada studi percakapan chatbot NLP untuk pembelian materi kursus online yang menggunakan data obrolan sebagai sistem pendukung.

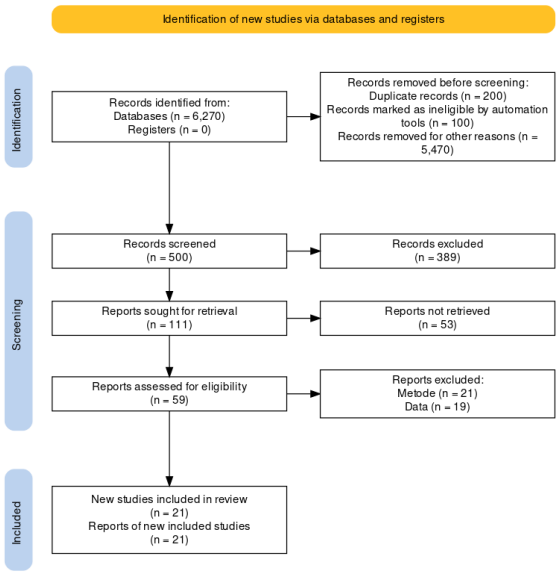
Langkah berikutnya adalah melakukan pencarian pada enam basis data akademik teratas di bidang ilmu komputer, yaitu IEEE Explore, Springer, ScienceDirect/Elsevier, Google Scholar. Penentuan

basis data ini didasarkan pada popularitas dan reputasi dari masing-masing basis data tersebut. Selanjutnya, kami mencari judul, abstrak, dan kata kunci dari seluruh makalah yang terdaftar dengan menggunakan istilah pencarian yang telah dikembangkan sebelumnya. Pencarian ini dilakukan untuk studi yang diterbitkan antara tahun 2017 hingga 2023. Hal ini dilakukan untuk memastikan bahwa makalah-makalah yang terpilih merupakan kajian terbaru dan relevan dengan topik yang dibahas.

Tabel 1.Tabel Hasil Pencarian Penelitian

Database	Hasil Pencarian
IEEE Explore	20
Springer	12
ScienceDirect	14
Google Scholar	13
Total	59

Hasil dari pencarian sumber penelitian, diperoleh artikel dari IEEE Explore sejumlah 21, springer 12, ScienceDirect/Elsevier 14, Google Scholar 13, dan total jumlah sebanyak 59 artikel.



Gambar 1. Proses seleksi artikel

Dengan keyword pencarian yang sudah ditentukan sebelumnya, memperoleh artikel dengan topik terkait sejumlah 6,270. Kemudian memiliki duplikat sebanyak 200 artikel, tidak tersedia berdasarkan tools 100 artikel, dan menyisihkan 5,470 artikel sehingga terdapat 500 artikel untuk dipilih berdasarkan penelitian. Kemudian ada pemangkasan lagi artikel sebanyak 389 sehigga menyisakan artikel sebanyak 111. Setelah itu terdapat pengurangan jumlah artikel lagi dikarenakan artikel tersebut tidak bisa diambil atau tidak tersedia sehingga menyisakan 59 artikel yang tersedia. Setelah di analisis secara mendalam ada ketidak cocokan antara metode seperti penggunaan framework atau aplikasi pihak ketiga dalam pembuatan percakapan chatbot ini, dan tidak adanya kejelasan data yang dipakainya. Hasil akhir dari proses seleksi artikel tersebut sejumlah 20 artikel.

2.3. Kriteria Inklusi dan Eksklusi data

Kriteria inklusi dan eksklusi telah dibuat dalam tahap ini untuk menilai secara menyeluruh relevansi dari studi primer yang potensial. Kriteria-kriteria tersebut adalah sebagai berikut :

1. Termasuk hanya karya tulis dalam Bahasa Inggris dan Bahasa Indonesia.
2. Termasuk karya yang dipublikasikan dalam jurnal, makalah konferensi, dan bab buku.
3. Termasuk karya yang dipublikasikan antara tahun 2017 hingga 2023.
4. Termasuk karya yang fokus pada analisis percakapan chatbot
5. Dikecualikan karya duplikat.
6. Dikecualikan studi sekunder (seperti tinjauan literatur).
7. Dikecualikan karya yang tidak melalui proses peer-review, seperti laporan teknis dan tesis.

3. Hasil dan Pembahasan

Penelitian sebelumnya yang telah dilakukan memperoleh hasil puskata yang terkait dengan topik seperti pada Table 2.

