



AI4NetMon Web app: A tool to explore & reduce biases in Internet Measurements

Sofia Kostoglou

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

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



Biases of Internet Measurement Platforms are known

Example 1 - Location bias:

RIPE Atlas has more probes in Europe

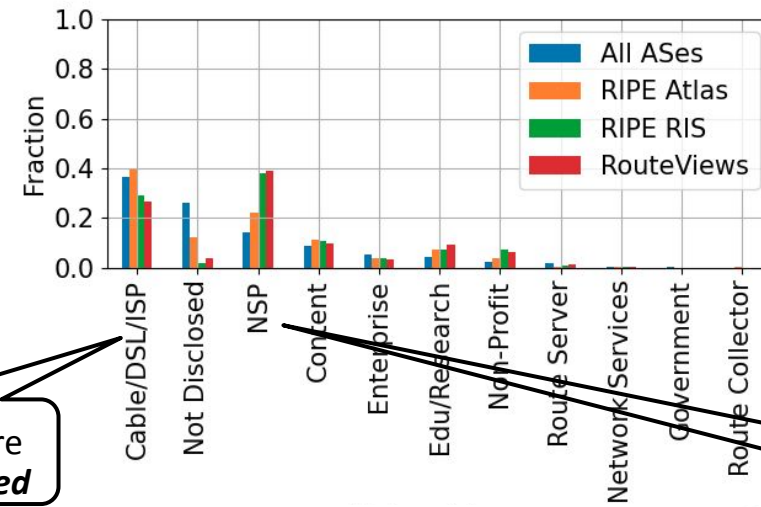


RIPE Atlas probes

<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

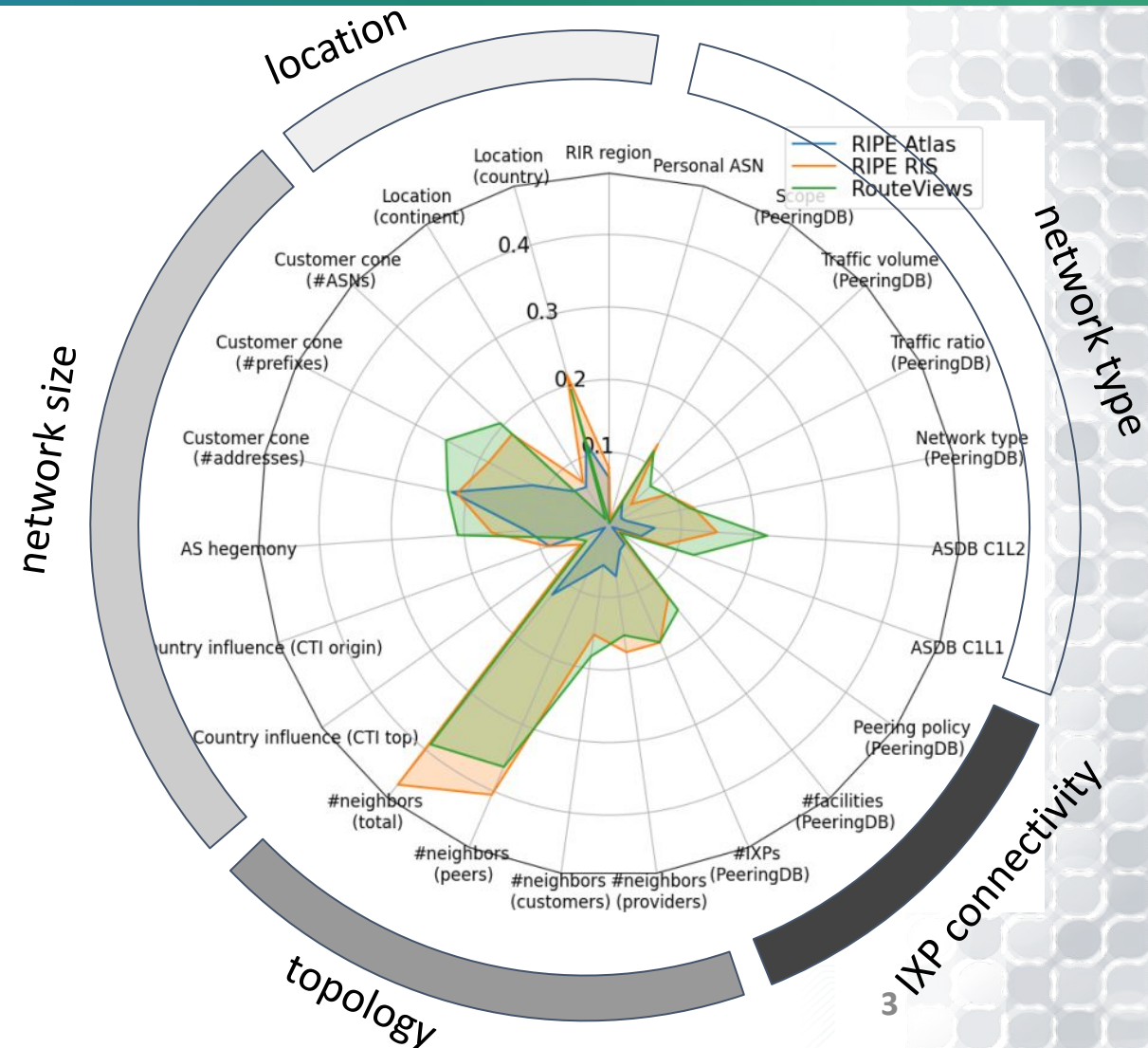


Cable/DSL/ISP are **under-represented**

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





AI4NetMon project: dataset, code, API, Web app

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



- Code & Data @ GitHub <https://github.com/sermpezis/ai4netmon/>

