

The RIPE Atlas Measurements Patterns Analysis tool (by the AI4NetMon project)

Pavlos Sermpezis

AI4NetMon project (<https://ai4netmon.csd.auth.gr/>)

Data & Web Science Laboratory (Datalab), <https://datalab.csd.auth.gr/>
Computer Science Dept., Aristotle University of Thessaloniki



AI4NetMon project: dataset, code, API, Web app

- AI4NetMon project <https://ai4netmon.csd.auth.gr/>
 - You can find all the information about the project!



- **RIPE Atlas Measurements Patterns Analysis tool**
<https://ai4netmon.csd.auth.gr/atlas-app/>



- **Web app** <https://app-ai4netmon.csd.auth.gr/>
- **API** <https://ai4netmon.csd.auth.gr/api/>
- **Code & Data @ GitHub** <https://github.com/sermpezis/ai4netmon/>
- **Paper @ TMA'23** <https://arxiv.org/abs/2307.09958>



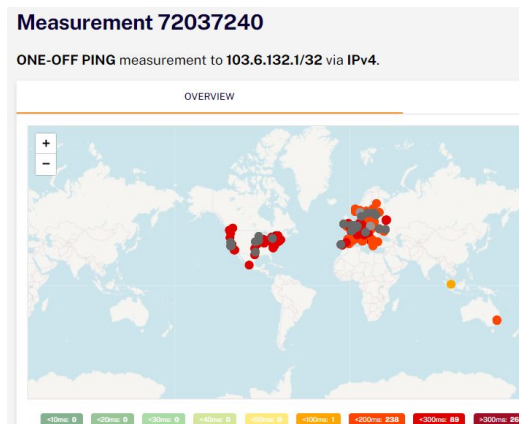
The tool... in a nutshell

- ***AI4NetMon's RIPE Atlas Measurements Patterns Analysis tool***
... or just ***"The tool"*** (for brevity in this presentation)
- Goal: Analyze patterns in a set of measurements
- Bias & generic patterns
- Complementary to RIPE Atlas UI



The tool... vs. RIPE Atlas UI

- RIPE Atlas UI presents (very nicely!) the **result** of **one measurement**



Search Results

DOWNLOAD RESULTS

Probe	ASN	Country	Time (UTC)	Min RTT	Packet Loss
114	2607	SK	2024-05-20 12:39:35	306.798 ms	0.00%
144	12637	IT	2024-05-20 12:39:36	148.379 ms	0.00%
410	29518	SE	2024-05-20 12:39:34	164.758 ms	0.00%
417	15954	ES	2024-05-20 12:39:37	137.296 ms	0.00%
430	16353	GB	2024-05-20 12:39:37	157.081 ms	0.00%
558	12628	GB	2024-05-20 12:39:34	143.234 ms	0.00%

- The AI4NetMon's tool presents data about the **set of probes (not the results)** in **a set of measurements**

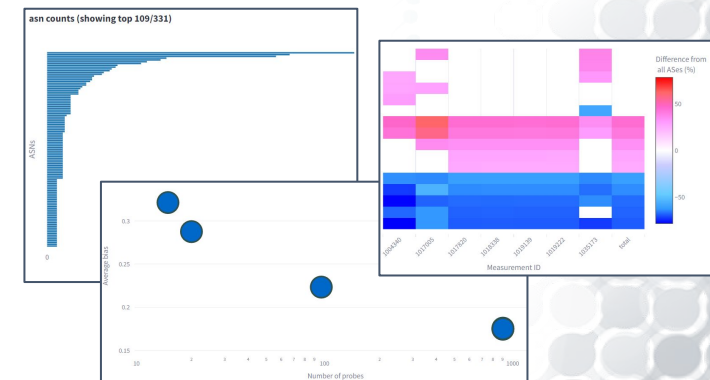


The tool... in a nutshell

- **The user** provides a set of RIPE Atlas measurement IDs
 - e.g., “1018338, 1004340, 1017820, 1019139, 1017005”
- **The tool (in the backend)** retrieves information about the measurements (RIPE Atlas API, AI4NetMon API) and performs analyses
- **The tool (through its UI)** presents a set of visualizations with the characteristics and patterns of measurements

Please enter a set of RIPE Atlas measurement(s) IDs:

1018338, 1004340, 1017820, 1019139, 1017005, ...





