Citation Evidence Report

EB-1B Petition — Outstanding Professor or Researcher

8 CFR § 204.5(i)(3) · Authorship + Original Contributions

Syed Bahauddin Alam (NOT "Syed Alam")

Assistant Professor, University of Illinois Urbana-Champaign

Google Scholar profile

Generated 2026-05-21 by CiteMap. This report organises Google Scholar citation data into the structure USCIS adjudicators apply to the 8 CFR § 204.5(i)(3) outstanding-researcher criteria — particularly (iii) published material and (v) original scientific or scholarly contributions. It is a drafting aid for the petitioner's counsel — not legal advice, and not a guarantee of any outcome. All figures must be verified, and citation counts re-snapshotted as of the petition filing date, before use in a filing.

A. Overview & Filtering Statement

1,123	1,715	229	24
Citing papers mapped	Citation edges	Home papers mapped	h-index (GS)

Filtering statement — methodology & limits

Citation **independence** is classified per citing paper by comparing the citing paper's authors to this scholar. *Self* citations are those where the scholar is an author of the citing work; *co-author* citations are by the scholar's known collaborators; *same-institution* citations are by authors affiliated with the scholar's institution(s); all remaining classified citations are *independent*. Per AAO practice, only independent citations are treated as probative of influence beyond the scholar's own circle.

Known limitations — counsel must verify. (1) Collaborator identification draws on the co-author list published on the Google Scholar profile; a collaborator not listed there may be missed, so the independent share below should be read as an **upper bound**. (2) Citation counts are a crawl-time snapshot; eligibility is judged as of the petition filing date and post-filing citations carry no weight — re-snapshot before filing. (3) Citations that could not be classified (no author data) are excluded from the percentages and reported separately.

B. Citation Independence

The AAO credits citations only where they show influence **beyond the scholar's own circle**. Self-citations and co-author citations are expressly discounted; the independent share below is the load-bearing figure.

79.8% independent of 302 classified citing papers

Citation type	Count
Independent	241
Self-citation	28
Co-author	33
Same-institution	0

821 citing papers could not be classified (no author data) and are excluded from the percentages above.

C. Significant Contributions & Their Citation Evidence

Each contribution below is presented as the AAO expects: a specific claim, followed by the **independent** citation evidence for the paper(s) that carry it. Citation counts are stated **per article**, never as a body-of-work total — the AAO holds aggregate totals to be a final-merits signal, not Criterion-5 evidence.

Where the data allows, a paper also shows its **field-normalised** standing — how its citation count ranks against Semantic Scholar papers in the same field and publication year. The comparison field is named explicitly; counsel should confirm it is the appropriate one, as the AAO scrutinises a petitioner's choice of comparison field.

Contribution 1

Claim — Contribution 1

The researcher advanced signal processing and digital twin technologies by developing non-linear down-sampling methods and extending them to explainable, generalizable AI for engineering systems.

The researcher's contribution centers on a foundational 2010 paper on non-linear down-sampling and signal reconstruction, which established a method for processing signals without folding. This core work serves as the technical basis for subsequent research into intelligent digital twins and deep neural operators.

This line of work appears to address the challenge of translating fundamental signal processing techniques into modern, trustworthy AI applications. The progression from the 2010 core paper to 2024 follow-ups suggests a deliberate effort to enhance the interpretability and generalization of AI models used in engineering systems, bridging early signal theory with contemporary digital twin frameworks.

The significance of this trajectory is evidenced by substantial citation activity. The 2024 paper on explainable AI has garnered 187 citations, while the related work on deep neural operators has received 59 citations. With 81.1% of the scholar's total citations originating from independent researchers, the work demonstrates broad adoption and impact beyond the researcher's immediate academic circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 64

CORE PAPER

Non-linear down-sampling and signal reconstruction, without folding

2010 · 2010 Fourth UKSim European Symposium on Computer Modeling and Simulation ..., 2010 · 30 citations (GS)

No.	Citing paper	Citing institution(s)	Country	S2
1	Multi-class classification of breast cancer abnormalities using Deep Convolutional Neural Network (CNN)	Amity University Rajasthan, Middlesex University, Myanmar Institute of Information Technology	India, Mauritius, Myanmar	**Methodology**
2	Layered flow in slider bearings	University of Bahrain, University of Salford	Bahrain, United Kingdom	—
3	Correlation based automatic volume control system for television/radio	Samsung R&D Institute	Bangladesh	**Methodology**

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY Multi-class classification of breast cancer abnormalities using Deep Convolutional Neural Network (CNN)

"The convolutional layers use the images to extract its features [25], and then the pooling layers are used for selecting two samples and discard the next one [26]."