Tabel 2.Tabel Sumber Pustaka

Peneliti	Tahun	Sumber Data	Publisher
Danilo Arruda1, Matheus Marinho1, Eric Souza, And Fernando Wanderley [15]	2019	Springer	India
Parth Thosani, Manas Sinkar, Jaydeep Vaghasiya, Radha Shankarmani [16]	2020	ScienceDirect /Elsevier	India
Mehdi Mekni, Zakaria Baani, Dalia Sulieman[17]	2020	Springer	USA
Lorenz Cuno Klopfenstein(B) , Saverio Delpriori, And Alessio Ricci [18]	2019	IEEE	Italy
Anupam Mondal, Monalisa Dey, Dipankar Das, Sachit Nagpal, Kevin Garda [19]	2018	ACM Digital	India
Fabio Clarizia, Francesco Colace, Marco Lombardi, Francesco Pascale, And Domenico Santaniello [20]	2018	Springer	Italy
Sharob Sinha, Shyanka Basak, Yajushi Dey And Anupam Mondal [21]	2020	IEEE	India

Shaziya Banu, Shantala Devi Patil [22]	2021	springer	India
Shai Rozenes And Yuval Cohen [23]	2022	Springer	Israel
Namrata Bhartiya, Namrata Jangid, Sheetal Jannu, Purvika Shukla [24]	2020	IEEE	India
Vrushil Gajra, Khwajaavais Lakdawala, Rahul Bhanushali, Dr. Sunita Patil[25]	2020	SSRN	India
Xuan Lam Pham, Thao Pham, Quynh Mai Nguyen, Thanh Huong Nguyen, Thi Thu Huong Cao [26]	2018	ICEEL	Vietnam
Juanan Pereira And Oscar D´ ´ Iaz [27]	2018	Springer	Spain
G. S. Ramesh, G. Nagaraju, Vemula Harish, And P. Kumaraswamy [28]	2021	Springer	India
Lopa Mandal And Sagnik Dutta [29]	2021	Springer	India
Chen Wei, Zhichen Yu, Simon Fong [30]	2018	ICMLC	China
Anil Kumar Reddy Konda, Shivaram Jimada, Praneet Amul Akash Cherukuri, And Mellacheruvu Janakirama Sarma [31]	2021	Springer	India
Ahtsham Manzoor, Dietmar Jannach [32]	2021	ScienceDirect /Elsevier	Austria
Chun Ho Chan, Ho Lam Lee, Wing Kwan Lo, Andrew Kwok-Fai Lui [33]	2018	IEEE	Hong Kong
Mallikarjuna Gowda C P, Anupam Srivastava, Shubham Chakraborty, Anurag Ghosh, Harsh Raj [34]	2021	IEEE	India
Md. Kowsher, Farhana Sharmin Tithi, M Ashraful Alam, Mohammad Nurul Huda, Mir Md Moheuddin, Md. Golam Rosul [35]	2019	IEEE	India
Donn Emmanuel Gonda, Jing Luo, Yiu-Lun Wong, Chi-Un Lei [36]	2018	IEEE	Hong Kong
B. S. Niranjan And Vinayak Hegde [37]	2021	Springer	India
Jeferson Da Silva Oliveira, Danubia Bueno Esp ´ ´Indola, Regina Barwaldt, Luciano Maciel Ribeiro, Marcelo Pias [38]	2020	IEEE	Brazil
Tarun Lalwani, Shashank Bhalotia, Ashish Pal, Shreya Bisen, Vasundhara Rathod [39]	2018	IJIRCST	India
Ho Thao Hien, Pham-Nguyen Cuong, Le Nguyen Hoai Nam, Ho Le Thi Kim Nhung, Le Dinh Thang [40]	2018	SOICT	Vietnam
Naing Naing Khin, Khin Mar Soe [41]	2020	IEEE	Myanmar
Kamal Souali, Othmane Rahmaoui, Mohammed Ouzzif, Ismail El Haddioui [42]	2019	IEEE	Morocco
Hrushikesh Koundinya K, Ajay Krishna Palakurthi, Vaishnavi Putnala, Dr.Ashok Kumar K [43]	2021	IEEE	India
Yasunobu Sumikawa, Masaaki Fujiyoshi, Hisashi Hatakeyama And Masahiro Nagai [44]	2020	Springer	Japan
György Molnár, Zoltán Szűts [45]	2018	IEEE	Budapest, Hungary
Mation Technology And Engineering, VIT Vello [46]	2019	ScienceDirect /Elsevier	India
Dina Fitria Murad, Adhi Gustian Iskandar, Erick Fernando, Tica Shinta Octavia, Deryan Everestha Maured [47]	2019	IEEE	Indonesia
Panitan Muangkammuen, Narong Intiruk, Kanda Runapongsa Saikaew [48]	2018	IEEE	Thailand
Ming-Hsiang Su, Chung-Hsien Wu, Kun-Yi Huang, Qian-Bei Hong, Hsin-Min Wang [49]	2017	IEEE	Taiwan
Yulius Denny Prabowo, Harco Leslie Hendric Spits Warnars, Widodo Budiharto, Achmad Imam Kistijantoro, Yaya Heryadi, Lukas [50]	2018	IEEE	Indonesia
E.Kasthuri, Dr.S.Balaji [51]	2021	IEEE	India
Julia El Zini, Yara Rizk , Mariette Awad, Jumana Antoun [52]	2019	IEEE	Lebanon
Vipasha Chandwani, Sandeep Kumar, Parikshit Kishor Singh [53]	2020	IEEE	India