- API <https://ai4netmon.csd.auth.gr/api/>
 - Documentation @ GitHub

- Paper @ TMA'23 <https://arxiv.org/abs/2307.09958>

- **Web app** <https://app-ai4netmon.csd.auth.gr/>





Web App (1): Explore biases at a glance...

- Give a set of vantage points (ASNs), or select a platform, ...
- ... and directly see if the set is biased (i.e., representative or not) through charts



Web App (1): Explore biases at a glance...

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Select a custom set of vantage points. In the boxes below, add a list of ASNs/Probe IDs (only numbers, separated with commas, no spaces; e.g., 174,1299,3333)

Select the type of list of numbers ASNs probe IDs

Custom Set #1 (ASNs)

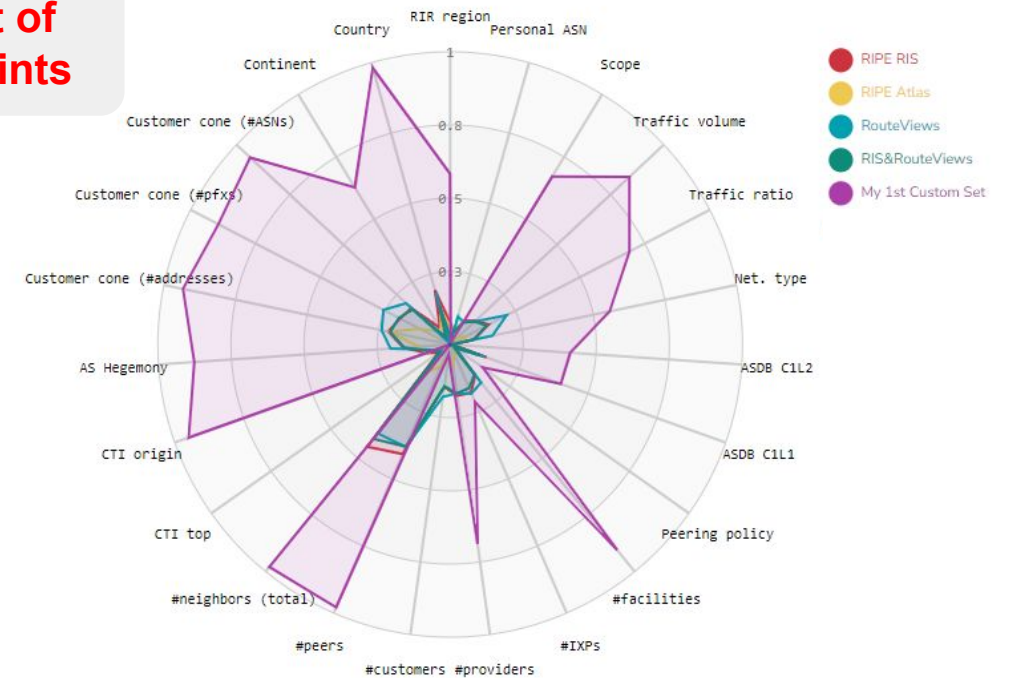
Custom Set #2 (ASNs)

