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Perspectives

"Tortured Phrases" in Covid-19 Literature: Can They Serve as Epistemic Markers to Assess the Integrity of Biomedical Information?

Jaime A. Teixeira da Silva[1]

1 Independent researcher, Ikenobe, Kagawa-ken, Japan. Email: jaimetex@yahoo.com

Abstract

Medical practitioners and healthcare workers rely on information accuracy in academic journals. Some Covid-19 papers contain "tortured phrases", nonstandard English expressions, or imprecise or erroneous terms, that give the impression of jargon but are not. Most post-publication attention paid to Covid-19 literature has focused on the accuracy of biomedical aspects, the validity of claims, or the robustness of data, but little has been published on linguistic specificity. This paper highlights the existence of "tortured phrases" in select Covid-19 literature, arguing that they could serve as a class of epistemic marker when evaluating the integrity of the scientific and biomedical literature.

1. The Current State of Covid-19 Literature in a Nutshell

An astonishing volume of Covid-19 literature has already been published, with several thousands of papers still emerging every month. In the initial year or so of the pandemic, as many as 100 papers were being published per day (Pal 2021). Separately, a 2022 estimate using an assessment of funding acknowledgments noted that about a third of all Covid-19 literature was funded (Shueb et al. 2022). The National Center for Biotechnology Information's (NCBI's) LitCovid currently lists 366,802 papers related to Covid-19 that are indexed on PubMed (NCBI 2023). When such a massive body of literature exists on a single topic, there are bound to be errors, inaccuracies, and instances of fraud (Cogan 2022). Some journals, in their desire to publish new information, and perhaps in a rush to gain citations based on this popular topic, have not been as stringent as they should have been in peer review, and work of a scientifically unsatisfactory level, or with insufficiently robust evidence, was published as a result (Teixeira da Silva, Bornemann-Cimenti, and Tsigaris 2021). A recent Perspective piece in *Philosophy of Medicine* highlighted the importance of the robustness of evidence-based medicine, suggesting a transition in medicine based on empirical evidence to one based on "theory-oriented organismic systems" as a strategy to mitigate future pandemics (Marcum and Tretter 2023, 1). That

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suggestion complements another call for more rigorous scrutiny prior to the submission and publication of Covid-19 research, precisely so that the data available to healthcare workers is robust (Chirico and Teixeira da Silva 2023).

The past three years of post-publication peer review have revealed numerous problems in the expansive Covid-19 literature, and these discoveries have led to corrections and retractions (Teixeira da Silva, Tsigaris, and Erfanmanesh 2021; Khan et al. 2022). To date, there are 346 retractions and 18 expressions of concern for papers and preprints related to Covid-19 (Retraction Watch 2023). Social media served to amplify findings that were both useful and harmful, including invalidated findings in retracted papers (Shamsi, Lund, and SeyyedHosseini 2022), even creating crowdsourced elites who overamplified their desired talking points about Covid-19 on Twitter (Gallagher et al. 2021). For various reasons, including amplification by social media and poor indication of retracted status, these Covid-19 papers have continued to be cited, some of them frequently (Taros et al. 2023).

2. What Possible Reasons Might Explain the Existence of Unreliable Covid-19 Research?

It would be difficult, impossible even, to assign a single reason for the existence of published Covid-19 research that has been found to be unreliable, erroneous, or fraudulent. One or more of the following conceivable factors might be involved:

1. opportunism by authors to gain publications in a "hot topic" to score high citation counts (Kambhampati et al. 2021; Ioannidis et al. 2022; Wang et al. 2023);
2. opportunism by editors to score papers in their journal as a way to potentially amplify its metrics (Delardas and Giannos 2022; Maillard and Delory 2022);
3. lax screening standards, either at editorial level, or at the level of peer review, and in the case of preprints, almost no scrutiny given their peer-review-free status, despite their speed of publication (Fraser et al. 2021);
4. an overwhelming number of opinion papers, editorials, and letters that are data-free (Raynaud et al. 2021), essentially introducing "noise" that is not necessarily evidence-based into the medical literature;
5. a flux in the number of nonspecialist authors contributing to the Covid-19 literature (Ioannidis et al. 2021; Haber et al. 2022); and
6. a rush to publish, focusing more on bringing results to the public, thinking or believing that speed (Schonhaut et al. 2023) is more important than careful scrutiny, and in the hope that rapidly diffused findings, such as through preprints (Älgå, Eriksson, and Nordberg 2021) might somehow be beneficial to academics, healthcare workers, and the public, as evidenced to some extent by the relatively minor changes between preprinted and peer-reviewed versions of papers (Brierley et al. 2022).