The tool... in a nutshell

- General statistics of measurements
 - Top most frequent ASNs and probes
 - Number of probes and ASNs used per measurement
- Bias analysis of measurements
 - Bias comparison: Measurements (average) vs random sample of probes
 - Number of probes vs Avg Bias per measurement
 - Bias Causes
 - CDF of Bias per Bias dimension
 - Data details

The tool... in action

Table of contents

- [RIPE Atlas Measurements Patterns Analysis](#)
- [General statistics of measurements](#)
 - [Top most frequent ASNs and probes](#)
 - [Number of probes and ASNs used per measurement](#)
- [Bias analysis of measurements](#)
 - [Bias comparison: Measurements \(average\) vs random sample of probes](#)
 - [Number of probes vs Avg Bias per measurement](#)
 - [Bias Causes](#)
 - [CDF of Bias per Bias dimension](#)
 - [Data details](#)

About

This dashboard was created within the context of the [AI4NetMon](#) project: a project dedicated to helping users discover bias aspects in Internet measurement platforms, their own measurements as well as providing them with recommendations on fixing them.

RIPE Atlas Measurements Patterns Analysis

Hi! 🎉 Welcome to our interactive Streamlit dashboard for analyzing RIPE Atlas measurements! 📊

In this dashboard you are able to see an analysis of your RIPE Atlas measurements. More specifically, you can see things such as the top most frequent ASNs and probes in your measurements, how your measurements' bias compares to the bias of random samples of probes (👉 which, by the way, have the lowest bias possible!), the causes of bias in your measurements and more!

In addition, you can interact with your data via our various widgets! 🛠️

To begin, you can simply input the measurement IDs of your measurements separated by commas in the box below. We have already provided an example case for you below! ✅

📄 Please enter a set of RIPE Atlas measurement(s) IDs:

1018338, 1004340, 1017820, 1019139, 1017005, 1019222, 1007976, 1035173, 1010732, 1036065

General statistics of measurements

Top most frequent ASNs and probes

👉 In this section you can see the top most frequent ASNs and Probe IDs in your measurements. You can select if you want to display their frequencies or counts. You can also select the top most frequent ASNs and probes you want to display and also download them as `.csv` files. Give it a go!

Select type of data you want to see

- Counts
- Frequencies

Probe ID counts sorted by count

📄 Please select the top most frequent probes you want to see



Probe ID counts data

probe_id	count
2706	6
3099	6
3091	6

Deploy

The tool... in action

Top most frequent ASNs and probes

👉 In this section you can see the top most frequent ASNs and Probe IDs in your measurements. You can select if you want to display their frequencies or counts. You can also select the top most frequent ASNs and probes you want to display and also download them as .csv files. Give it a go!

Select type of data you want to see

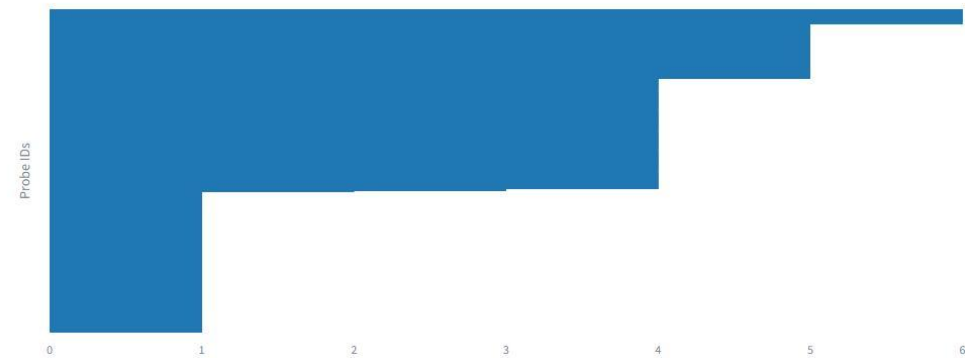
- Counts
 Frequencies

Probe ID counts sorted by count

📄 Please select the top most frequent probes you want to see



probe_id counts (showing top 1616/1616)



