Citation Evidence Report

EB-2 NIW Petition — National Interest Waiver

Matter of Dhanasar · Prong 2 (well-positioned)

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[Google Scholar profile]

Generated 2026-05-21 by CiteMap. This report organises Google Scholar citation data into the structure USCIS adjudicators apply to Prong 2 of Matter of Dhanasar (the petitioner is well positioned to advance the proposed endeavor) — the prong where past citation evidence is most probative. 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

2,770	3,023	30	35
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.

93.7% independent of 394 classified citing papers

Citation type	Count
Independent	369
Self-citation	8
Co-author	17
Same-institution	0

2,376 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 established a foundational framework for traffic matrix estimation, synthesizing existing techniques and defining new research directions that have significantly influenced network measurement and inference methodologies.

The researcher's contribution centers on the seminal 2002 paper, 'Traffic matrix estimation: Existing techniques and new directions,' which serves as the cornerstone for this line of inquiry. This work appears to have provided a critical synthesis of the state of the art while identifying key avenues for future development in the field of network traffic analysis.

Originality in this body of work is suggested by the progression from a broad survey and directional guide in 2002 to more specialized technical contributions in 2005. The follow-up papers, focusing on balancing measurements with inference and modeling, and specifically applying Kalman filters for tracking, indicate a deepening of the initial framework. This trajectory suggests the researcher moved from defining the problem space to proposing concrete methodological solutions for dynamic traffic estimation.

The significance of this research is evidenced by the substantial citation counts, with the core paper accumulating 828 citations and the follow-up works garnering 295 and 96 citations respectively. Furthermore, the high degree of citation independence, with 94.2% of classified citations originating from independent researchers, strongly indicates that this work has been widely adopted and recognized by the broader scientific community as a standard reference in the field.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 97 · **12 flagged influential by Semantic Scholar**

CORE PAPER

Traffic matrix estimation: Existing techniques and new directions

2002 · ACM SIGCOMM Computer Communication Review 32 (4), 161-174, 2002 · 828 citations (GS)

Field-normalised: 576 Semantic Scholar citations place it in the top 1% of Computer Science papers from 2002 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	B4: Experience with a globally-deployed software defined WAN	Google	United States	—
2	Diagnosing network-wide traffic anomalies	Boston University	United States	—
3	MicroTE: Fine grained traffic engineering for data centers	Microsoft Research, University of Wisconsin-Madison	United States	—
4	Providing public intradomain traffic matrices to the research community	—	—	—
5	Fast accurate computation of large-scale IP traffic matrices from link loads	—	—	Methodology
6	Spatio-temporal compressive sensing and internet traffic matrices	University of Adelaide	Australia	Background
7	Making intra-domain routing robust to changing and uncertain traffic demands: Understanding fundamental tradeoffs	—	—	—
8	Data streaming algorithms for efficient and accurate estimation of flow size distribution	Georgia Institute of Technology	United States	Background
9	On the complexity of traffic traces and implications	University of Vienna	Austria	—
10	Simplifying the synthesis of Internet traffic matrices	University of Adelaide	Australia	Methodology