What factors might allow unreliable findings to enter the Covid-19 literature? If a journal claims to be peer reviewed but then fails in its most basic task, not too many fingers can be pointed, and it can be assumed that either the authors are overly sly, or the journal management is overly lax. When excessive integrity breaches occur in a journal, it can be argued that "junk" journal management might exist, including oversight of the peer-review process, and with insufficient checks and balances of papers at each stage of submission-to-publication processes (Teixeira da Silva 2023b), a concept that does not

limit itself to journals that publish Covid-19 research. In the case of the disappearance of bibliometrically indexed preprints, and the information therein—that is, "silent retractions"—a pall is laid on preprint servers that display a lack of transparency regarding such removals (Teixeira da Silva 2021c). In essence, peer review is necessary to reduce the uncertainty of findings in preprints and to fortify the robustness of those findings (Nelson et al. 2022).

At the beginning of the pandemic, an alert was issued regarding the the risk of "quack" research (Freckelton 2020) being published in potentially predatory venues (Gupta et al. 2020; Teixeira da Silva 2021a; Rebeaud et al. 2022) and in explosive research volumes (Tiwari and Kaur 2020), risks that eventually manifested themselves in the form of misinformation, hyped treatments, solutions that were not supported by robust data (Kricorian, Civen, and Equils 2022), and an entire class of "research" (or that claimed to be research) that was stamped within popular circles and social media as "fake science," "fake news," or collectively conspiratorial information (Lee et al. 2022), in part triggering vaccine hesitancy (Chirico and Teixeira da Silva 2023). At this juncture, it is best to note that not all venues that produce bad science are necessarily exploitative (that is, seeking to maximize benefit and/or profit off good research, as would be affirmed by the peer-reviewed status of papers) or "predatory" (that is, seeking to maximize benefit and/or profit off bad research, as defined by the lack of peer review, combined with a business model built on exploiting authors' disingenuity). Yet, exploitative behavior seems to be everywhere: society exploiting itself (Zhang et al. 2022); authors exploiting journals' weaknesses; journal editors exploiting weaknesses of society and its state of distraction to promote their journals' growth; publishers exploiting their promise to make all Covid-19 research open, some of them later reneging on that promise (Teixeira da Silva and Okagbue 2022), with the ultimate risk that they might attempt to profit from the pandemic or from the popularity of Covid-19 research to amplify their profiles.

There is also informational risk in fringe, non-indexed, and potentially predatory journals while erroneous medical literature, especially that pertaining to Covid-19, may serve as a vehicle to propagate misinformation (Vervoort, Ma, and Shrime 2020), so it is essential that journals allow the publication of letters to the editor and commentaries for the open discussion and challenge of Covid-19-related findings (Teixeira da Silva 2021b; Daly 2023).

3. Introducing "Tortured Phrases" in the Covid-19 Literature

Among the errors that exist in the Covid-19 literature, not much attention has been paid to what some perceive as minor issues, such as grammar or linguistic specificity, and when standard technical terms or jargon are misrepresented via linguistic manipulation, mistranslation, or the evasion of plagiarism detection, a phenomenon known as "tortured phrases" might result (Cabanac, Labbé, and Magazinov 2021). These emerge from lax editorial and screening procedures (Teixeira da Silva 2022c), and their presence and use may distort the accuracy of medical literature (Teixeira da Silva 2022b). This has already been evidenced in neurological diseases such as Alzheimer's and Parkinson's disease (Teixeira da Silva 2022a, 2023c; Teixeira da Silva and Daly 2023). Even the reliability of information in preprints may be impacted, even more so if they are related to health or medical information (Teixeira da Silva 2023d). It is also possible to envision that thematic

nonspecialists and non-native English speakers might be more likely to resort to synonymizing software to rephrase concepts and ideas than native English speakers.

Drawing on select cases on PubPeer, which can be sourced by readers by using the digital object identifiers (DOIs) of papers on that website, this paper draws attention to the existence of "tortured phrases" in 47 papers related to Covid-19, ranging between minor errors and almost incomprehensible and nonsensical text (see Table 1 at the end of this paper). Some cases may have multiple "tortured phrases."[1] The accuracy of terms and jargon used is important, especially since some of these papers may be health-related.[2] One paper was retracted in December 2021, precisely due to the existence of "tortured phrases" and nonsensical text.[3]

For all cases in Table 1, how were these errors not detected by the peer reviewers, editors, or publishing staff (such as copyeditors) during peer review, subsequent editorial handling, and proof stages? Covid-19 papers can be retracted not only for misconduct but also due to a lack of integrity of the paper's basic medical information, which should have been detected by peer reviewers and editors.[4] Since "tortured phrases" might exist in the wider biomedical literature (Cabanac, Labbé, and Magazinov 2021; Else 2021; Teixeira da Silva 2022b), an extensive bibliometric analysis may be warranted once the volume of Covid-19 literature begins to tail off.

4. Could "Tortured Phrases" Serve as Epistemic Markers?

In order to be able to appreciate the nature of science (NOS), and to validate the knowledge construct that it creates, truth, reasoning, perception, and skepticism are required. "Tortured phrases" allow the validity of scientific knowledge to be probed by creating a scaffold in which it is possible to discern an established and correct term (state of truth) from a derivative, unconventional, and incorrect term (state of falsehood). The NOS, when triangulated with epistemic values, and within the context of science education (Peters-Burton, Dagher, and Erduran 2023) relies on scientific information that has been established on a base of rigorous scientific ethos and validated by stringent methodology, so as to create a body of knowledge that has dynamic professional and sociopolitical applications. Such complexity might be difficult to segment into distinct deontological units, so I tend to view NOS from a more simplistic prism, based on a structure with four cornerstones: truth, reasoning, perception, and skepticism.