Probe ID counts data

probe_id	count
2706	6
3099	6
3091	6
2863	6
2470	6
2977	6
2221	6
3247	6
3239	6
2071	6

📄 Download data as .csv

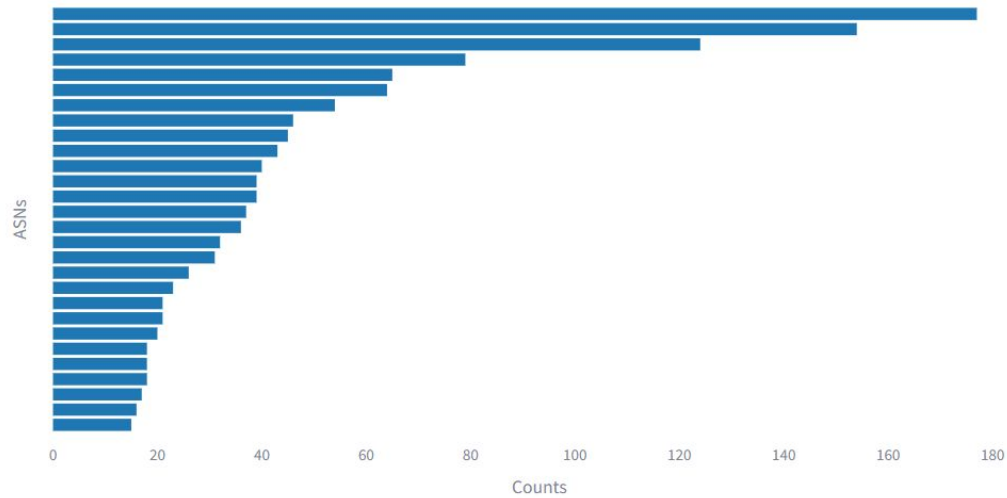
The tool... in action

ASN counts sorted by count

Please select the top most frequent ASNs you want to see



asn counts (showing top 28/642)



ASN counts data

asn	count
7922	177
3320	154
9	124
12322	79
3333	65
20712	64
3265	54
3215	46
6830	45
13030	43