No.	Citing paper	Citing institution(s)	Country	S2
11	An information-theoretic approach to traffic matrix estimation	Stanford University	United States	Methodology
12	Packet caches on routers: the implications of universal redundant traffic elimination	Carnegie Mellon University, University of California, Berkeley	United States	—
13	Understanding the modeling of computer network delays using neural networks	Universitat Politècnica de Catalunya	Spain	Methodology
14	Swing: Realistic and responsive network traffic generation	Google	United States	Background
15	Traffic matrix estimation on a large IP backbone: a comparison on real data	—	—	Result
16	Realistic and responsive network traffic generation	Google	United States	Background
17	An ldp compatible sketch for securely approximating set intersection cardinalities	—	—	—
18	Spatiotemporal traffic matrix synthesis	University of Adelaide	Australia	Background
19	Incremental SDN deployment in enterprise networks	—	—	—
20	YouTube traffic dynamics and its interplay with a tier-1 ISP: An ISP perspective	University of Minnesota	United States	Background
21	Robust traffic matrix estimation with imperfect information: Making use of multiple data sources	Georgia Institute of Technology	United States	Background
22	On traffic matrix completion in the internet	Boston University	United States	Methodology
23	In-network address caching for virtual networks	Technion	Israel	—
24	Inference of link delay in communication networks	Stanford University	United States	—
25	Coping with network failures: Routing strategies for optimal demand oblivious restoration	—	—	Influential
26	Lying your way to better traffic engineering	—	—	—
27	Spatio-temporal Prediction of Fine-Grained Origin-Destination Matrices with Applications in Ridesharing	Meta	United States	—
28	A data streaming algorithm for estimating entropies of od flows	Georgia Institute of Technology	United States	—
29	NetQuest: A flexible framework for large-scale network measurement	University of Texas at Austin	United States	Background
30	The impact of BGP dynamics on intra-domain traffic	University of California, Berkeley	United States	Background

Showing the 30 most-cited of 68 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 Fast accurate computation of large-scale IP traffic matrices from link loads

"The paper concluded [7] that none of the prior methods for computing traffic matrices was satis f ctory for even a PoP to PoP traffic matrix on a large network, let alon e a BR to BR matrix."

METHODOLOGY Simplifying the synthesis of Internet traffic matrices

"Examples of side information used in the context of Internet TMs are a Poisson model [15, 13], a Gaussian model [1], a logit-choice model [7], or a gravity model [16]."

METHODOLOGY An information-theoretic approach to traffic matrix estimation

"While there is experience with the gravity model above and some success in its application, it is also known that it g ives results that are not as accurate as may be obtained using addi tional information [16, 28]."

METHODOLOGY Understanding the modeling of computer network delays using neural networks

"As for the traffic matrices we use a "hot spot" model [16], where few pairs of nodes generate most of the traffic carried by the network."

RESULT Traffic matrix estimation on a large IP backbone: a comparison on real data

"This difference could be explained from the fact that [12] calculates the 1-second mean-variance relationship per demand over 400 intervals of 100 seconds each."

FOLLOW-UP WORK

Traffic matrices: balancing measurements, inference and modeling

2005 · Proceedings of the 2005 ACM SIGMETRICS international conference on ..., 2005 · 295 citations (GS)

Field-normalised: 241 Semantic Scholar citations place it in the top 5% of Computer Science papers from 2005 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Providing public intradomain traffic matrices to the research community	—	—	—
2	Spatio-temporal compressive sensing and internet traffic matrices	University of Adelaide	Australia	Background
3	Spatiotemporal traffic matrix synthesis	University of Adelaide	Australia	—
4	Robust traffic matrix estimation with imperfect information: Making use of multiple data sources	Georgia Institute of Technology	United States	**Methodology**
5	Estimating latent processes on a network from indirect measurements	Harvard University	United States	Background
6	Traffic matrix estimation: Advanced-Tomogravity method based on a precise gravity model	—	—	**Methodology**
7	Optimal sampling in state space models with applications to network monitoring	University of Michigan	United States	**Methodology**
8	The nature of data center traffic: measurements & analysis	Microsoft, Microsoft Research	United States	**Methodology**
9	Network tomography: A review and recent developments	—	—	**Influential**
10	Deep learning based traffic prediction method for digital twin network	—	—	—
11	Towards traffic matrix prediction with LSTM recurrent neural networks	—	—	**Methodology**
12	Energy savings scheme in radio access networks via compressive sensing-based traffic load prediction	—	—	**Methodology**