Kanaad Pathak, Arti Arya [54]	2019	IEEE	India
Asmund Kamphaug, Ole-Christoffer Granmo, Morten Goodwin, And Vladimir I. Zadorozhny [55]	2018	Springer	Norway
Ping-Huan Kuo, Ssu-Ting Lin, Jun Hu And Chiou-Jye Huang [56]	2021	MDPI	Taiwan
Prasnurzaki Anki, Alhadi Bustamam And Rinaldi Anwar Buyung [57]	2021	MDPI	Indonesia
Yashvardhan Sharmaa , Sahil Guptaa [58]	2018	ScienceDirect /Elsevier	India
Moneerh Aleedy, Hadil Shaiba [59]	2019	SAI	Saudi Arabia
Yurio Windiatmoko, Ahmad Fathan Hidayatullah, Dhomas Hatta Fudholi, Ridho Rahmadi [60]	2022	IJAIR	Indonesia
Dr. Manoj Kuma, Abhishek Singh, Arnav Kumar, Ankit Kumar[61]	2021	IEEE	India
Saurabh Mathur, Daphne Lopez[62]	2018	WILEY	India
Zeeshan Haque Syed, Asma Trabelsi, Emmanuel Helbert, Vincent Bailleau, Christian Muths [63]	2021	ScienceDirect /Elsevier	Paris
Achtaich Khadija, Fagroud Fatima Zahra, Achtaich Naceur[64]	2021	ScienceDirect /Elsevier	Morocco
Elen Siglen, Hildegunn Høberg Vetti, Aslaug Beathe Forberg Lunde, Thomas Akselberg Hatlebrekke, Nina Strømsvik, Anniken Hamang, Sigrid Tronsli Hovland, Jill Walker Rettberg, Vidar M. Steen, Cathrine Bjorvatn, [65]	2022	ScienceDirect /Elsevier	Norway
Joyjit Chatterjee, Nina Dethlefs [66]	2023	ScienceDirect /Elsevier	UK
Nicolas De la Peña, Oscar Granados [67]	2023	ScienceDirect /Elsevier	Colombia
Sushreeta Tripathy, Rishabh Singh, Mousim Ray [68]	2023	ScienceDirect /Elsevier	India
Tim Dwyer, Graeme Hoit, David Burns, James Higgins, Justin Chang, Daniel Whelan, Irene Kiroplis, Jaskarndip Chahal [69]	2023	ScienceDirect /Elsevier	Canada
Doris Dippold [70]	2023	ScienceDirect /Elsevier	United Kingdom
Ming-Yuan Huang, Chia-Sui Weng, Hsiao-Li Kuo, Yung-Cheng Su [71]	2023	ScienceDirect /Elsevier	India
Alec Radford, Karthik Narasimhan, Tim Salimans, Ilya Sutskever [72]	2023	OPENAI	-
Doris Dippold [73]	2023	ScienceDirect /Elsevier	United Kingdom

Setelah memperoleh sumber pustaka dari penelitian sebelumnya yang terkait, tahapan selanjutnya adalah menganalisis metode dan data yang dipakai untuk dijadikan landasan penelitian chatbot dalam pembelian kursus online. Hasil dari tahapan analisis ini disajikan di Table 3.