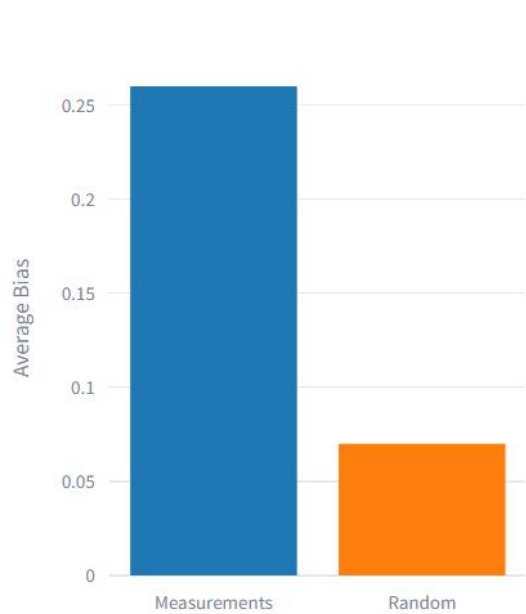
Download data as .csv

The tool... in action

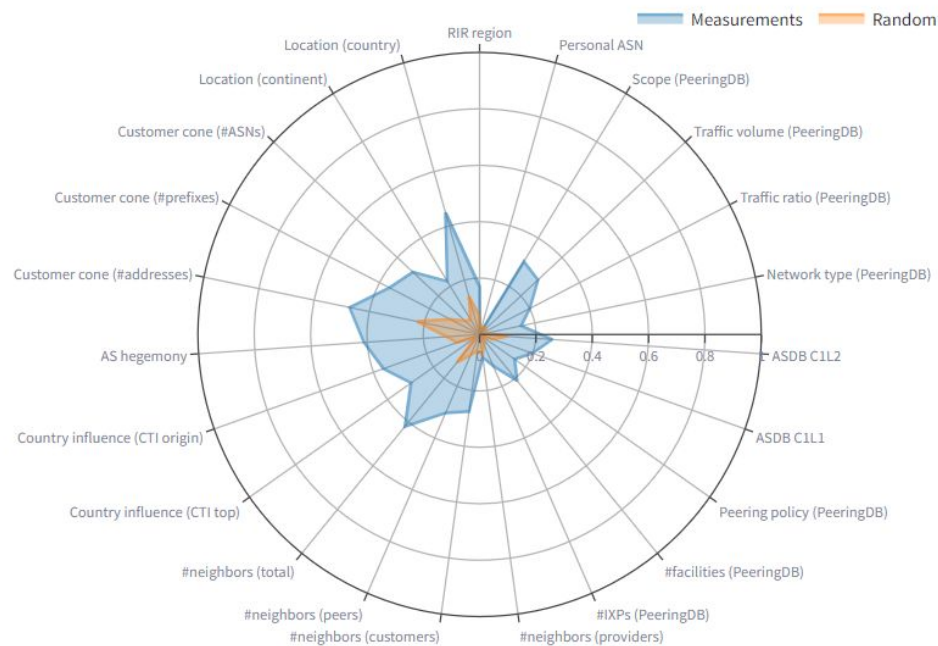
Bias analysis of measurements

Bias comparison: Measurements (average) vs random sample of probes

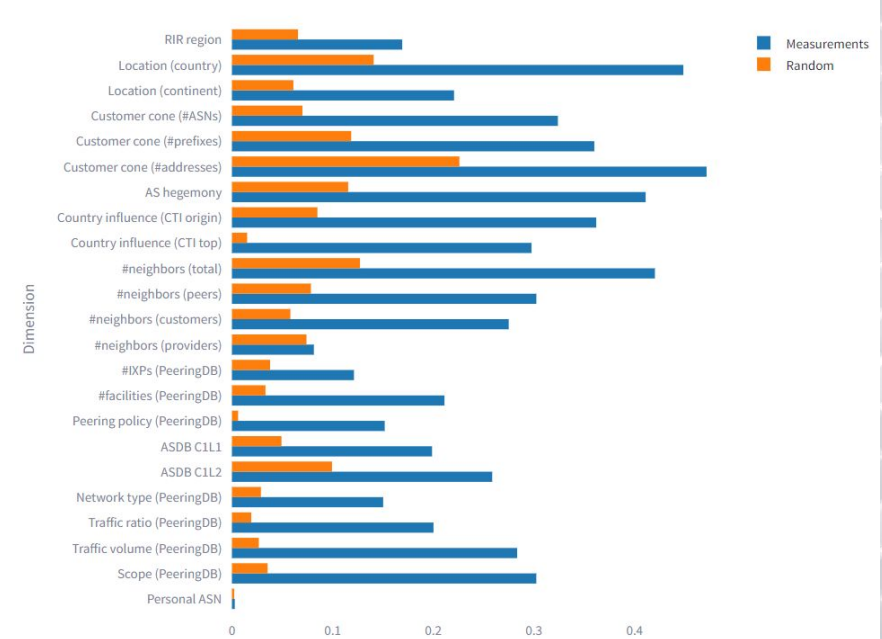
Average Bias per sample



Age Bias Distribution for Measurements and Random sample



Avg Bias per Dimension