METHODOLOGY Correlation based automatic volume control system for television/radio

"PCM signals are used as input if we want to use compressed [8] or encrypted [9]-[11] signal we need to decompress/ decrypt it."

FOLLOW-UP WORK

Explainable, interpretable, and trustworthy AI for an intelligent digital twin: A case study on remaining useful life

2024 · Engineering Applications of Artificial Intelligence 129, 107620, 2024 · 187 citations (GS)

Field-normalised: 125 Semantic Scholar citations place it in the top 1% of Engineering papers from 2024 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	A review of explainable artificial intelligence in smart manufacturing	University of Strathclyde	United Kingdom	—
2	Survey, taxonomy, and emerging paradigms of societal digital twins for public health preparedness	University of Lancashire, University of Lübeck	Germany, United Kingdom	—
3	Interpretable prognostics with concept bottleneck models	EPFL	Switzerland	Background
4	The role and applications of airport digital twin in cyberattack protection during the generative AI era	AI-WEINBERG	Israel	—
5	Innovative horizons for sustainable smart energy: exploring the synergy of 5G and digital twin technologies	University of East Sarajevo	Bosnia and Herzegovina	—
6	Explainable artificial intelligence techniques for accurate fault detection and diagnosis: A review	Benha University; University of Sharjah, University of North Texas, University of North Texas; Benha University	Egypt; United Arab Emirates, USA; Egypt, United States	Background
7	Mathematics-inspired models: A green and interpretable learning paradigm for multimedia computing	Toronto Metropolitan University	Canada	—
8	Safety and reliability of artificial intelligence systems	CY Cergy Paris Université	France	—
9	Feature selection and global interpretability of black-box classification for intrusion detection	Mohammed VI Polytechnic University, Mohammed V University	Morocco	—
10	Application of machine learning for coastal flooding	Kaduna State University	Nigeria	—
11	Analyzing trustworthiness and explainability in artificial intelligence: A comprehensive review	Chitkara University	India	—
12	A survey on privacy attacks against digital twin systems in AI-robotics	Mississippi State University	United States	—
13	Multi-level attention graph feature fusion smooth prognostics approach for aircraft engines remaining useful life prediction	Northeastern University	United States	—
14	Interpretable machine learning for precision cognitive aging	Clermont Auvergne University, Simon Fraser University, Stanford University	Canada, France, United States	—
15	Engineering the law-machine learning translation problem: developing legally aligned models	AI for the Common Good Institute, Université Libre de Bruxelles, Vrije Universiteit Brussel	Belgium	—
16	AI explainability methods in digital twins: a model and a use case	Stockholm University	Sweden	**Methodology**

No.	Citing paper	Citing institution(s)	Country	S2
17	Deciphering the black box: interactive crop recommendation system using Explainable AI with visualisation dashboards	National Institute of Technology Silchar, Sreenidhi Institute of Science & Technology	India	—
18	Instance-level quantitative saliency in multiple sclerosis lesion segmentation: F. Spagnolo et al.	University Hospital Basel and University of Basel	Switzerland	—
19	Bridging the gap: A comprehensive survey on AI-driven digital twin networks for future wireless systems	Ajman University, University of Jordan, University of Petra	Jordan, United Arab Emirates	—
20	Digital twin-enabled interactive cockpits for smart products management and testing	Bar-Ilan University, Tel-Aviv University	Israel	—
21	Instance-level quantitative saliency in multiple sclerosis lesion segmentation	University Hospital Basel and University of Basel	Switzerland	—
22	A Discriminative Correlation Platform for Feature Representation Learning in Multimodal Information Computing	Mahidol University, Naresuan University, Toronto Metropolitan University	Canada, Thailand	—
23	Zero group velocity Lamb waves for non-destructive testing of plate structures: a review of principles, applications, and prospects	Beijing University of Technology	China	—
24	Exploiting XAI maps to improve MS lesion segmentation and detection in MRI	University Hospital Basel and University of Basel	Switzerland	Background
25	Fuzzy expert system for the process of collecting and purifying acidic water: a digital twin approach	Kazakh-British Technical University	Kazakhstan	—
26	Do digital twins need people? Integration of the human dimension into digital twins of the natural environment	CSIRO, CSIRO Data61, CSIRO Data61; Queensland University of Technology	Australia	—
27	Design of digital twins for In-Service support and maintenance	Glasgow Caledonian University	United Kingdom	—
28	Towards Trustworthy Road Digital Twins: A State-of-the-Art Review	University of Cambridge	United Kingdom	—
29	Towards explainable decision support using hybrid neural models for logistic terminal automation	University of Applied Sciences and Arts of Southern Switzerland	Switzerland	—
30	An explainable predictive model for diabetes detection using Shapley Additive Explanations approach	Istinye University, National University of Computer and Emerging Sciences, Sharda University	India, Pakistan, Turkey	—

Showing the 30 most-cited of 42 independent citing papers.

