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Studi Literatur

Systematic Literature Review: Analisis Sentimen Berbasis Deep Learning

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ABSTRACT

Systematic literature review ini bertujuan untuk mengetahui tren penelitian analisis sentimen berbasis *deep learning* antara tahun 2020-2023. Fokus kajiannya adalah pada pemahaman tentang pemodelan yang digunakan oleh banyak peneliti, juga nilai akurasi dari masing-masing klasifikasi tersebut. Pertanyaan utama dalam SLR ini yaitu teknik analisis sentimen berbasis *deep learning* apa yang memberikan akurasi tertinggi. Peneliti menemukan 400 artikel terindeks Scopus dengan menggunakan *Publish or Perish 8*. Selanjutnya, penyaringan jurnal dan pencarian kluster menggunakan aplikasi Microsoft Excel, Zotero, Mendeley, dan VOS Viewer yang menghasilkan 105 artikel terpilih untuk dianalisis secara deskriptif. Berdasarkan hasil temuan metode yang populer digunakan dalam melakukan analisis sentimen berbasis *deep learning* dalam jangka waktu yang telah ditentukan adalah metode LSTM dan CNN, baik dilakukan satu metode maupun keduanya. Adapun akurasi tertinggi mencapai 99% dengan rata-rata 89% menggunakan metode LSTM. Pengetahuan ini dapat digunakan untuk mengusulkan model analisis sentimen berbasis *deep learning* yang memberikan akurasi tertinggi.

1. PENDAHULUAN

Analisis sentimen masih menjadi topik yang menarik untuk diteliti di bidang *text mining*. Analisis sentimen mampu memberikan berbagai implementasi, terutama digunakan untuk menentukan peringkat pengguna produk, layanan, tokoh politik, dan merek tertentu. Perkembangan media sosial menyebabkan analisis sentimen mendapat tempat, karena media sosial adalah sumber komunikasi yang kuat di antara orang-orang untuk berbagi sentimen mereka dalam bentuk opini dan pandangan tentang sebuah artikel atau topik. Ada milyaran pengguna media sosial, tercatat pada <https://datareportal.com> per April 2023, terdapat 4.80 miliar pengguna aktif media sosial dari total populasi penduduk sebanyak 8.03 miliar jiwa [1]. Mereka dapat memberikan opini dan pendapatnya secara bebas, tidak dibatasi oleh tempat dan waktu. Oleh karena itu, sikap, perasaan, pandangan, dan pendapat merupakan bagian penting dalam menganalisis perilaku seseorang. Untuk menginterpretasikan opini tersebut ke dalam opini positif dan negatif tentunya diperlukan alat dan metode. Metode analisis sentimen yang baik

adalah metode yang akan menjamin keakuratan sentimen sesuai dengan kondisi yang sebenarnya.

Ada tiga paradigma pendekatan untuk mendapatkan sentimen dari opini, yaitu analisis sentimen berdasarkan *lexicon-based techniques*, *machine learning-bases techniques*, dan *hybrid approaches*. Pendekatan *Machine learning* terdiri dari dua jenis, yaitu berbasis *traditional models* dan *deep learning models*. Deep learning mengadaptasi pendekatan multilayer ke lapisan neural network. Pemodelan yang diekstrak secara otomatis, sehingga mencapai akurasi dan kinerja yang lebih baik [2].

Analisis sentimen dengan menggunakan pendekatan *deep learning* merupakan area penelitian yang menjanjikan. Fakta lainnya metode *deep learning* menjadi sangat populer karena memberikan kinerja yang tinggi belakangan ini [3]. Oleh karena itu, diperlukan kajian mendalam untuk menemukan metode terbaru atau model terbaik untuk analisis sentimen berbasis *deep learning* dalam empat tahun terakhir belakangan ini. Selain itu juga dapat mengetahui nilai akurasi tertinggi berdasarkan tren penelitian analisis sentimen berbasis *deep learning*. Hal ini dapat dilakukan dengan memanfaatkan *systematic literature review*.

Systematic literature review (SLR) yang merupakan suatu cara mengidentifikasi, mengevaluasi, dan menginterpretasikan semua ketersediaan penelitian yang relevan terhadap rumusan masalah atau area topik yang diteliti [4]. Salah satu syarat dalam melakukan kajian yaitu harus mampu memahami suatu penelitian secara komprehensif. Hal tersebut dilakukan dengan pemetaan studi secara sistematis yang mengidentifikasi dan mengklasifikasikan kumpulan publikasi yang terkait pada suatu topik [5].

2. METODE

Peneliti menggunakan metode *Systematic literature review* (SLR) berdasarkan pedoman yang disediakan oleh Kitchenham [6] dengan merumuskan pertanyaan penelitian berdasarkan pedoman [6] dan studi literatur oleh [7]. Dalam pedoman tersebut terbagi ke dalam tiga fase, yang terdiri dari *planning the review phase*, *conducting the review phase*, dan *reporting the review phase*.