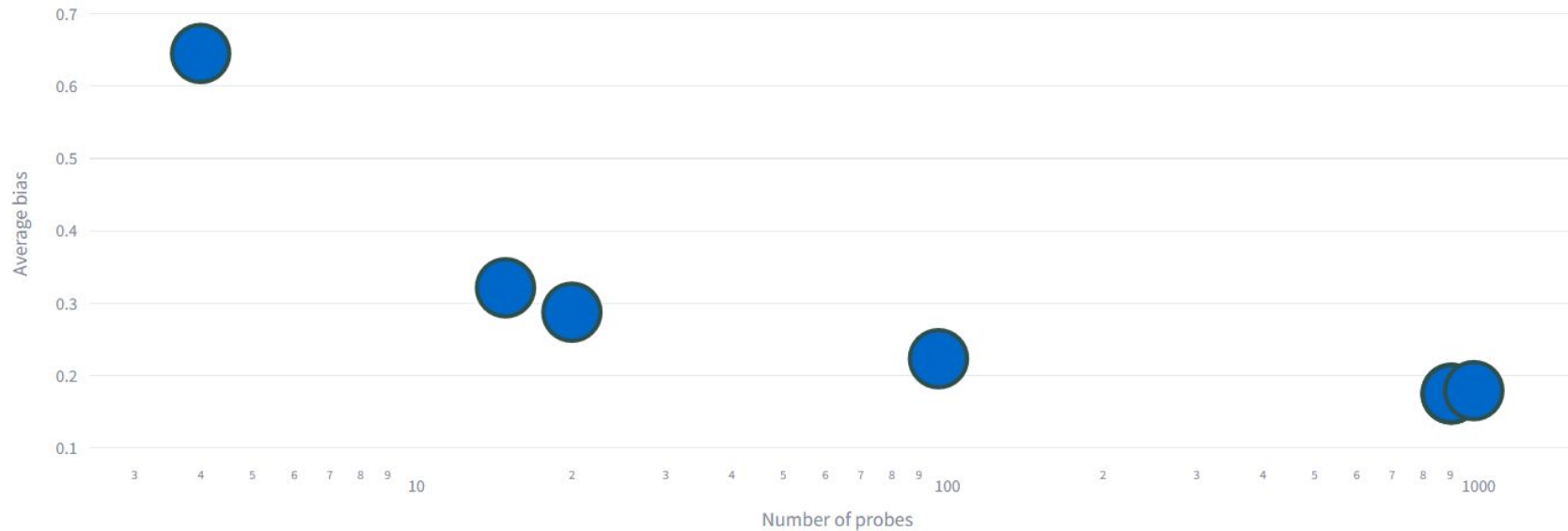


The tool... in action

Number of probes vs Avg Bias per measurement

👉 Below you can see a scatter plot, showing you the average bias per measurement vs its number of probes. Each dot in the plot represents one of your measurements.

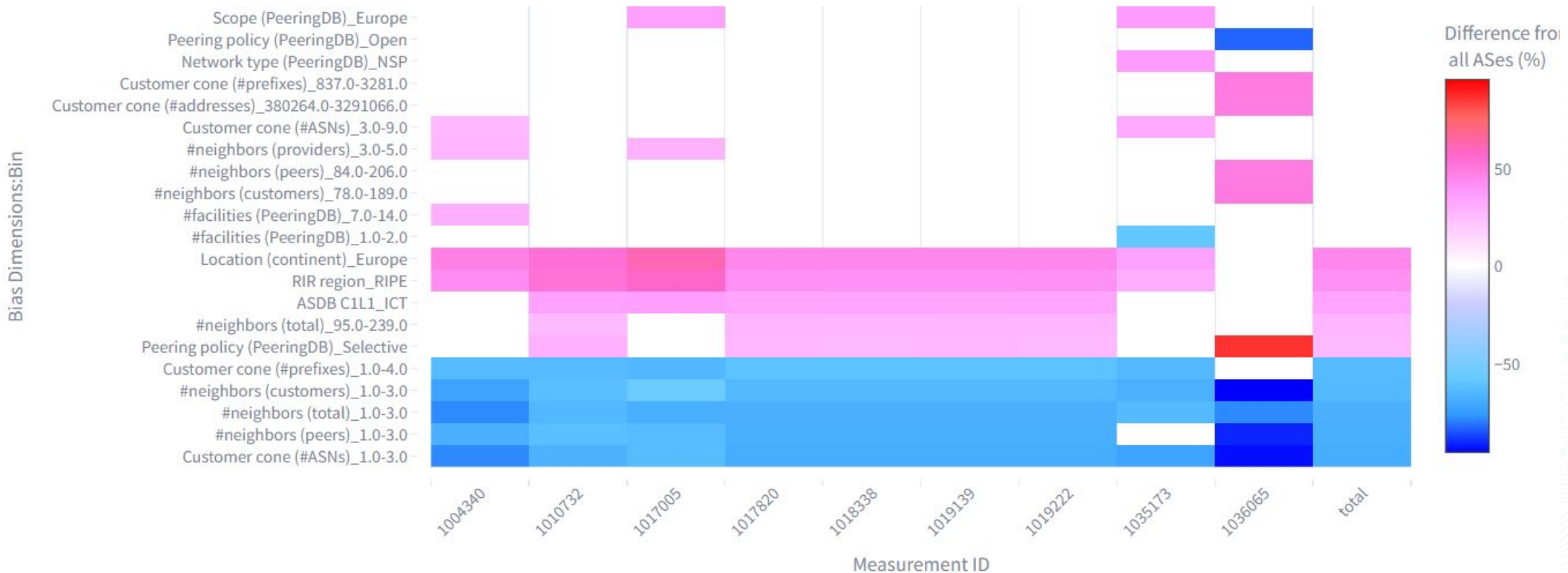
Number of probes vs Average bias for each measurement