To assess the validity of knowledge constructs, it is necessary to have robust epistemic tools, or "metacognitive scaffolds," which allow for an appreciation of how science has been constructed, and how a body of knowledge has come to exist (Boon and Van Baalen 2019). Tools that are able to provide such insight are valuable epistemic periscopic instruments. This paper introduces "tortured phrases" as a candidate epistemic marker, precisely because they are unconventional or nonstandard expressions that have come to replace established scientific terminology or jargon (Cabanac, Labbé, and Magazinov

[1] See, for example, 10.1016/j.matpr.2020.10.866 or 10.1016/j.saa.2021.120066.
[2] Such as 10.1088/1742-6596/2040/1/012015, which sought to use artificial intelligence to assess Covid-19 infection levels.
[3] 10.1088/1742-6596/1917/1/012023.
[4] See, for example, 10.1007/s00500-021-05871-6, 10.1016/j.matpr.2020.10.866, and 10.1007/s10619-021-07358-7.

2021). Although, to my knowledge, there are no universal clear-cut methodologies available to appreciate how the validity or robustness of an epistemic tool could be measured, "tortured phrases" allow the validity of a science knowledge construct to be tested or probed against established terms, at least according to a defined pool of peers.

The basis of the "tortured phrases" epistemic probe lies in its ability to discern an established and correct term (state of truth) from a derivative, unconventional, and incorrect term (state of falsehood). "Tortured phrases" should not, however, be confused with neologisms that are created to expand and strengthen science's lexicon. So how does one differentiate a "tortured phrase" from a neologism? One tangible example of the former and latter, respectively, are the terms "salicylic corrosive" representing "salicylic acid" (Teixeira da Silva 2023a). This offers a simple example of how a "tortured phrase" can serve as a probe to judge a term's legitimacy, and thus a lexicon's integrity. With a modicum of reasoning, skepticism, testing, and sensibility, one part of the truth of NOS can thus be discerned.

Can the existence of "tortured phrases" be explained and what is the underlying "metacognitive scaffold" at the heart of the existence of such terms? At a subliminal level, a lapse in judgment, or the inability to discern established from derivative terms, perceiving them as interchangeable equals, is an acceptable explanation. However, it is necessary to activate one of the cornerstones of NOS—skepticism—to appreciate that a more nefarious rationale might also exist; namely, the desire to manipulate language in such a way as to avoid epistemological failure, such as plagiarism. NOS involves probing the validity of science's knowledge, so "tortured phrases" can serve as an epistemic marker to allow scientists to exercise thematic vigilance (Teixeira da Silva and Daly 2023).

5. Conclusion

Medical jargon exists for a reason, primarily to guide medical practitioners about terms that have been standardized and accepted among the majority of a scientific community, to avoid confusion and ambiguity, and to ensure clear and targeted communication among professionals (Rau, Basir, and Flynn 2020), although excessive jargon may defeat the purpose of making medical scientific literature accessible and appreciated by a wider audience, such as the nonscientific public (Willoughby, Johnson, and Sterman 2020). "Tortured phrases" cancel the importance of jargon by replacing common or proper nouns within established jargon with other synonymous common or proper nouns, sometimes replacing established abbreviations with garbled phrases, resulting in terms that while not always incomprehensible, are not established terminology. As noted above, with an explosion in research, including by many individuals who are perhaps unfamiliar with medical jargon, and possibly also faced with stringent plagiarism detection in journals, it is assumed that the authors in the studies indicated in Table 1 may have relied on software that provides synonymous phraseology, impregnating their work with "tortured phrases" as a result. Editors, peer reviewers, copyeditors, typesetters, and proofreaders may also have all failed in their basic mission of ensuring that the work they oversaw and approved for publication was error-free (or at least as error-free as possible). It might also reveal that managers for some of these tasks do not exist in the processing of an accepted paper until publication. Under ideal conditions, all errors would be corrected (Teixeira da Silva 2016), and in some cases, those errors were not ignored, as evidenced by the retraction of

6 of the 47 papers (crudely > 10%) listed in Table 1. This means that there are a large number of journals and publishers who have left erroneous literature untouched, reaping unfair citations or reputational gains (Teixeira da Silva and Vuong 2021). The decision to correct or retract an error-filled paper may be difficult, and the line between unrecognizable science and "acceptable" errors that do not distort the research's overall meaning will likely differ considerably between journals because it depends on editors' subjectivity.