No.	Citing paper	Citing institution(s)	Country	S2
13	Spatiotemporal traffic matrix prediction: A deep learning approach with wavelet multi-scale analysis	—	—	—
14	Spatio-temporal Kronecker compressive sensing for traffic matrix recovery	University of Maryland, Baltimore County, Uppsala University	Sweden, United States	Methodology
15	Deep learning-based network traffic prediction for secure backbone networks in internet of vehicles	Chongqing University of Posts and Telecommunications	China	Methodology
16	Towards accurate online traffic matrix estimation in software-defined networks	University of California, Davis, University of Electronic Science and Technology of China	China, United States	Background
17	Understanding multiple days' metro travel demand at aggregate level	—	—	—
18	Traffic and environmental impacts of constructing and operating a BRT service: Case study in Amman, Jordan	—	—	Methodology
19	Modeling internet topology dynamics	Delft University of Technology, University College London, University of Cambridge	Netherlands, United Kingdom	—
20	How can multi-topology routing be used for intradomain traffic engineering?	Simula Research Laboratory	Norway	Background
21	Short-term origin-destination demand forecasting in bus rapid transit based on dual attentive multi-scale convolutional network	—	—	—
22	The observer effect in computer networks	Hebrew University of Jerusalem	Israel	—
23	A compressive sensing-based network tomography approach to estimating origin–destination flow traffic in large-scale backbone networks	—	—	Methodology
24	Traffic matrix prediction with attention-based recurrent neural network	Sun Yat-sen University	China	Methodology
25	An efficient process for estimation of network demand for QoS-aware IP network planning	Kingston and St George's University, Sheffield Emergency Care Forum, University of Bath	United Kingdom	Methodology
26	Compressive sensing of internet traffic matrices using CUR decomposition	—	—	—
27	A compressive sensing-based approach to end-to-end network traffic reconstruction utilising partial measured origin-destination flows	—	—	Methodology
28	A reconstructing approach to end-to-end network traffic based on multifractal wavelet model	—	—	—

No.	Citing paper	Citing institution(s)	Country	S2
29	Role of correspondence analysis in network traffic flow analysis	—	—	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 Robust traffic matrix estimation with imperfect information: Making use of multiple data sources

"(2)The work [14] studies the similar problem but uses different approach to take advantage of the flow measurement data."

METHODOLOGY Traffic matrix estimation: Advanced-Tomogravity method based on a precise gravity model

"9, we find the SRE of Advanced-Tomogravity is remarkably smaller than the other one's."

METHODOLOGY Optimal sampling in state space models with applications to network monitoring

"This model (4) works well in practice [21] possibly because the misspecification in the conditional distribution of X(t) given X(t−1) is small."

METHODOLOGY The nature of data center traffic: measurements & analysis

"Will the familiar inference methods to obtain tra�c matrices in the Internet Servic e Provider (ISP) networks extend to data centers [20, 32 , 34, 35]? If they do, the barrier to understand the tra�c characteristic s of datacenters will be lowered from the detailed instrumentation that we have done here to analyzing the more easily available SNMP link counters."

METHODOLOGY Towards traffic matrix prediction with LSTM recurrent neural networks

"At fi rst, simple statistical models like Gaussian or Poisson distributions were widely used to solve TM prediction and estimation problem [3]."

FOLLOW-UP WORK

Traffic matrix tracking using kalman filters

2005 · ACM SIGMETRICS Performance Evaluation Review 33 (3), 24-31, 2005 · 96 citations (GS)

Field-normalised: 85 Semantic Scholar citations place it in the top 10% of Computer Science papers from 2005 indexed by Semantic Scholar, by citation count.

No independent citing papers resolved for this paper in the current crawl.

Contribution 2

Claim — Contribution 2

The researcher developed a foundational framework for network anomaly detection by integrating filtering and statistical methods, subsequently extending this approach to address specific challenges in traffic analysis and backbone networks.

The researcher established a significant contribution to network security by publishing a seminal paper in 2005 that combined filtering and statistical methods for anomaly detection. This core work serves as the foundation for a sustained line of inquiry into identifying irregularities in complex network environments.