Custom Set #3 (ASNs)

Monitor sets RIPE RIS RIPE Atlas RouteViews RIS&RouteViews My 1st Custom Set My 2nd Custom Set My 3rd Custom Set

Bias dimensions RIR region Country Continent Customer cone (#ASNs) Customer cone (#pfxs) Customer cone (#addresses) AS Hegemony CTI origin CTI top #neighbors (total) #peers #customers #providers #IXPs #facilities Peering policy ASDB C1L1 ASDB C1L2 Net. type Traffic ratio Traffic volume Scope Personal ASN

Custom set of vantage points





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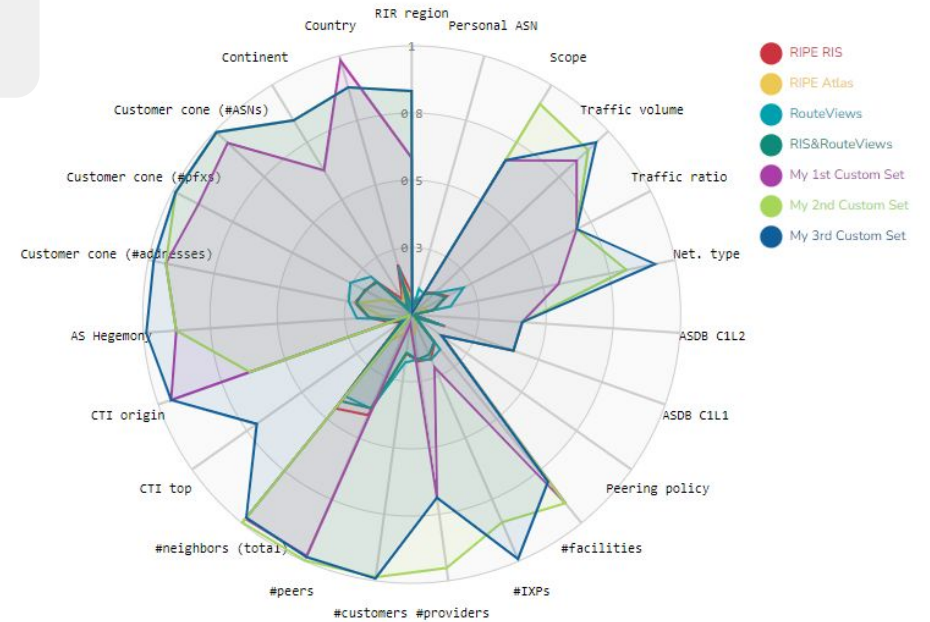
Custom Set #2 (ASNs)

Custom Set #3 (ASNs)