Tabel 3.Tabel Hasil Analisis Sumber Pustaka

Topik	Data	Metode	Akurasi
A Chatbot for Goal-Oriented Requirements Modeling [15]	Database	KAOS	50%
Chatbot: An automated conversation system for the educational domain [19]	Database	Random Forest	88.60%
Chatbot: An Education Support System for Student [20]	Database	Latent Dirichlet Allocation (LDA)	71,12%
An Educational Chatbot for Answering Queries [21]	Database	K-means clustering algorithm	60.10%
Artificial Neural Network Based University Chatbot System [24]	JSON	Feedforward	72%
How to Build a Chatbot: Chatbot Framework and its Capabilities [30]	Database	SVM	92%
Chatbot Implementation for Enhancement of Student Understanding—A Natural Language Processing Approach [31]	JSON	NN	80%
Conversational recommendation based on end-to-end learning: How far are we? [32]	Movie Lens dataset	Rule-based	-
Developing a Chatbot for College Student	Database	NLP Cloud Service	22%

Programme Advisement [33]			
Doly: Bengali Chatbot for Bengali Education [35]	Database	Naïve Bayesian	88%
Question Answering based University Chatbot using Sequence to Sequence Model [41]	Database	Seq2Seq	35%
Supporting Creation of FAQ Dataset for E-Learning Chatbot [44]	FAQ dataset	IBM Watson	76.9%
Chatbot As An Intelligent Personal Assistant For Mobile Language Learning [26]	FAQ dataset	Dialogflow	-
Design and Development of Diagnostic Chabot for supporting Primary Health Care Systems [46]	Database	Decision Tree	75%.
Towards Smart LMS to Improve Learning Outcomes Students Using LenoBot with Natural Language Processing [47]	Database	TF-ID	20%
Automated Thai-FAQ Chatbot using RNN-LSTM [48]	QnA Dataset	LSTM	93.2%
A Metaphorical Study Of Variants Of Recurrent Neural Network Models For A Context Learning Chatbot [54]	Facebook bAbi dataset	LSTM GRU	95% 72%
Comparative Analysis of Performance between Multimodal Implementation of Chatbot Based on News Classification Data Using Categories [57]	News Aggregator Dataset	CNN	99%
Deep Learning Approaches For Question Answering System [58]	Babi Dataset Of Facebook	LSTM, Memory Networks, Dynamic Memory Network	49% 75% 91%
Generating and Analyzing Chatbot Responses using Natural Language Processing [59]	Customer Support on Twitter Kaggle	LSTM GRU CNN	87% 83% 75%
Mi-Botway: A Deep Learning-Based Intelligent University Enquiries Chatbot	Database	GRU	99%

Berdasarkan hasil analisis pustaka pada Tabel 3. Diperoleh hasil 50% terhadap penelitian berdasarkan judul "*A Chatbot for Goal-Oriented Requirements Modeling*" menggunakan sebuah *framework* NLP yang diharapkan bisa dengan mudah dipakai oleh kebutuhan pemula. Kemudian pada penelitian dengan judul "*Chatbot: An automated conversation system for the educational domain*" chatbot tersebut menggunakan pendekatan *machine learning* dan memperoleh hasil akurasi 88.60%. penelitian lainnya dengan judul,"*Chatbot: An Education Support System for Student*" memperoleh hasil akurasi 71,12%.

Pada penelitian yang berjudul, "*An Educational Chatbot for Answering Queries*" memperoleh hasil akurasi sejumlah 60.10%. sedangkan dalam penelitian yang berjudul,"*Artificial Neural Network Based University Chatbot System*" memperoleh akurasi 72%. Penelitian lainnya dengan topik," *How to Build a Chatbot: Chatbot Framework and its Capabilities*" dengan menggunakan machine learning memperoleh hasil 92%. Dan pada penelitian," *Chatbot Implementation for Enhancement of Student Understanding—A Natural Language Processing Approach*" menggunakan pendekatan NN memperoleh hasil sebesar 80%.

Dalam penelitian dengan judul," *Conversational recommendation based on end-to-end learning: How far are we?*" menggunakan Rule-Based memperoleh hasil dengan bagus. Sedangkan dalam penelitian yang berjudul "*Developing a Chatbot for College Student Programme Advisement*" dengan bantuan aplikasi pihak ketika memperoleh hasil akurasi 22%. Kemudian pada penelitian dengan judul "*Doly: Bengali Chatbot for Bengali Education* " menggunakan algoritma *Naïve Bayesian* memperoleh hasil akurasi senilai 88%.

Kemudian pada penelitian yang berjudul "*Question Answering based University Chatbot using Sequence to Sequence Model*" menggunakan model *Seq2Seq* memperoleh hasil akurasi senilai 35%. Selanjutnya pada judul penelitian "*Supporting Creation of FAQ Dataset for E-Learning Chatbot*" menggunakan model dari IBM Watson memperoleh hasil 76.9%, selanjutnya penelitian yang berjudul "Chatbot As An Intelligent Personal Assistant For Mobile Language Learning" menggunakan peran pihak ketiga yaitu dialogflow dan memperoleh hasil yang baik dalam memberikan respon dalam peran sebagai personal asisten. Sedangkan dalam penelitian yang berjudul "*Design and Development of Diagnostic Chabot for supporting Primary Health Care Systems*" memperoleh hasil 75%.