The tool... in action

Bias causes for each measurement and all measurements





Summarizing...

- Contribution: An online tool to explore characteristics and patterns in RIPE Atlas measurements
 - AI4Netmon website <https://ai4netmon.csd.auth.gr/>
 - Online tool <https://ai4netmon.csd.auth.gr/atlas-app/>
- Who & Why to use it? → network operators & researchers
 - easily get deeper view your own measurements (reporting, recommendations, bias insights, etc.)
 - identify patterns in measurements of others (e.g., learn best practices).
 - analyze usage patterns in RIPE Atlas measurements at scale
- We want your feedback & ideas for extra functionality!





Our questions for you ... give us your feedback!

- **Reporting** for your measurements?
 - would it be useful for you?
 - what info would you like to see?
 - how to provide results (e.g.,html, pdf, json, csv)?
- **User Interface**
 - what other visualizations to include?
 - feedback on current visualizations
- **Best practices** analysis
 - How to select past measurements to analyze?
e.g., all measurements from country X to CDN networks?
 - What info / patterns to look at? (e.g., number of probes)



<https://forms.gle/aTR8WZh8kYia8zfX6>





BACKUP SLIDES



Biases of Internet Measurement Platforms are known

Example 1 - Location bias:

RIPE Atlas has more probes in Europe

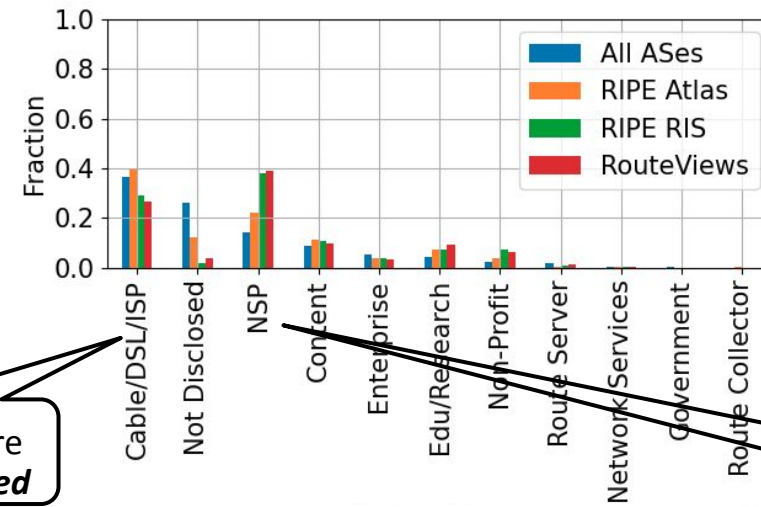


RIPE Atlas probes

<https://atlas.ripe.net/results/maps/network-coverage/>

Example 2 - Network type bias:

Peers of **RIPE RIS** and **RouteViews** do not equally represent all network types

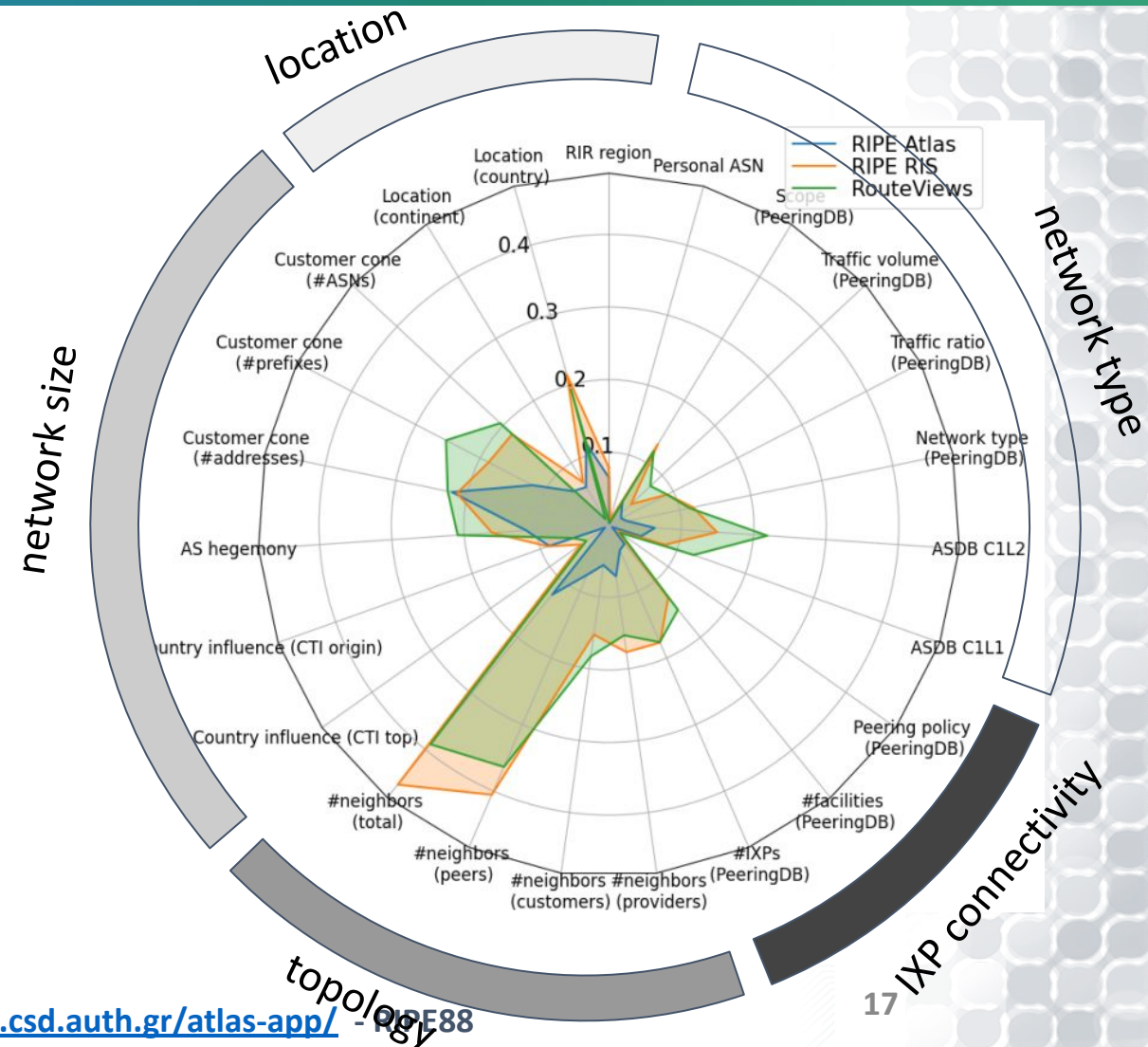


Cable/DSL/ISP are **under-represented**

NSPs are **over-represented**

Quantifying bias

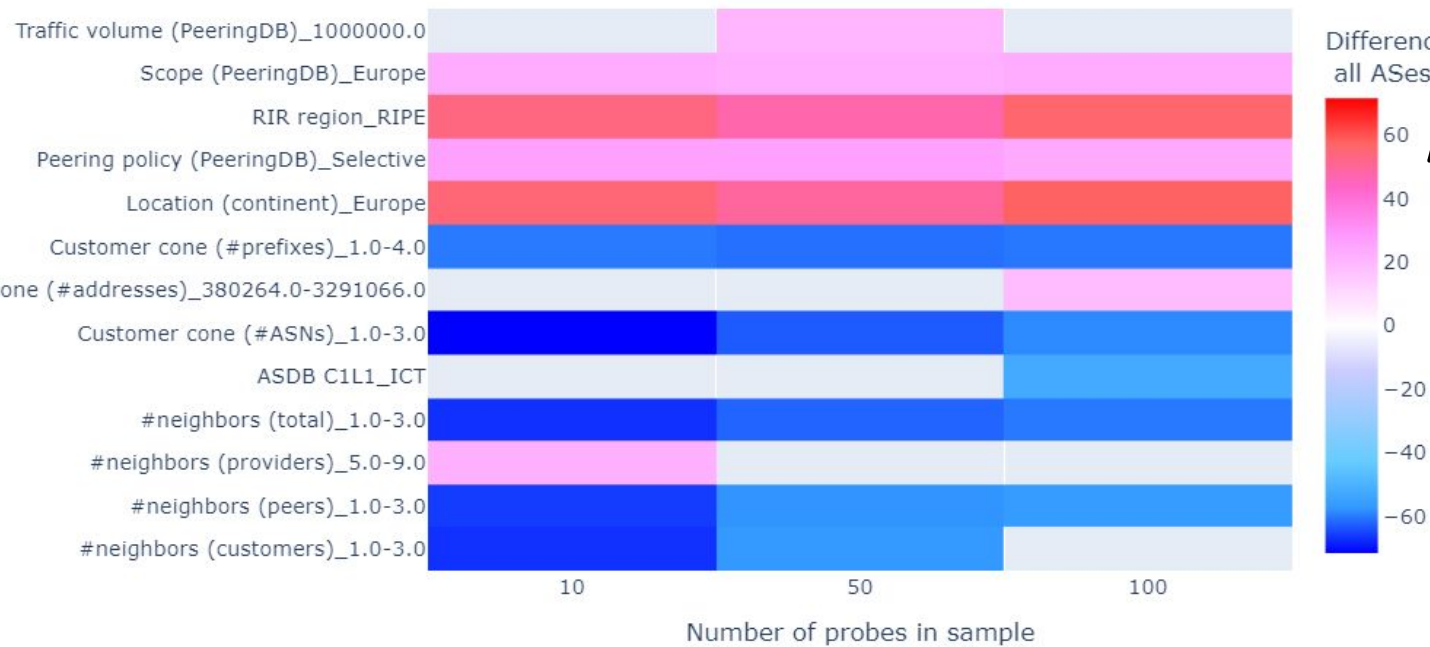
- Many dimensions of bias
 - *location, network size, topology, IXP connectivity, network type, etc.*
- Bias score per dimension
 - **Bias score:** a value between 0 (low bias) and 1 (high bias)
- Radar plot of bias
 - each radius → a bias dimension
 - colored lines/areas → bias score
 - high bias → far from center





Use case: analyzing random sets of Atlas measurements

Bias causes for samples with different numbers of probes



Users tend to *prefer*:

1. Medium/well-connected ASes with mostly providers as neighbours.
2. Medium/larger ASes.
3. European ASes.
4. ASes with Selective Peering Policy

Bias reduction recommendations

- Employ random sampling for the selection of their measurements' probes.
- Use more probes for their measurements.
- Use probes that lie in smaller, less connected ASes with Open Peering Policies.