2.1. Planning the Review Phase

Fase awal yang dilakukan yaitu membuat *research question* (RQ) bertujuan untuk menjawab pertanyaan penelitian. Peneliti membuat *research question* ini berpedoman dengan pertanyaan penelitian yang diajukan oleh [7] dalam studi literatur mereka tentang SLR dalam rekayasa perangkat lunak. Maka, kami membuat pertanyaan dengan mengaitkan penelitian. Adapun *research question* yang kami gunakan yaitu:

RQ1 : Metode apa yang populer digunakan peneliti dalam melakukan analisis sentimen berbasis *deep learning*?

RQ2 : Berapa persentase akurasi tertinggi dari analisis sentimen berbasis *deep learning*?

2.2. Conducting the Review Phase

Fase selanjutnya diawali dengan pencarian yang melibatkan penggunaan *database online* standar yang digunakan untuk SLR yaitu yang mengindeks *sentiment analysis* AND *deep learning*. Tools yang kami gunakan yaitu *publish or perish 8* yang merupakan *software* program dengan mensitasi dari berbagai sumber, seperti Scopus, IEEE Xplore, Springer, ACM, Science Direct, Google Scholar, dll. *Software* program ini sudah memberikan cakupan yang sangat baik untuk literatur yang diinginkan dengan berbagai jurnal yang tersedia. Pencarian berlangsung pada tanggal 10 Mei 2023 dengan dataset kami ambil bersumber dari Scopus.

Tabel 1. Kriteria Inklusi dan Eksklusi

	Jurnal diterbitkan dalam tahun 2020-2023
Inklusi	Jurnal memiliki topik utama proses analisis sentimen
	Jurnal dengan pendekatan <i>deep learning</i>
Eksklusi	Jurnal tidak diterbitkan sebelum tahun 2020
	Jurnal yang subjek utamanya bukan analisis sentimen
	Jurnal dengan pendekatan baik <i>lexicon</i> maupun campuran

Selanjutnya menentukan kriteria inklusi dan eksklusi yang merupakan karakteristik umum subjek penelitian untuk memfilter

jurnal sesuai topik yang diinginkan. Dalam artian kriteria inklusi menjadi patokan dalam topik yang dijangkau, begitu sebaliknya kriteria eksklusi tidak akan dimasukkan pada topik yang akan dijangkau. Berikut kriteria dalam penelitian ini terdapat pada Tabel 1.

Fase selanjutnya melakukan penilaian kualitas (*quality assessment*) jurnal dalam bentuk pertanyaan yang digunakan untuk menilai kualitas dari masing-masing jurnal. Adapun lima kriteria untuk menilai kualitas dari masing-masing jurnal tersebut di antaranya:

QA.1 Apakah penelitian menggambarkan tujuan analisis sentimen dengan jelas?

QA.2 Apakah penelitian menggambarkan *deep learning* dengan jelas?

QA.3 Apakah penelitian menggambarkan tahap *preprocessing* dengan jelas?

QA.4 Apakah penelitian menggambarkan proses klasifikasi menggunakan model yang dihasilkan dengan jelas?

QA.5 Apakah penelitian menggambarkan tingkat akurasi dengan jelas?

Penilaian kualitas tersebut dinilai berdasarkan seberapa baik mereka memenuhi kriteria kualitas yang tercantum pada Tabel 2. Sistem poin berikut digunakan untuk menentukan skor kriteria individu: Ya (Y) = 1 poin, Parsial (P) = 0,5 poin, Tidak (N) = 0 poin.

Tabel 2. Penilaian Kualitas Jurnal

QA	Kriteria		
	Ya (skor 1)	Sebagian (skor 0,5)	Tidak (skor 0)
QA.1, QA.2, QA.3, QA.4, dan QA.5	Kriteria inklusi didefinisikan secara eksplisit	Kriteria inklusi bersifat implisit	Kriteria inklusi tidak didefinisikan dan tidak dapat disimpulkan

Tahap selanjutnya melakukan ekstraksi data dari studi yang terpilih menggunakan *Microsoft Excel* untuk menganalisis semua informasi yang diperlukan dalam penelitian. Adapun informasi hasil data dari studi terpilih dikumpulkan dalam bentuk ekstraksi data: tahun, penulis, judul, penerbit, DOI, abstrak, dan *keyword*.

2.3. Reporting the Review Phase

Terdapat 400 jurnal pada rentang tahun 2020 sampai 2023 yang telah diterbitkan di Scopus. Selanjutnya, penyaringan jurnal dan pencarian kluster dilanjutkan menggunakan aplikasi Mendeley Desktop, Zotero, Microsoft Excel, dan VOS Viewer. Proses pemilihan jurnal dilakukan berdasarkan *quality assessment* (QA). Daftar akhir studi primer yang dipilih memiliki jurnal yang sesuai dengan kriteria yang akan dibahas. Kemudian, teks lengkap dari jurnal tersebut dianalisis.