Selanjutnya dalam penelitian yang berjudul "*Towards Smart LMS to Improve Learning Outcomes Students Using LenoBot with Natural Language Processing*"

memperoleh hasil akurasi sebesar 20%. Sedangkan dalam penelitian "*Automated Thai-FAQ Chatbot using RNN-LSTM*" memperoleh hasil akurasi 93.2%. Pada penelitian dengan judul "*A Metaphorical Study Of Variants Of Recurrent Neural Network Models For A Context Learning Chatbot*" memperoleh hasil LSTM 95% dan GRU 72%.

Sedangkan dalam penelitian lainnya dengan judul "*Comparative Analysis of Performance between Multimodal Implementation of Chatbot Based on News Classification Data Using Categories*" model CNN memperoleh hasil 99%. Selain itu penelitian dengan judul "*Deep Learning Approaches For Question Answering System*" memperoleh hasil penggunaan LSTM 49%, Memory Network 75%, dan Dynamic Memory Network 91%. Dan dalam penelitian yang berjudul "*Generating and Analyzing Chatbot Responses using Natural Language Processing*" terdapat hasil penggunaan LSTM 87%, GRU 83% dan CNN 75%. Kemudian dalam penelitian "*Mi-Botway: A Deep Learning-Based Intelligent University Enquiries Chatbot*" menggunakan RNN GRU memperoleh hasil akurasi 99%.

Melalui hasil analisa di atas model menggunakan Dynamic Memory Network memiliki kemampuan yang lebih baik dari LSTM, dan Memory Network dengan akurasi 91%. LSTM memungkinkan untuk mengingat informasi jangka Panjang dan jangka pendek dan digunakan untuk tugas-tugas pemodelan Bahasa, klasifikasi teks. Dan generasi teks. Memory Network digunakan untuk menyimpan informasi yang diperlukan untuk memecahkan masalah. Memory Network ini umumnya lebih baik daripada metode LSTM dalam memahami konteks dan melakukan pemecahan masalah yang memerlukan memori jangka Panjang. Sedangkan metode dari Dynamic Memory Network (DMN) memiliki kemampuan untuk memilih informasi yang relevan dari memori eksternal dan mengintegrasikannya dengan konteks untuk menghasilkan jawaban yang tepat. Biasanya DMN ini lebih baik daripada LSTM dan Memory Network dalam memecahkan masalah yang memerlukan pemahaman konteks yang lebih dalam.

4. Kesimpulan

Berdasarkan hasil penelitian yang telah dilakukan dapat disimpulkan bahwa perkembangan percakapan chatbot NLP memperoleh beberapa opsi penggunaan. Antara perannya aplikasi pihak ketiga seperti Dialogflow dan IBM Watson, kemudian penggunaan metode yang terbaik dalam obrolan chatbot untuk sistem pendukung memperoleh tiga perbandingan akhir. Dengan awal mulanya nilai terbaik diperoleh chatbot menggunakan metode LSTM dengan kemampuan mampu mempelajari informasi jangka panjang dan jangka pendek pada data sekuential, sehingga lebih efektif dalam memprediksi pola-pola yang kompleks pada data sekuential untuk diterapkan di chabot. Namun ada perbandingan pada penelitian dengan metode Memory Network pada chatbot menggunakan dataset dari bAbI Dataset Of Facebook memperoleh hasil yang lebih baik dari LSTM. Kemudian dalam penelitian chatbot yang sama, Dibandingkan lagi antara LSTM, Memory Network, Dan Dynamic Memory Network. Perolehan metode Dynamic Memory Network lebih baik dengan perolehan akurasi yang cukup tinggi 91%. Hal tersebut dikarenakan Dynamic Memory Network menggabungkan kelebihan LSTM dan Memory Network dengan menambahkan mekanisme attention yang dinamis, sehingga model dapat fokus pada informasi yang paling relevan pada setiap langkah waktu atau posisi dalam data sekuensial. Meskipun penelitian ini memberikan temuan yang menarik, namun untuk penerapan di dunia nyata, diperlukan penelitian lebih lanjut mengingat perbedaan karakteristik dan ketersediaan data yang berbeda pada berbagai skenario.

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