This line of work appears to address the limitations of isolated detection techniques by proposing a hybrid approach. The subsequent publications from 2009 suggest the researcher expanded this framework to tackle specific implementation challenges, such as applying Principal Component Analysis to traffic data and utilizing association rules for anomaly extraction in backbone networks. This progression indicates a methodical refinement of the initial theoretical model into practical, domain-specific solutions.

The impact of this research is evidenced by the substantial citation counts for both the core paper and its follow-ups. Furthermore, the high degree of citation independence, with over 94% of citations originating from independent researchers, suggests that this work has been widely adopted and validated by the broader academic community as a reliable standard in the field.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 76 · **7 flagged influential by Semantic Scholar**

CORE PAPER

Combining filtering and statistical methods for anomaly detection

2005 · Proceedings of the 5th ACM SIGCOMM conference on Internet Measurement, 31-31, 2005 · 457 citations (GS)

Field-normalised: 367 Semantic Scholar citations place it in the top 5% of Computer Science papers from 2005 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	A Survey on Internet Traffic Identification	Ericsson Research, Federal University of Campina Grande, Federal University of Pernambuco	Brazil, Hungary	Methodology
2	Anomaly detection: A survey	—	—	—
3	Opprentice: Towards practical and automatic anomaly detection through machine learning	Baidu, Tsinghua University	China	Methodology
4	Anomaly-based intrusion detection systems: The requirements, methods, measurements, and datasets	—	—	Methodology
5	Detection and identification of network anomalies using sketch subspaces	University of Southern California	United States	Methodology
6	Latent representation learning for attributed graph anomaly detection	China University of Mining and Technology	China	—
7	Rapid detection of maintenance induced changes in service performance	The University of Texas at Austin	United States	Methodology
8	Extracting hidden anomalies using sketch and non gaussian multiresolution statistical detection procedures	National Institute of Informatics	Japan	Methodology
9	Anomaly detection approaches for communication networks	Kingston and St George's University, Sheffield Emergency Care Forum, University of Bath	United Kingdom	Methodology
10	Detection and quantification of anomalies in communication networks based on LSTM-ARIMA combined model	—	—	Methodology
11	Machine learning applications in misuse and anomaly detection	—	—	Methodology
12	Shadow configuration as a network management primitive	Yale University	United States	Background
13	Generic outlier detection in multi-armed bandit	University of Illinois at Urbana-Champaign	United States	Background
14	Machine learning applications in misuse and anomaly detection	—	—	Methodology
15	The need for simulation in evaluating anomaly detectors	Princeton University, University of Adelaide	Australia, United States	Methodology
16	A simple method for unsupervised anomaly detection: An application to Web time series data	—	—	—

No.	Citing paper	Citing institution(s)	Country	S2
17	Hunting attacks in the dark: clustering and correlation analysis for unsupervised anomaly detection	—	—	**Methodology**
18	Analysis and detection of fake views in online video services	The Chinese University of Hong Kong	China	—
19	Janus: A Dual-Mask Attention Transformer for Log-based Anomaly Detection in Cellular Networks	Purdue University	United States	—
20	Toward fast and accurate emergency cases detection in BSNs	—	—	—
21	A wavelet-based nonparametric CUSUM control chart for autocorrelated processes with applications to network surveillance	—	—	Background
22	The risk-utility tradeoff for IP address truncation	—	—	—
23	DeepFlow: A deep learning framework for software-defined measurement	University of Southern California	United States	Background
24	Stealthy attacks on smart grid PMU state estimation	TU Wien	Austria	**Methodology**
25	Malicious Overtones: Hunting data theft in the frequency domain with one-class learning	—	—	**Methodology**
26	Fake view analytics in online video services	The Chinese University of Hong Kong	China	—
27	Introductory Chapter: Machine Learning in Misuse and Anomaly	—	—	—
28	Visual comparison of network anomaly detectors with chord diagrams	—	—	**Methodology**
29	Cooperative security management for broadband network environments	—	—	**Methodology**
30	Efficient failure prediction in autonomic networks based on trend and frequency analysis of anomalous patterns	—	—	Background