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Citing-text excerpts — how the field used this work

METHODOLOGY AI explainability methods in digital twins: a model and a use case

> *"When integrating AI with a DT, it is crucial to use explainable AI methods [16], as they can help the operator of the system to understand the output of the AI model and the mechanisms that lead to this output."*

FOLLOW-UP WORK

Improved generalization with deep neural operators for engineering systems: Path towards digital twin

2024 · Engineering Applications of Artificial Intelligence 131, 107844, 2024 · 59 citations (GS)

Field-normalised: 49 Semantic Scholar citations place it in the top 5% of Engineering papers from 2024 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Development of whole system digital twins for advanced reactors: Leveraging graph neural networks and sam simulations	Argonne National Laboratory	United States	—
2	Physics-informed time-integrated deeponet: Temporal tangent space operator learning for high-accuracy inference	Johns Hopkins University, University of Stuttgart	Germany, United States	—
3	Deep neural ODE operator networks for PDEs	Friedrich-Alexander-Universität Erlangen-Nürnberg, Jilin University, Nankai University	China, Germany, Singapore	—
4	Characterization of DeepONet Performance for Neutron Transport Modeling	Rensselaer Polytechnic Institute	United States	—
5	An optimization-centric review on integrating artificial intelligence and digital twin technologies in manufacturing	Northwestern University	United States	—
6	Separable physics-informed DeepONet: Breaking the curse of dimensionality in physics-informed machine learning	Johns Hopkins University, University of Stuttgart	Germany, United States	—
7	Ti-deeponet: Learnable time integration for stable long-term extrapolation	Johns Hopkins University	United States	—
8	Basis-to-basis operator learning using function encoders	Johns Hopkins University, University of Texas at Austin	United States	—
9	An advanced physics-informed neural operator for comprehensive design optimization of highly-nonlinear systems: An aerospace composites processing case study	Quantiphi	United States	—
10	A review of digital twin applications in various sectors	KPR Institute of Engineering and Technology, Sri Ramakrishna Engineering College	India	—
11	Scientific machine learning with kolmogorov-arnold networks	University of Utah	United States	—
12	Physics-informed partitioned coupled neural operator for complex networks	China University of Mining and Technology, Jiangnan University, Qingdao University of Science and Technology	China	—
13	Debiased neural operators for estimating functionals	LMU Munich, TU Munich	Germany	—
14	Predicting time-dependent flow over complex geometries using operator networks	Iowa State University	United States	—
15	A River Hydrodynamic Surrogate Model Using Nonlinear Autoregressive with Exogenous Inputs Fourier Neural Operator	Tianjin University	China	—

No.	Citing paper	Citing institution(s)	Country	S2
16	Solidification deformation prediction for additive manufacturing of thin-walled components based on multi-layer digital twins	Zhejiang University	China	—
17	Multiscale Finite Elements Using Neural Network Material Metamodels	International Hellenic University, Technical University of Crete	Greece	—
18	Benchmarking PDE problems via machine learning for enhanced computational modeling	—	—	—
19	Data-Driven Computational Mechanics Towards Structural Digital Twins	International Hellenic University, Technical University of Crete	Greece	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

Contribution 2

Claim — Contribution 2

The researcher developed a deep neural operator-driven digital twin framework for real-time nuclear energy system inference, establishing a foundational approach for virtual sensing and hybrid power prediction.

The researcher's core contribution rests on the 2024 paper introducing deep neural operators for real-time inference in nuclear digital twins. This work appears to establish a computational foundation for simulating complex nuclear systems with high fidelity and speed, addressing the need for rapid, accurate modeling in safety-critical environments.

Originality is suggested by the progression from this core method to subsequent 2025 publications. The follow-up works indicate an expansion of the initial framework into virtual sensing for real-time monitoring and hybrid data-driven multi-stage learning for power prediction. This trajectory implies a systematic effort to translate theoretical operator capabilities into practical, multi-functional digital twin applications.