3. HASIL

400 jurnal tentang analisis sentimen diterbitkan dalam periode tahun 2020 hingga April 2023. Dari 400 jurnal yang didapatkan, jumlah publikasi mengalami kenaikan di setiap tahunnya. Terkecuali di tahun 2023 yang hanya terdapat 22 publikasi saja,

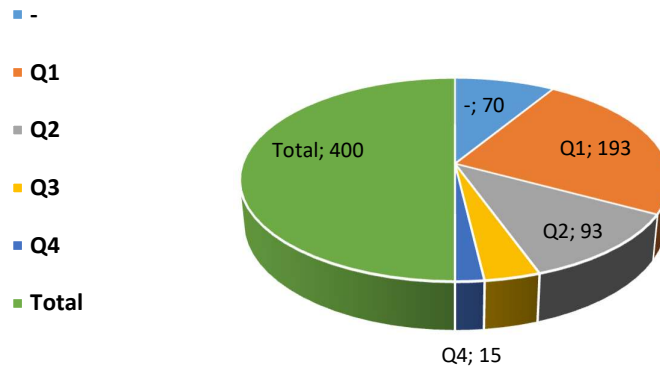
hal ini dikarenakan pengambilan data dilakukan hingga bulan April 2023. Dapat dilihat dalam Gambar 1 grafik jumlah jurnal yang diterbitkan Scopus berdasarkan tahun terbitnya.



Gambar 1. Jumlah Jurnal berdasarkan Tahun Publikasi

Gambar 2 merupakan grafik jumlah jurnal yang terindeks maupun tidak terindeks Scopus. Indeks Scopus sendiri dibagi dalam 4 kuartil (*Q-ranking of journal*) di mana Q1 merupakan

ranking tertinggi dan Q4 merupakan ranking terendah. Dari 400 jurnal, terdapat 70 jurnal yang tidak terindeks Scopus. Namun, untuk Q1 cukup mendominasi dengan jumlah 193 publikasi.



Gambar 2. Jumlah Jurnal Berdasarkan Quartile

Hasil dari proses *quality assessment* jurnal, menghasilkan 105 jurnal telah sesuai dengan kriteria inklusi dan eksklusi yang mempunyai pembahasan berkaitan dengan analisis sentimen berbasis *deep learning*. Sebagaimana terlihat pada Tabel 3.

Tabel 3. Filtrasi Jurnal Temuan

No.	Deskripsi	Hasil Temuan Jurnal
1	Studi ditemukan tahun 2020-2023	400
2	Filtrasi berdasarkan QA.1	376
3	Filtrasi berdasarkan QA.2, QA.3, QA.4, dan QA.5	105

4. PEMBAHASAN

4.1. RQ1: Metode apa yang populer digunakan peneliti dalam melakukan analisis sentimen berbasis deep learning?

Berdasarkan QA.4 ditemukan sebanyak 46 jenis model berbasis *deep learning* dari 105 jurnal yang telah diteliti. Masing-masing peneliti melakukan tahap klasifikasi baik menggunakan satu metode maupun lebih dari dua metode untuk mendapatkan hasil yang lebih akurat. Pada Tabel 4 diuraikan matriks ekstraksi data yang telah dilakukan untuk mengetahui metode yang populer digunakan peneliti belakangan ini.

Tabel 4. Metode Analisis Sentimen

No.	Metode	Jumlah	Sitasi
1	LSTM	13	[8] [20]
2	CNN	12	[21] [32]
3	CNN, LSTM	11	[33] [43]
4	BERT	9	[44] [52]
5	SVM	5	[53] [57]
6	Bi-LSTM	5	[58] [62]
7	CNN, RNN	4	[63] [66]
8	GRU	4	[67] [70]
9	DNN	2	[60], [61]
10	LSTM, RNN	2	[62], [63]
11	RCNN	2	[64], [65]
12	CNN, Bi-LSTM	2	[66], [67]
13	DenseNet121	1	[68]
14	RoBERTa, LSTM	1	[69]
15	Word2Vec	1	[70]
16	MLP	1	[71]
17	RoBERTa	1	[72]
18	MLGNN	1	[73]
19	CRNN	1	[74]
20	MBRA	1	[75]
21	MPAN	1	[76]
22	ReMemNN	1	[77]
23	Bi-GRU	1	[78]
24	LSTM, GRU	1	[79]
25	RNN	1	[80]
26	TLBO-LSTM	1	[81]
27	DBi-LSTM	1	[82]
28	GRU, CNN	1	[83]
29	CNN, SCL	1	[84]
30	CNN, LDA	1	[85]
31	ST-GCN	1	[86]
32	SER	1	[87]
33	Bi-LSTM, GRU	1	[88]
34	GRU, CapsNet	1	[89]
35	BRB-DL	1	[90]
36	APSO, LSTM	1	[91]
37	Bi-LSTM, ATT	1	[92]
38	AEC-LSTM	1	[93]
39	Bi-IndyLSTM, CRF	1	[94]
40	GANN	1	[95]
41	BERT, Bi-GRU	1	[96]
42	FastText	1	[97]
43	RNN, SVM	1	[98]
44	DNN, CNN	1	[99]
45	XLNetCN	1	[100]
46	GloVe	1	[101]
Total		105	