...up to 3 custom sets of vantage points

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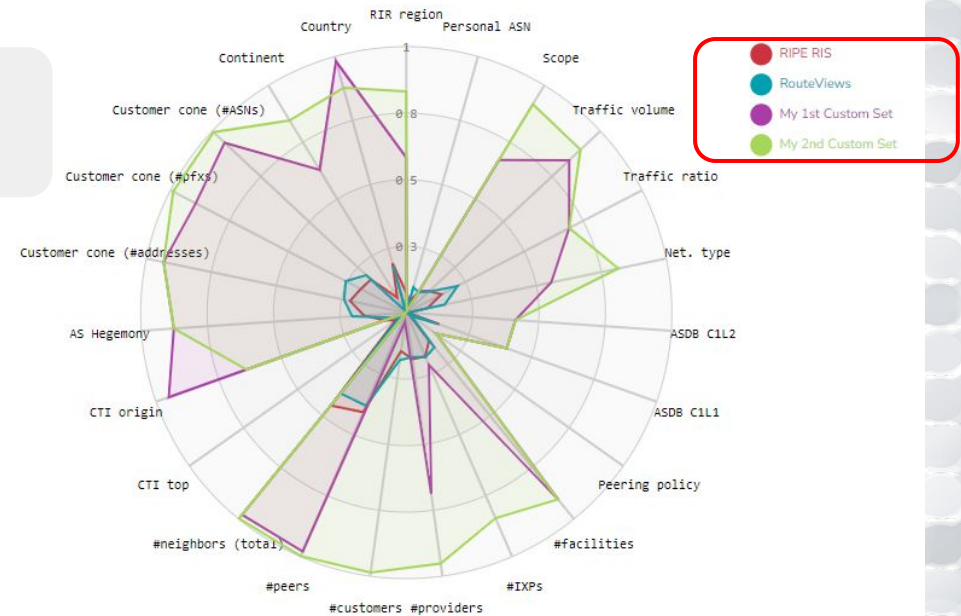
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select sets to show in the radar-plot





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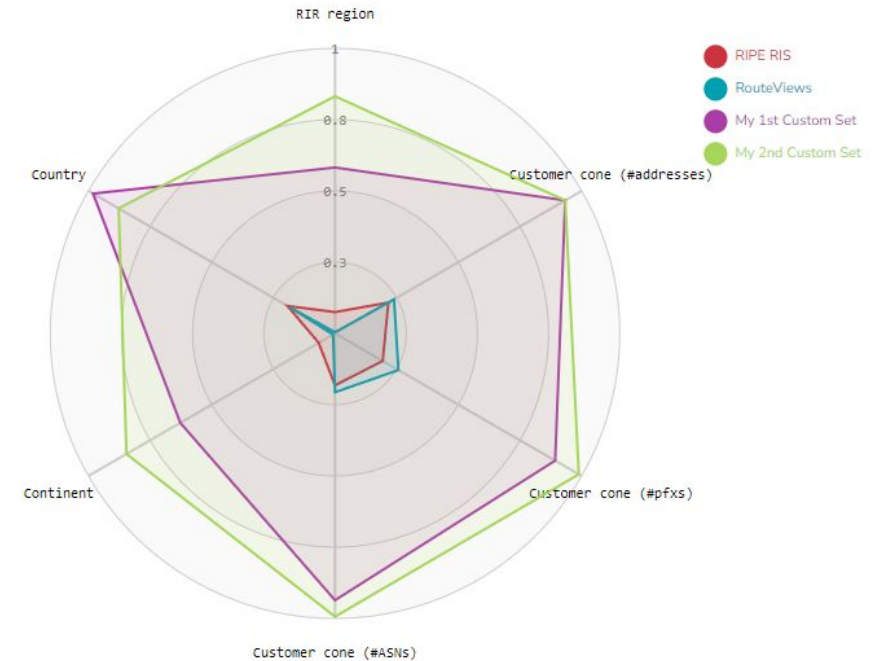
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keep only subset of bias dimensions





Web App (2): But...why does this bias exist?

- Find out more details about distributions for all characteristics (or “dimensions”)...
- ... and understand why sets are not representative for each dimension!

Web App (2): But...why does this bias exist?