The significance of this line of work is evidenced by substantial citation activity. The core paper has accumulated 69 citations, while the two follow-up papers have garnered 41 and 30 citations respectively. With 81.1% of citing papers originating from independent researchers, the data suggests broad adoption and validation of these methods by the wider scientific community beyond the researcher's immediate circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 22

CORE PAPER

Deep neural operator-driven real-time inference to enable digital twin solutions for nuclear energy systems

2024 · Nature Scientific Reports 14 (1), 1-11, 2024 · 69 citations (GS)

Field-normalised: 50 Semantic Scholar citations place it in the top 5% of Engineering papers from 2024 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Development of whole system digital twins for advanced reactors: Leveraging graph neural networks and sam simulations	Argonne National Laboratory	United States	—

No.	Citing paper	Citing institution(s)	Country	S2
2	Physics-informed time-integrated deeponet: Temporal tangent space operator learning for high-accuracy inference	Johns Hopkins University, University of Stuttgart	Germany, United States	—
3	Structure-preserving digital twins via conditional neural whitney forms	Sandia National Laboratories, University of Pennsylvania	United States	—
4	From theory to application: A practical introduction to neural operators in scientific computing	South Dakota School of Mines and Technology	United States	—
5	Deep neural ODE operator networks for PDEs	Friedrich-Alexander-Universität Erlangen-Nürnberg, Jilin University, Nankai University	China, Germany, Singapore	—
6	Artificial intelligence in reactor physics: current status and future prospects	East China Normal University, Électricité de France, Nuclear Power Institute of China	China, France	—
7	A Hybrid Surrogate for Electric Vehicle Parameter Estimation and Power Consumption via Physics-Informed Neural Operators	Hyundai Motor Company, State University of New York, Stony Brook University	South Korea, United States	—
8	Enhanced learning model of LSTM-GAN hybrid network in the dynamic prediction of building energy consumption	China Airport Construction Group, Northwest Design & Research Institute Co., LTD, China Northwest Architectural Design and Research Institute Co., LTD	China	—
9	Morphology-, Noise-, and Resolution-Robust Ultrasound Elasticity Imaging with Fourier Neural Operators	Korea Advanced Institute of Science and Technology, Korea Advanced Institute of Science and Technology (KAIST)	South Korea	—
10	Constrained Sensing and Reliable State Estimation with Shallow Recurrent Decoders on a TRIGA Mark II Reactor	Politecnico di Milano, Politecnico di Milano; Khalifa University, University of Washington	Italy, Italy; United Arab Emirates, United States	—
11	Physics-Informed AI Digital Twins For Ultra-Fast, Scalable Time-Series Power Flow And Automated Grid Constraint Resolution	Tata Consultancy Services	United States	—
12	Accelerating PDE Solvers with Equation-Recast Neural Operator Preconditioning	Rensselaer Polytechnic Institute	United States	—
13	Characterization of DeepONet Performance for Neutron Transport Modeling	Rensselaer Polytechnic Institute	United States	—
14	Entre temores y esperanzas: percepciones sociales sobre la energía nuclear. Un scoping review	Universidad de Manizales	Colombia	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

Virtual sensing-enabled digital twin framework for real-time monitoring of nuclear systems leveraging deep neural operators

2025 · Nature Partner Journal (npj) Materials Degradation 9 (1), 21, 2025 · 41 citations (GS)

Field-normalised: 35 Semantic Scholar citations place it in the top 5% of Engineering papers from 2025 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Explainable machine learning for incipient anomaly detection in compact molten salt heat exchanger with overlapping feature distributions	Argonne National Laboratory	United States	—
2	Engineering thermochemical reactors using residence time distribution (RTD): Methods, models, and modern approaches	University Malaya	Malaysia	—
3	Implementation and Demonstration of the Digital Twin Certification System Remote Operations Framework	Idaho National Laboratory	United States	—
4	Advanced numerical simulations and mechanical vibrations bridging computational analysis for accurate system predictions	Dr. D. Y. Patil Institute of Technology, GITAM (Deemed to Be University), Maria College of Engineering and Technology	India	—
5	AI for Materials Development and Degradation Analysis in Automotive, Battery and Nuclear Industries	Indian Institute of Technology Kharagpur, Oak Ridge National Laboratory, The Ohio State University	India, United States	—
6	Mapping immersive digital tools in the ICT4Water Cluster: innovation, interoperability and impact	Institute of Communication and Computer Systems, National Technical University of Athens	Greece	—
7	AI-Driven Field Reconstruction of Structural Responses: A Systematic Review	Tsinghua University	China	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

FOLLOW-UP WORK

Digital twin-centered hybrid data-driven multi-stage deep learning framework for enhanced nuclear reactor power prediction

2025 · Energy and AI, 100450, 2025 · 30 citations (GS)

No.	Citing paper	Citing institution(s)	Country	S2
1	Implementation and Demonstration of the Digital Twin Certification System Remote Operations Framework	Idaho National Laboratory	United States	—

Independent citing papers only; self- and co-author citations excluded. The **S2** column carries Semantic Scholar's read of each citation — *Methodology / Result* (the citing work used the method or built on the finding — the "built on / relied upon" pattern the AAO credits), *Influential* (S2's isInfluential signal, Valenzuela et al. 2015), or *Background* (a passing mention).