Metode yang populer digunakan untuk melakukan analisis sentimen berbasis *deep learning* adalah metode LSTM (*Long Short-Term Memory*) dengan jumlah 13 jurnal. Metode populer kedua yang digunakan adalah metode CNN (*Convolutional Neural Network*) dengan jumlah 12 jurnal, dan metode populer ketiga peneliti melakukan klasifikasi dengan kombinasi metode CNN-LSTM dengan jumlah 11 jurnal.

4.2. RQ2: Berapa persentase akurasi tertinggi dari analisis sentimen berbasis deep learning?

Tabel 5 merupakan metode yang populer terpilih dengan nilai akurasi dari masing-masing hasil analisis.

Tabel 5. Nilai Akurasi Metode LSTM

No.	Jurnal Penelitian	Tahun Publikasi	Indeks	Akurasi
1	[8]	2020	Q1	76%
2	[9]	2021	Q1	95,80%
3	[10]	2021	Q2	89,71%
4	[11]	2021	Q2	89,80%
5	[12]	2020	Q1	88,20%
6	[13]	2021	-	87,90%
7	[14]	2021	Q2	88,02%
8	[15]	2022	Q1	78%
9	[16]	2022	Q4	96,95%
10	[17]	2023	Q2	99,14%
11	[18]	2023	Q2	96,04%
12	[19]	2022	Q2	79,10%
13	[20]	2022	-	95%
	Tertinggi			99,59%
	Rata-rata			89%

Pada Tabel 4 menjelaskan bahwa publikasi jurnal tentang analisis sentimen berbasis *deep learning* di tahun 2020, 2021, 2022, dan 2023 terdapat 14 jurnal dengan masing-masing terdapat 3 jurnal, 5 jurnal, 4 jurnal, dan 2 jurnal. Nilai akurasi tertinggi hasil penelitian [17] melakukan penelitian tentang analisis sentimen COVID-19 pada media sosial twitter. Peneliti mengklasifikasikan sentimen menggunakan metode LSTM yang mampu memberikan nilai akurasi sebesar 99,14%, presisi dan recall sebesar 99,1%, dan F1-score sebesar 99,12%. Selanjutnya penelitian dari [16] tentang analisis sentimen dalam mendeteksi polaritas posting di media sosial Facebook tentang opini komentar dalam bahasa Bengali. Hasil dari penelitian tersebut dengan menggunakan metode LSTM menghasilkan nilai recall, precision, dan F-measure, dengan masing-masing mencapai 97% dan accuracy mencapai 96,95%.

Berdasarkan observasi akurasi model analisis sentimen berbasis *deep learning*, akurasi bisa dikatakan cukup tinggi, mencapai 99%. Akurasi yang tinggi sebanding dengan *preprocessing*, model, dan kondisi dataset opini yang digunakan. Pada publikasi jurnal tahun 2020-2023 menggunakan pendekatan *deep learning* dengan penerapan metode LSTM mampu menghasilkan tingkat akurasi rata-rata sebesar 89%.

5. KESIMPULAN

Berdasarkan hasil penelitian yang sudah dilakukan, maka dapat diambil kesimpulan bahwa penelitian yang dilakukan menggunakan metode *systematic literature review* yang bertujuan untuk mengidentifikasi dan menganalisis teknik analisis sentimen berbasis *deep learning* apa yang populer dan memberikan akurasi tertinggi. Terdapat 105 jurnal yang diperoleh berdasarkan hasil seleksi pencarian studi dari tahun 2020-2023 di Scopus. Hasil dari *research question* (RQ1) pada publikasi jurnal yang signifikan, bahwa sebanyak 46 model metode dalam melakukan analisis sentimen berbasis *deep learning* ditemukan, di mana metode populer terdapat pada LSTM dengan jumlah 13 jurnal, diikuti dengan metode CNN sebanyak 12 jurnal, dan 11 jurnal dengan mengkombinasikan metode CNN-LSTM. Pada *research question* (RQ2), akurasi tertinggi mencapai 99,59% dengan rata-rata nilai akurasi 89% dari metode populer LSTM.

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