This commentary only provides an initial insight into the presence of "tortured phrases" in select papers on basic or applied research related to Covid-19. Known formally as such since 2021, "tortured phrases" in themselves are not a formalized science but rather an increasingly recognized phenomenon and a budding branch of linguistics and applied ethics. The cases discussed here are only one portion, possibly not even a representative portion, of the entire Covid-19 literature that carries these phrases. Some of the suggested appropriate terms and jargon in Table 1 may be subject to debate and it is possible that some are representative of other terms or jargon. Given the increasing interest being shown in "tortured phrases," a detailed bibliometric analysis of existing cases, and a wider search for new cases, including in the gray literature on Google Scholar, is merited.

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No competing interests were reported by the author.

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Table 1: Select Cases of "Tortured Phrases" in the Covid-19 Literature (Non-Exhaustive List)[1]

Authors[2]	**Paper DOI and title**	**"Tortured phrase" (verbatim)**	**Standard (highly likely) term/jargon**[3]	**Journal / book / congress title**	**Publisher**
Abdullah et al. 2021*	10.1088/1742-6596/1917/1/012023 "Detecting Subacute Thyroiditis after Covid-19 Infection Using Deep Learning Techniques: A Case Study"	Communities for Disease Control extreme intense respiratory condition hack invulnerable framework profound neural organization profound learning	Centers for Disease Control and Prevention severe acute respiratory syndrome cough immune system deep neural network deep learning	*Journal of Physics: Conference Series*	IOP Publishing
Ahmad et al. 2021	10.1002/ijfe.2434 "The Impact of Covid-19 on Unemployment Rate: An Intelligent Based Unemployment Rate Prediction in Selected Countries of Europe"	concealed/shrouded coating fractional auto-correlation work fake neural organization edge autoregressive backing vector machine	hidden layer partial autocorrelation function artificial neural network threshold autoregressive support vector machine	*International Journal of Finance & Economics*	Wiley

[1] Detailed and background information, as well as additional examples, can be drawn from entries at PubPeer (https://www.pubpeer.com/) using the DOI of indicated papers. Several of those cases were detected using the Problematic Paper Screener (https://dbrech.irit.fr/pls/apex/f?p=9999:1), where 335 entries for "Covid" were indicated (28 July 2023), including potential false positives. Exact page numbers are not indicated since "tortured phrases" might exist on one or multiple pages of each paper; in several cases, the "tortured phrase" can be easily detected since the definition does not match the abbreviation (for example, artificial neural network should be ANN but is represented as "counterfeit neural organization" in Lai et al. (2021)). This table does not explore other possible issues in the cited papers that might affect their academic integrity or reliability. Not all "tortured phrases" are indicated. The term "synonymized text" might be encountered on PubPeer to indicate potentially plagiarized text, modified to avoid the detection of plagiarism, but such cases are not shown in this table. The singular form of terms is represented even though the plural might have been used. Some instances/cases were detected by the author, independently of findings by commentators at PubPeer, following examination of the papers' full content. None of these cases are cited in the reference of the main text so as not to "award" them with a citation.

[2] Disclaimer: a claim of misconduct is not being leveled at any author or about any paper. Furthermore, so as not to give the impression of stigmatizing any cultural group or country, bibliometric details pertaining to institute and country are not provided.

[3] Most likely intended meaning/jargon; U.M., unclear meaning.

* Retracted (can also sometimes be represented by the term "withdrawal" but these terms are considered synonymous).

		signifying complete inaccuracy shrouded neurons	mean absolute error hidden neurons		
Asif et al. 2020	10.1101/2020.05.01.20088211 [preprint] 10.1109/iccc51575.2020.9344870 "Classification of Covid-19 from Chest X-ray Images Using Deep Convolutional Neural Network[s]"	bogus negative hack polymerase chain response	false negative cough polymerase chain reaction	*bioRxiv* *2020 IEEE 6th International Conference on Computer and Communications*	CSHL IEEE
Banik et al. 2021 Banik et al. 2023	10.21203/rs.3.rs-867959/v1 [preprint] "Automatic Approach for Mask Detection Effective: For Covid-19" 10.1007/s00500-022-07700-w "Automatic Approach for Mask Detection: Effective for Covid-19"	radical Covid inflicting Covid contamination 2019 radical Covid generating Covid contamination 2019 facial/face veil social removal/hole informational collection neural association/ organization preparation set profound learning fatality/demise price profound figuring out acknowledgement score unmarried step/ shot/level	coronavirus disease 2019 (Covid-19) coronavirus disease 2019 (Covid-19) face mask social distancing dataset neural network training set deep learning fatality rate/cost of life deep learning recognition rate single step/shot/level	*Research Square* *Soft Computing*	Research Square Platform LLC Springer Nature
Chopra et al. 2022	10.1016/j.stae.2022.100012 "Analysis & Prognosis of Sustainable Development Goals Using Big Data-Based Approach during Covid-19 Pandemic"	life submerged social removing sun oriented energy	life below water (SDG 14) social distancing solar energy	*Sustainable Technology and Entrepreneurship*	Elsevier
Degadwala et al. 2020	10.1109/iceca49313.2020.9297510 "Visual Social Distance Alert System Using Computer Vision & Deep Learning"	social removing/ separating cross-entropy misfortune	social distancing cross-entropy loss	*2020 4th International Conference on Electronics,*	IEEE