Showing the 30 most-cited of 36 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 A Survey on Internet Traffic Identification

"While focusing on anomaly detection (not application iden-ti fi cation), Soule et al [66] use Origin-Destination fl ows to generate a traf fi c matrix and compare four tests (the last two new proposals) to detect anomalies, namely, threshold, deviation score, wavelet transform and generalized..."

METHODOLOGY Opprentice: Towards practical and automatic anomaly detection through machine learning

"Fortunately, the KPI data, nowadays, are easy to obtain [1, 4, 9, 12, 14, 17, 26]."

METHODOLOGY Detection and identification of network anomalies using sketch subspaces

"More recently, these approaches have been extended to operate on flow measurements using wavelets [1] or Kalman filters [10]."

METHODOLOGY Rapid detection of maintenance induced changes in service performance

"Note that the use of multiscale analysis in [31] is different from ours; they use it to reduce false positives by ensuring that an anomaly is captured at all timescales."

METHODOLOGY Extracting hidden anomalies using sketch and non gaussian multiresolution statistical detection procedures

"from past observations, (using, for instance, Holt-Winters forecasting [5, 13, 24], or Kalman filtering [22]) or direct observation [8]."

FOLLOW-UP WORK

Applying PCA for traffic anomaly detection: Problems and solutions

2009 · IEEE INFOCOM 2009, 2866-2870, 2009 · 248 citations (GS)

Field-normalised: 175 Semantic Scholar citations place it in the top 5% of Computer Science papers from 2009 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	Rapid detection of maintenance induced changes in service performance	The University of Texas at Austin	United States	Methodology
2	Orchestrating the development lifecycle of machine learning-based IoT applications: A taxonomy and survey	Cardiff University, The University of Sydney, University of Leeds	Australia, United Kingdom	—
3	Discovering spatio-temporal causal interactions in traffic data streams	Microsoft Research Asia, University of Science and Technology of China, University of Sydney	Australia, China	Methodology
4	Dimensionality reduction using principal component analysis for network intrusion detection	—	—	—
5	Robust traffic anomaly detection with principal component pursuit	University of Luxembourg	Luxembourg	—
6	Networkmetrics: multivariate big data analysis in the context of the internet	—	—	Background
7	Privacy-preserving distributed network troubleshooting—bridging the gap between theory and practice	ETH Zurich	Switzerland	Methodology
8	An artificial intelligence-based real-time monitoring framework for time series	—	—	—
9	Efficient and effective automated surveillance agents using kernel tricks	—	—	—
10	Round-Trip time anomaly detection	—	—	—
11	Three novel simple beamforming algorithms for CDMA communication systems	—	—	—

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 Rapid detection of maintenance induced changes in service performance

"[3] further showed that the sensitivities come from the lack of capturing temporal correlations and proposed to use Karhunen-Loeve Transform to improve robustness of PCA."

METHODOLOGY Privacy-preserving distributed network troubleshooting—bridging the gap between theory and practice

"The computation of the entropy of feature distributions has been successfully applied in network anomaly detection [Lakhina et al. 2005; Brauckhoff et al. 2009b; Li et al. 2006; Tellenbach et al. 2011]."