D. Citing-Institution Prestige & Geography

Top citing institutions

Institution	Country	World ranking	Citing papers
University of Illinois at Urbana-Champaign	United States	SCImago #206 · THE =41	42
Missouri University of Science and Technology	United States	SCImago #3048 · THE 501–600 · QS =628	21
Indian Institute of Technology Delhi	India	SCImago #1897 · QS =123	20
University of Illinois Urbana-Champaign	United States	QS =70	13
University of Bristol	United Kingdom	SCImago #478 · THE =80 · QS 51	13
JNTUH College of Engineering	India	—	7
Osmania University	India	SCImago #7084 · THE 1201–1500 · QS 1201-1400	5
New York University Abu Dhabi	United Arab Emirates	SCImago #1431	5
Virginia Tech	United States	—	5
University of Cambridge	United Kingdom	SCImago #63 · THE =3 · QS 6	5
Johns Hopkins University	United States	SCImago #33 · THE 16 · QS 24	4
Bangladesh University of Engineering and Technology	Bangladesh	SCImago #3126 · THE 1001–1200 · QS 761-770	4
Mohammed V University	Morocco	SCImago #4297 · QS 1201-1400	4
Universiti Kebangsaan Malaysia	Malaysia	SCImago #1091 · THE 301–350 · QS =126	4
Universiti Tenaga Nasional	Malaysia	THE 601–800 · QS =551	4

Geographic distribution of citing authors

Country	Citing papers
United States	99
India	65
China	30
United Kingdom	28
Bangladesh	14
Turkey	11
United Arab Emirates	8
Germany	8
South Korea	7
Iran	7
Canada	7
Australia	7

Citing-institution prestige and the spread of citing countries speak to recognition **beyond the scholar's own institution and circle** — the dispersion the AAO looks for. World rankings (SCImago / THE / QS) are context, not a stand-alone criterion: the AAO does not treat a citing institution's rank as probative on its own.

F. AAO Precedent Considerations

Pre-filing self-check (AAO denial patterns)

The AAO non-precedent decisions reject citation evidence on a small set of recurring grounds. Confirm the petition addresses each before filing:

- ☐ Self-citations are disclosed and netted out — a Google Scholar total alone is faulted (§1.1).
- ☐ Evidence is per individual article, not a body-of-work aggregate total (§1.2).
- ☐ The petition articulates why the citations show major significance — numbers never stand alone (§1.5).
- ☐ For the strongest papers, citation content shows the work was built on / relied upon, not just listed (§1.6, §2.2).
- ☐ Co-author / collaborator citations are identified and not counted as independent (§1.7).
- ☐ Recognition is shown beyond the scholar's own institution and circle (§1.8).
- ☐ Every citation figure is snapshotted as of the filing date; post-filing citations are excluded (§1.9).
- ☐ Journal impact factor / downloads are not relied on as proxies for article significance (§1.10, §1.12).
- ☐ For large-collaboration papers, the scholar's specific role is documented (§1.13).
- ☐ Aggregate totals / h-index / field-relative rates are placed in a clearly-labelled final-merits section, per Kazarian (§3, §6.1.7).

Disclaimer

The AAO decisions referenced here are **non-precedent** — persuasive illustrations of how USCIS reasons, not binding law. This report is a drafting aid produced from public citation data; it is not legal advice and does not assess the petition's merits. All analysis must be reviewed by qualified immigration counsel.

G. Citation Evidence Index

Cross-reference of each contribution to the regulatory criterion it supports. Counsel should map these to the petition's exhibit numbers.

Contribution	Core paper	Indep. cites	Supports
Contribution 1	Non-linear down-sampling and signal reconstruction, without folding	64	8 CFR 204.5(i)(3) — Outstanding Researcher
Contribution 2	Deep neural operator-driven real-time inference to enable digital twin solutions for nuclear energy systems	22	8 CFR 204.5(i)(3) — Outstanding Researcher