		help vector machine picture grouping strategic relapse tainted individuals	support vector machine (SVM) image classification logistic regression infected/affected individuals	*Communication and Aerospace Technology (ICECA)*	
Degadwala et al. 2021	10.1109/ICAIS50930.2021.9395864 "Classification of COVID-19 Cases Using Fine-Tune Convolution Neural Network (FT-CNN)"	Corona affliction (Covid-19) incredible outrageous respiratory issue crown 2 (SARS-CoV-2) X-shaft, X-pillar, X-bar, X-light impaired lattice ROC twist	coronavirus disease 2019 (Covid-19) severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) X-ray confusion matrix ROC curve	*2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS)*	IEEE
Dubey & Parwekar 2021	10.1007/978-981-16-0171-2_14 "Combating Covid-19 through Emerging Digital Technologies"	Middle East respiratory disorder serious intense respiratory condition flare-up	Middle East respiratory syndrome (MERS) severe acute respiratory syndrome (SARS) outbreak	*Data Engineering and Intelligent Computing*	Springer Nature
Elgazzar et al. 2020*	10.21203/rs.3.rs-100956/v3 [preprint] "Efficacy and Safety of Ivermectin for Treatment and Prophylaxis of Covid-19 Pandemic"	extreme intense respiratory syndrome-coronavirus 2 (SARS-CoV-2)	severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)	*Research Square*	Research Square Platform LLC
Gomathi et al. 2022	10.1108/wje-09-2020-0450 "Pattern Analysis: Predicting Covid-19 Pandemic in India Using AutoML"	head part examination invulnerable framework social separating	principal component analysis immune system social distancing	*World Journal of Engineering*	Emerald Publishing Ltd.
Hussain et al. 2020*	10.1109/access.2020.3007939 "AI Techniques for Covid-19"	extreme intense respiratory disorder (SARS) mad-made brainpower (AI)	severe acute respiratory syndrome (SARS) artificial intelligence (AI)	*IEEE Access*	IEEE

		Alzheimer's/ Parkinson's sickness twofold tree locale of intrigue lung knob programming bundle social removing enormous information	Alzheimer's/Parkinson's disease binary tree region of interest lung nodule software package social distancing big data		
Jain et al. 2022	10.1007/978-981-16-6369-7_70 "Secure Covid-19 Treatment with Blockchain and IoT-Based Framework"	Covid-19 pestilence flexibly chain tainted individuals hit and trial	Covid-19 pandemic supply chain infected/affected individuals trial and error	*Intelligent Sustainable Systems: Lecture Notes in Networks and Systems, vol. 334*	Springer Nature
Kaviya et al. 2020	10.1109/icpects49113.2020.9337018 "A Novel Covid Prevention Method Using Deep Learning"	Euclidean separation extreme intense respiratory convolutional neural organization preparation information social separating	Euclidean distance severe acute respiratory convolutional neural network training data social distancing	*2020 International Conference on Power, Energy, Control and Transmission Systems (ICPECTS)*	IEEE
Khadka et al. 2020	10.21608/nrmj.2020.84016 "Epidemiology and Pathogenesis of Coronavirus Disease (Covid-19)"	extreme intense respiratory respiratory disappointment	severe acute respiratory respiratory failure	*Novel Research in Microbiology Journal*	Egyptian Association for Medical Mycologists
Khan 2021	10.1007/s11356-021-13851-4 "The Covid-19 Pandemic and Its Impact on Environment: The Case of the Major Cities in Pakistan"	cardiovascular breakdown feasible advancement objectives irresistible illnesses monetary misfortunes ozone depleting substance discharge	heart failure sustainable development goals (SDGs) contagious/transmissible diseases financial damage greenhouse gas emissions	*Environmental Science and Pollution Research*	Springer Nature

		ozone depleting substance emanations world wellbeing association worldwide temperature alteration	greenhouse gas emissions World Health Organization (WHO) global warming		
Khanday et al. 2022	10.1016/j.jjimei.2022.100120 "Detecting Twitter Hate Speech in Covid-19 era Using Machine Learning and Ensemble Learning Techniques"	inclination boosting choice tree preparation information/set drawn aimlessly, haphazardly/ arbitrarily chosen	gradient boosting decision tree training data/set randomly selected	*International Journal of Information Management Data Insights*	Elsevier
Kumaran et al. 2023	10.1109/iccmc56507.2023.10083788 "Covid-19 Detection and Classification Using Transfer Learning with XGboost"	Covid-19 trial caskets extravagant severe respirational impairment serious intense respirational condition Middle East respiratory condition severe respirational pain disorder bogus negative/ positive disarray grid/lattice/ network district of intrigue information picture k esteem pre-prepared model recognizable proof separating highlights cerebrum/bosom	Covid-19 test kits severe acute respiratory syndrome (SARS) severe acute respiratory syndrome (SARS) Middle East respiratory syndrome (MERS) acute respiratory distress syndrome (ARDS) false negative/positive confusion matrix region of interest input image K value pre-trained model identification extracting features brain tumor/breast	*2023 7th International Conference on Computing Methodologies and Communication (ICCMC)*	IEEE