FOLLOW-UP WORK

Anomaly extraction in backbone networks using association rules

2009 · Proceedings of the 9th ACM SIGCOMM conference on Internet measurement, 28-34, 2009 · 216 citations (GS)

Field-normalised: 139 Semantic Scholar citations place it in the top 5% of Computer Science papers from 2009 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	A survey of itemset mining	Ho Chi Minh City University of Science, Ho Chi Minh City University of Technology	Vietnam	—
2	Opprentice: Towards practical and automatic anomaly detection through machine learning	Baidu, Tsinghua University	China	**Methodology**
3	Hunting attacks in the dark: clustering and correlation analysis for unsupervised anomaly detection	—	—	**Influential**
4	Visual comparison of network anomaly detectors with chord diagrams	—	—	**Methodology**
5	Privacy-preserving distributed network troubleshooting—bridging the gap between theory and practice	ETH Zurich	Switzerland	**Methodology**
6	Event labeling combining ensemble detectors and background knowledge	INESC TEC	Portugal	Background
7	Beehive: Large-scale log analysis for detecting suspicious activity in enterprise networks	—	—	Background
8	MAWILab: Combining diverse anomaly detectors for automated anomaly labeling and performance benchmarking	—	—	**Methodology**
9	Disclosure: detecting botnet command and control servers through large-scale netflow analysis	Northeastern University, UC Santa Barbara	United States	**Methodology**
10	Decaf: Diagnosing and triaging performance issues in large-scale cloud services	Amazon, Microsoft, Microsoft Research	United States	Background
11	Flowchronicle: synthetic network flow generation through pattern set mining	Helmholtz Center for Information Security	Germany	—
12	Sketching linear classifiers over data streams	Stanford University	United States	**Methodology**
13	What happened in my network: mining network events from router syslogs	—	—	**Methodology**
14	Classifying internet one-way traffic	ETH Zurich	Switzerland	**Methodology**
15	Anomaly localization for network data streams with graph joint sparse PCA	—	—	Background
16	Secure cyber incident analytics framework using Monte Carlo simulations for financial cybersecurity insurance in cloud computing	—	—	**Methodology**
17	Listen to me if you can: tracking user experience of mobile network on social media	—	—	**Methodology**

No.	Citing paper	Citing institution(s)	Country	S2
18	A Hough-transform-based anomaly detector with an adaptive time interval	National Institute of Informatics	Japan	Background
19	Novel intrusion prediction mechanism based on honeypot log similarity	—	—	Methodology
20	Online adaptive anomaly detection for augmented network flows	—	—	Methodology
21	Automating root-cause analysis of network anomalies using frequent itemset mining	ETH Zurich	Switzerland	Methodology
22	Flow-oriented detection of low-rate denial of service attacks	—	—	—
23	Temporally oblivious anomaly detection on large networks using functional peers	—	—	—
24	Crossroads: A practical data sketching solution for mining intersection of streams	—	—	Methodology
25	Flooding attacks detection in backbone traffic using power divergence	—	—	Methodology
26	Characterizing network traffic behaviour using granule-based association rule mining	—	—	Methodology
27	Multidimensional data mining for anomaly extraction	—	—	—
28	Discovering anomaly on the basis of flow estimation of alert feature distribution	—	—	—
29	A hybrid association rule mining approach for characterizing network traffic behaviour	—	—	—

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 Opprentice: Towards practical and automatic anomaly detection through machine learning

"(b) Some work uses ROC curves to evaluate the performance of different detectors regardless of their thresholds [9, 14, 26]."

METHODOLOGY Visual comparison of network anomaly detectors with chord diagrams

"Identifying anomalous events is a crucial network task relying on statistical methods such as wavelet [1], Kalman filters [15], hash projection [3, 5, 10], Principal Component Analysis (PCA) [9,13], pattern recognition [8]."

METHODOLOGY Privacy-preserving distributed network troubleshooting—bridging the gap between theory and practice

"The computation of the entropy of feature distributions has been successfully applied in network anomaly detection [Lakhina et al. 2005; Brauckhoff et al. 2009b; Li et al. 2006; Tellenbach et al. 2011]."

METHODOLOGY MAWILab: Combining diverse anomaly detectors for automated anomaly labeling and performance benchmarking

"The goal of this inspection is to assess that each community is a group of related alarms standing for the traffic with common features; this is a similar goal to the dominant state analysis presented in [35], or the association rule mining of [8]."

METHODOLOGY Disclosure: detecting botnet command and control servers through large-scale netflow analysis

"While some of the works proposed anomaly detection methods to detect specific kinds of malware such as worms [34] or spamming botnets [28], others tried to propose more general approaches to distinguish malicious traffic from benign traffic [8,13,30]."

Contribution 3

Claim — Contribution 3

The researcher developed foundational Hidden Markov Modeling techniques for network communication channels, establishing a methodological framework for analyzing complex network traffic patterns.

The researcher's core contribution rests on the 2001 paper 'Hidden markov modeling for network communication channels,' which appears to introduce probabilistic modeling techniques to the study of network communications. This work serves as the foundation for a sustained line of inquiry into network analysis methodologies.

This line of work appears to address the challenge of characterizing network behavior through statistical models. The subsequent 2004 paper, 'Flow classification by histograms: or how to go on safari in the internet,' suggests an evolution from theoretical channel modeling to practical flow classification, indicating a broadening of the researcher's methodological toolkit to include histogram-based analysis for internet traffic.

The significance of this work is evidenced by the core paper's 169 citations and the follow-up's 91 citations. With 94.2% of citing papers originating from independent researchers, the work demonstrates substantial adoption and influence within the broader academic community, extending well beyond the researcher's immediate circle.

INDEPENDENT CITATIONS FOR THIS CONTRIBUTION: 13 **· 1 flagged influential by Semantic Scholar**

CORE PAPER

Hidden markov modeling for network communication channels

2001 · ACM SIGMETRICS Performance Evaluation Review 29 (1), 92-101, 2001 · 169 citations (GS)

Field-normalised: 140 Semantic Scholar citations place it in the top 10% of Computer Science papers from 2001 indexed by Semantic Scholar, by citation count.

No.	Citing paper	Citing institution(s)	Country	S2
1	M&M: Multi-level Markov model for wireless link simulations	—	—	Methodology
2	Statistical detection of intruders within computer networks using scan statistics	—	—	—
3	Improving wireless link simulation using multilevel markov models	—	—	Methodology
4	Packet loss concealment by interpolation for speech over IP network services	—	—	—
5	Performance issues of multimedia applications	—	—	Methodology
6	Rigorous statistical analysis of internet loss measurements	The University of Adelaide	Australia	—
7	Predicting packet loss statistics with hidden Markov models	Universidade Federal do Rio de Janeiro	Brazil	—
8	Modeling of temporal dependence in packet loss using universal modeling concepts	University of Southern California	United States	Methodology
9	Modeling the short-term dynamics of packet losses	—	—	Influential
10	An adaptive FEC algorithm using hidden Markov chains	University of Massachusetts, Amherst	United States	—
11	Forward error correction concealment method for celp-based coders in packet networks	—	—	Background

No.	Citing paper	Citing institution(s)	Country	S2
12	The use of FEC method for packet loss concealment for CELP based coders in packet networks	—	—	—
13	A comparison of packet loss concealment and control for voice transmission over IP network services	—	—	Background

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 M&M: Multi-level Markov model for wireless link simulations

"In [24], HMMs were proposed for modeling packet reception traces and choosing a model based on the likelihood criterion."

METHODOLOGY Improving wireless link simulation using multilevel markov models

"…on Sensor Networks, Vol. 10, No. 1, Article 17, Publication date: November 2013. conducted on a 12-node test bed, using the proposed approach, there was a 10% difference between measured and predicted throughput capacity in contrast to a 50% difference in more traditional simulation models."

METHODOLOGY Performance issues of multimedia applications

"Salamatian and Vaton [61] propose the use of Hidden Markov models (HMM) to model the loss sequence in the Internet, due to their capability to represent dependencies in the observed process."

METHODOLOGY Modeling of temporal dependence in packet loss using universal modeling concepts

"In [14] the authors have used hidden Markov models (HMM) for modeling the temporal dependence in packet loss."