		cancer agent chest X-beam traverse-approval thoracic radiographic pictures	cancer representative chest X-ray cross-validation chest X-ray images		
Lai et al. 2021*	10.1007/s00500-021-05871-6 "Covid-19 Pandemic and Unemployment Rate: A Hybrid Unemployment Rate Prediction Approach for Developed and Developing Countries of Asia"	counterfeit neural organization backing vector machine auto-relationship work partial auto-connection work upheld vector machine	artificial neural network support vector machine autocorrelation function partial autocorrelation function support vector machine	*Soft Computing*	Springer Nature
Lakhani & Sharma 2020	10.1016/j.jor.2020.06.002 "Corona Virus (Covid-19): ITS Implications in Pediatric Orthopedic Care"	Middle East respiratory disorder extreme intense respiratory disorder distributed genome succession soft tissue compromise	Middle East respiratory syndrome severe acute respiratory syndrome published genome sequence soft tissue injury	*Journal of Orthopaedics*	Elsevier
Li et al. 2022	10.3389/fpubh.2021.778548 "Covid-19's Impact on China's Strategic Emerging Industries: An Observation of Policy Difficulties"	Covid-19 plague outbreak/ pestilence Poisson pseudo most excellent probability World Financial Standpoint World Well-being Association	Covid-19 pandemic Poisson pseudo-maximum likelihood (PPML) World Economic Outlook (WEO) World Health Organization (WHO)	*Frontiers in Public Health*	Frontiers
Lodh et al. 2020	10.1109/iceca49313.2020.9297399 "Prototype for Integration of Face Mask Detection and Person Identification Model—Covid-19"	irresistible infections liquor-based rub	contagious/transmissible diseases alcohol-based disinfectant	*2020 4th International Conference on Electronics,*	IEEE

		social removing biometric acknowledgment/ highlight discourse acknowledgment distinguishing proof informational collection misfortune work reconnaissance framework	social distancing biometric recognition/ feature voice/speech recognition identification dataset loss of function surveillance system	*Communication and Aerospace Technology (ICECA)*	
Maqbul et al. 2022	10.1016/j.hazadv.2022.100188 "Computation of the Complications post Covid-19 Infections among Urban Population in Saudi Arabia"	chances proportion P-esteem coronary supply route sickness IBM Factual Bundle for the Sociologies direct relapse certainty span	odds ratio P-value coronary artery disease IBM Statistical Package for the Social Sciences linear regression confidence interval	*Journal of Hazardous Materials Advances*	Elsevier
Mehta & Rathod 2021[4]	10.1007/978-3-030-75657-4_18 "Role of Artificial Intelligence in Covid-19 Pandemic"	computerized reasoning/man-made brainpower fluffy rationale hereditary calculation human services conveyance unequivocal innovation	artificial intelligence fuzzy logic genetic algorithm healthcare delivery decisive technology	*Advanced Soft Computing Techniques in Data Science, IoT and Cloud Computing*	Springer Nature
Mehta et al. 2021	10.1007/978-3-030-69744-0_3 "Application of Covid-19 Pandemic Using Artificial Intelligence"	offbeat coronavirus (Covid-19) wellbeing experts malady episodes nauseated extra than	coronavirus disease 2019 (Covid-19) health officials disease outbreaks killed more than	*Artificial Intelligence for COVID-19. Studies in Systems, Decision*	Springer Nature

[4] Determined exclusively from PubPeer and abstract since full text was only available behind a paywall.

		social protection people extent of sullying (POI) ground-glass appearance	socially isolated individuals point of interest (POI) translucent appearance	*and Control, vol. 358*	
Mishra et al. 2020	10.1016/j.sintl.2020.100042 "Global Impacts of Pre- and Post-Covid-19 Pandemic: Focus on Socio-Economic Consequences"	coronary illness counterfeit news general wellbeing authorities resistant framework tainted individuals worldwide temperature alteration	coronary artery disease fake news public health officials immune system infected/affected individuals global warming	*Sensors International*	Elsevier
Mohanty et al. 2020	10.1016/j.dsx.2020.06.068 "Application of Artificial Intelligence in Covid-19 Drug Repurposing"	computerized reasoning prescient model resistant framework bunching strategies repetitive neural network (RNN) completely associated feed-forward systems relapse strategies Golgi contraption	artificial intelligence predictive model immune system clustering methods recurrent neural network (RNN) fully-connected feed-forward networks regression methods Golgi apparatus	*Diabetes & Metabolic Syndrome Clinical Research & Reviews*	Elsevier
Mohsen et al. 2020	10.18231/j.ijmmtd.2020.016 "Similarities & Correspondences of Novel Coronavirus (CoV), SARS and MERS in KSA"	extreme intense respiratory general wellbeing authorities intense respiratory trouble kidney/respiratory disappointment polymerase chain response	severe acute respiratory public health officials acute respiratory distress syndrome (ARDS) kidney/respiratory failure polymerase chain reaction	*IP International Journal of Medical Microbiology and Tropical Diseases*	IP Innovative Publication Pvt. Ltd.

		social separating switch interpretation neutralization counteracting agent test	social distancing reverse transcriptase neutralizing antibody assay		
Murali et al. 2020*	10.1016/j.matpr.2020.10.866 "Convolutional Neural Network Use Chest Radiography Images for Identification of Covid-19"	Covid sickness 2019 counterfeit clever convolution neural organization district of intrigue redressed straight unit PC helped indicative PC tomography picture haphazardly	coronavirus disease 2019 artificial intelligence convolutional neural network region of interest rectified linear unit computer-aided design computed tomography image randomly	*Materials Today: Proceedings*	Elsevier
Nalini et al. 2021	10.1063/5.0069041 "Development of Forecasting Model for Infectious Disease (Covid-19)"	backslide models direct backslide hack social detachment	regression models linear regression cough social isolation	*AIP Conference Proceedings*	AIP Publishing
Pathari & Rahul 2020 Pathari 2021	10.1101/2020.05.27.20100297 [preprint] 10.48550/arXiv.2110.09384 "Automatic Detection of Covid-19 and Pneumonia from Chest X-ray Using Transfer Learning"	convolutional neural system figured tomography man-made consciousness profound neural system X-beam	convolutional neural network computed tomography artificial intelligence deep neural network X-ray	*medRxiv* *arXiv*	CSHL Cornell University
Pon Bharathi et al. 2022	10.1109/ICACCS54159.2022.9785093 "Temperature Monitoring Mechanism for Covid-19 Using WSN"	world wellbeing association kidney disappointment invulnerable framework constant sickness affirm instances clinic confirmations directing/steering	World Health Organization kidney failure immune system chronic disease confirmed cases hospital admissions routing protocol	*2022 8th International Conference on Advanced Computing and Communication Systems (ICACCS)*	IEEE

		convention hereditary calculation social separating subterranean insect settlement	genetic algorithm social distancing ant colony		
Purohit et al. 2020 Purohit et al. 2022	10.1101/2020.07.15.205567 [preprint] 10.1007/978-981-16-6890-6_30 "Covid-19 Detection on Chest X-ray and CT Scan Images Using Multi-image Augmented Deep Learning Model"	bleakness lymph hub	morbidity lymph node	*bioRxiv* *Proceedings of the Seventh International Conference on Mathematics and Computing: Advances in Intelligent Systems and Computing, vol. 1412*	CSHL Springer Nature
Rafi 2020	10.1101/2020.07.08.20148924 [preprint] 10.30538/psrp-easl2020.0054 "A Holistic Comparison between Deep Learning Techniques to Determine Covid-19 Patients Utilizing Chest X-ray Images"	concealed layer convolutional neural system hack polymerase chain response yield layer	hidden layer convolutional neural network cough polymerase chain reaction output layer	*bioRxiv* *Engineering and Applied Science Letters*	CSHL PSR Press
Ramteke & Sahu 2020	10.1016/j.cscee.2020.100029 "Novel Coronavirus Disease 2019 (Covid-19) Pandemic: Considerations for the Biomedical Waste Sector in India"	respiratory disappointment extreme intense respiratory disorder plague mindfulness isolate offices	respiratory failure severe acute respiratory syndrome pandemic preparedness quarantine facilities	*Case Studies in Chemical and Environmental Engineering*	Elsevier
Rangayasami et al. 2021	10.1016/j.sintl.2020.100079 "Influence of Nanotechnology to Combat against Covid-19 for Global Health Emergency: A Review"	contaminated diseases research facility bio care topographical nearness	contagious diseases laboratory biosafety guidance geographical proximity	*Sensors International*	Elsevier

Ranjan & Shekhawat 2022	10.1109/ICERECT56837.2022.10060863 "Analysis of Face Mask Detection through Machine Learning Techniques in Spread of COIVD-19 [*sic*]"	approval misfortune brain organization info picture man-made reasoning profound brain network recognizable proof reconnaissance framework tainted individuals world wellbeing association	validation loss neural network input image artificial intelligence deep neural network identification surveillance system infected/ affected individuals World Health Organization (WHO)	*2022 Fourth International Conference on Emerging Research in Electronics, Computer Science and Technology (ICERECT)*	IEEE
Rehman et al. 2021	10.3390/app11199023 "A Self-Activated CNN Approach for Multi-Class Chest-Related Covid-19 Detection"	AI calculation choice tree information mining/ index initiation work polymerase chain response recognizable proof	machine learning algorithm decision tree data mining/set activation function polymerase chain reaction identification	*Applied Sciences*	MDPI
Saadoon & Hussein 2021	10.2991/ahsr.k.211012.003 "Covid-19 Infection among Hemodialysis Patients in Tikrit City"	mellow side effects extreme ailment upper breath, aviation route tainted individuals	mild reactions severe illness upper respiratory tract infected individuals	*Proceedings of the 1st International Ninevah Conference on Medical Sciences (INCMS 2021)*	Atlantis Press (Springer Nature)
Sagar & Bhardwaj 2022	10.1007/978-3-030-95711-7_44 "Comparing the Accuracy and the Efficiency in Detection of Coronavirus in CT Scans and X ray Images"	enactment work informational collection/index profound neural organization wellness esteem X-beam pictures	activation function dataset deep neural network fitness value X-ray images	*AIST 2021: Artificial Intelligence and Speech Technology*	Springer Nature
Salem et al. 2021	10.1016/j.saa.2021.120066 "Combining Subsidiary and Synchronous	coronavirus infection human	coronavirus disease 2019 human	*Spectrochimica Acta Part A:*	Elsevier