FOLLOW-UP WORK

Flow classification by histograms: or how to go on safari in the internet

2004 · Proceedings of the joint international conference on Measurement and …, 2004 · 91 citations (GS)

Field-normalised: 69 Semantic Scholar citations place it in the top 10% of Computer Science papers from 2004 indexed by Semantic Scholar, by citation count.

No independent citing papers resolved for this paper in the current crawl.

D. Citing-Institution Prestige & Geography

Top citing institutions

Institution	Country	World ranking	Citing papers
Boston University	United States	SCImago #272 · THE =76 · QS =88	7
Stanford University	United States	SCImago #18 · THE =5 · QS 3	7
University of Bath	United Kingdom	SCImago #1061 · THE 251–300 · QS =132	6
Tsinghua University	China	SCImago #8 · THE 12 · QS =17	6
University of Lincoln	United Kingdom	SCImago #3036 · THE 601–800 · QS 801-850	6
University of Adelaide	Australia	SCImago #652	6
Princeton University	United States	SCImago #386 · THE =3 · QS =25	6
Kingston and St George's University	United Kingdom	—	6

Institution	Country	World ranking	Citing papers
Sheffield Emergency Care Forum	United Kingdom	—	6
Yorkshire Ambulance Service NHS Trust	United Kingdom	—	6
University of Sheffield	United Kingdom	SCImago #526 · THE =108 · QS 92	6
Carnegie Mellon University	United States	SCImago #266 · THE 24 · QS 52	5
ETH Zurich	Switzerland	THE 11 · QS 7	5
University of Southern California	United States	SCImago #192 · THE =73 · QS 146	5
Georgia Institute of Technology	United States	SCImago #270 · THE =41 · QS =123	5

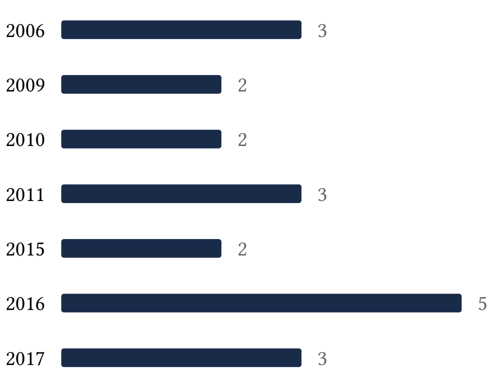
Geographic distribution of citing authors

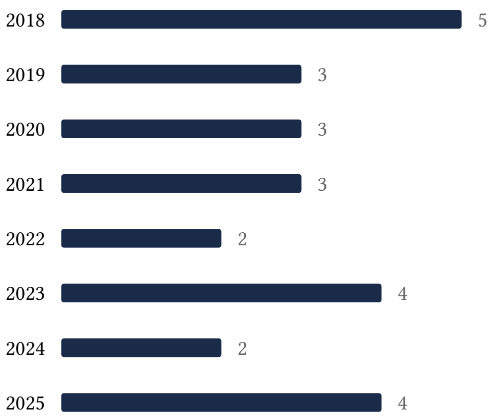
Country	Citing papers
United States	90
China	25
Australia	18
United Kingdom	18
Italy	14
Canada	11
Switzerland	8
France	7
Spain	6
Sweden	5
Germany	5
Brazil	3

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.

E. Citation Growth Over Time

Distinct citing papers by publication year. Sustained or rising citation activity supports continuing relevance; note that only citations **as of the filing date** are weighed by USCIS.





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	Traffic matrix estimation: Existing techniques and new directions	97	Dhanasar — Prong 2 (well-positioned)
Contribution 2	Combining filtering and statistical methods for anomaly detection	76	Dhanasar — Prong 2 (well-positioned)
Contribution 3	Hidden markov modeling for network communication channels	13	Dhanasar — Prong 2 (well-positioned)