	Approaches for Concurrent Spectrofluorimetric Assurance of Lopinavir and Ritonavir in Tablets Utilized in Convention for Treatment of Coronavirus Infection (Covid-19) and Biological Fluids"	immunodeficiency infection Nourishment and Medicate Organization World Wellbeing Organization serious intense respiratory disorder ghastly Cary Overshadow Fluorescence Spectrofluorimeter refined water stock arrangements dissolvable Universal Conference on Harmonization exactness worthy factual information medicate moo investigation time	immunodeficiency virus Food and Drug Administration World Health Organization severe acute respiratory syndrome spectral Cary Eclipse fluorescence spectrometer distilled water stock solutions solute International Council for Harmonisation precision statistically significant data drug U.M.	*Molecular and Biomolecular Spectroscopy*	
Santhosh Kumar et al. 2020	10.1109/iciss49785.2020.9316014 "Coronary Artery Disease Prediction Using Data Mining Techniques"	chest torment choice emotionally supportive coronary illness guileless/innocent Bayes heart ailments/ sickness hereditary calculation kick the bucket irregular timberland	chest pain dynamic decision support systems coronary artery disease naive Bayes heart/cardiac disease genetic algorithm die random forest	*2020 3rd International Conference on Intelligent Sustainable Systems (ICISS)*	IEEE
Singh & Das 2021	10.1007/978-981-16-2786-6_1 "An Overview of Significant Role of Data	backing vector machine	support vector machine	*Impact of AI and Data Science in*	Springer Nature

	Science and Its Associated Methodologies in Covid-19 Handling"	enormous information computerized reasoning irregular backwoods monetary misfortune processed tomography slant investigation supposition examination profound learning ultra man-made reasoning instruments flap of the lung passing pace CT sweeps ordinary patient	big data artificial intelligence random forest financial damage computed tomography trend analysis hypothesis testing deep learning deep learning-based software lung lobe death rate CT scans healthy patient	*Response to Coronavirus Pandemic: Algorithms for Intelligent Systems*	
Sitharthan & Rajesh 2021*	10.1007/s10619-021-07358-7 "Application of Machine Learning (ML) and Internet of Things (IoT) in Healthcare to Predict and Tackle Pandemic Situation"	intelligence profound learning simulated intelligence profound learning	empowerment learning model artificial intelligence deep learning	*Distributed and Parallel Databases*	Springer Nature
Vijay et al. 2020	10.1109/ICRAIE51050.2020.9358301 "Sentiment Analysis on Covid-19 Twitter Data"	respiratory plot feathered creature mellow disease	respiratory tract bird mild disease	*2020 5th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE)*	IEEE
Vijay et al. 2021	10.1088/1742-6596/2040/1/012015 "Simulation of Real-Time Medicine Suggestion Box for Covid Screening"	counterfeit neural organization profound neural network profound learning convolution neural organization	artificial neural network deep neural network deep learning convolutional neural network	*Journal of Physics: Conference Series*	IOP Publishing

		long-momentary memory tainted patients bogus positive conclusion	long short-term memory infected patients false discovery rate?		
Vinod & Prabaharan 2023	10.1007/s11831-023-09882-4 "Covid-19: The Role of Artificial Intelligence, Machine Learning, and Deep Learning: A Newfangled"	affectability computer-based intelligence extremely intense respiratory nucleic corrosive picture division polymerase chain response recognizable proof speculation capacity tainted individuals unaided/profound learning	sensitivity artificial intelligence severe acute respiratory nucleic acid image segmentation polymerase chain reaction identification predictive ability infected/affected individuals unsupervised/deep learning	*Archives of Computational Methods in Engineering*	Springer Nature
Wang & Lin 2022	10.1155/2022/8173768 "Political Will and the Impact Assessment of the New Crown Epidemic on Economic and Social Development and Countermeasures"	angle plummet blunder brain organization crown epidemic sure financial development board causality board mistake revision system inexhaustible man-made consciousness design acknowledgment rate focuses secret layer	gradient descent error neural network corona epidemic positive economic development panel causality panel error correction model renewable artificial intelligence pattern recognition percentage points hidden layer	*Journal of Environmental and Public Health*	Hindawi (Wiley)