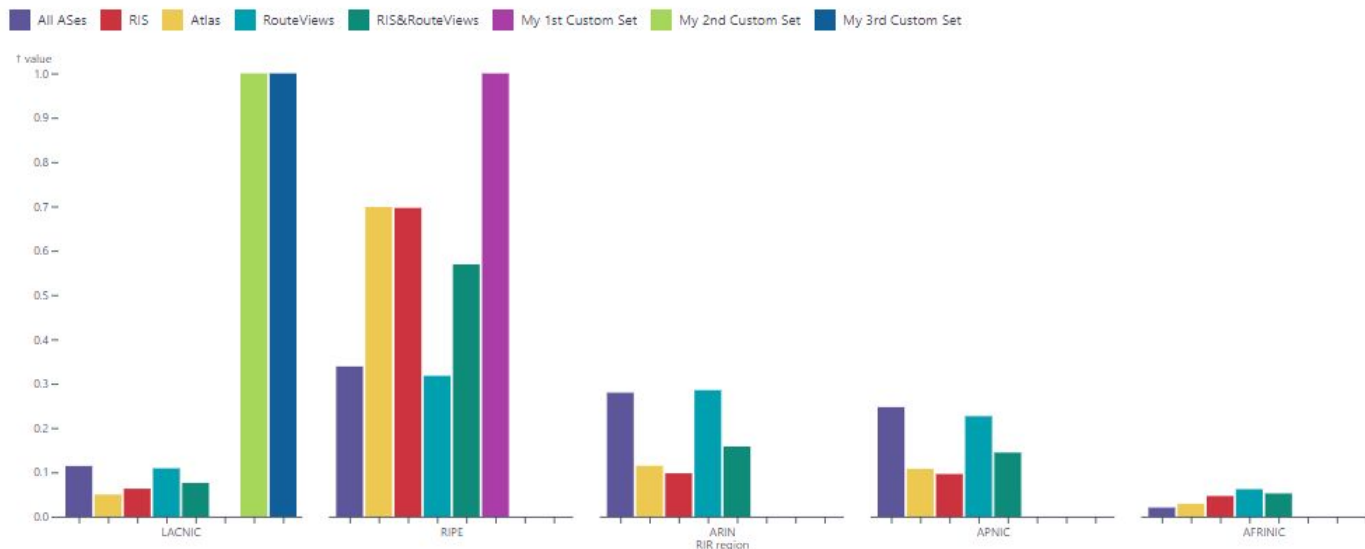
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! ! Bias = difference in “population” (All ASes) and “sample” distributions (monitors sets).

Bias dimensions

check distribution per bias dimension





Web App (2): But...why does this bias exist?

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Dive deeper into bias “causes”: for all different values of each dimension, shed light into the relative change of distributions

Vantage point set: My 1st Custom Set

Filter by: Bias Dimension, Value or Difference

Search: 199 results

Bias Dimension	Value	Difference %
Customer cone (#ASNs)	1.0-3.0	-93.836
Customer cone (#ASNs)	3.0-9.0	96.274
Location (continent)	North America	-30.224
Location (continent)	Europe	70.523

different value-bins for num values (points to 3.0-9.0)

different values for categ values (points to Europe)



Web App (3): Recommendations for unbiasing measurements

- Find the most important “causes” of bias to understand which networks affect bias
- Get recommendations for adding extra vantage points in your measurements



Web App (3): Recommendations for unbiasing measurements

- Available at <https://app-ai4netmon.csd.auth.gr/>



Check the largest and smallest percentage difference in the bias causes

Greatest Positive Difference %

The characteristic **Traffic ratio (PeeringDB)** with value **Not Disclosed** is the most **overrepresented** in the selected set, by a percentage of **30.31 %**

Greatest Negative Difference %

The characteristic **#neighbors (peers)** with value **1.0-3.0** is the most **underrepresented** in the selected set, by a percentage of **-81.2564 %**



Web App (4): Detailed pages for Route Collector & RIPE Atlas

- Check all the bias analysis and tools, especially for route collectors and Atlas probes

Web App (4): Detailed pages for Route Collectors measurements

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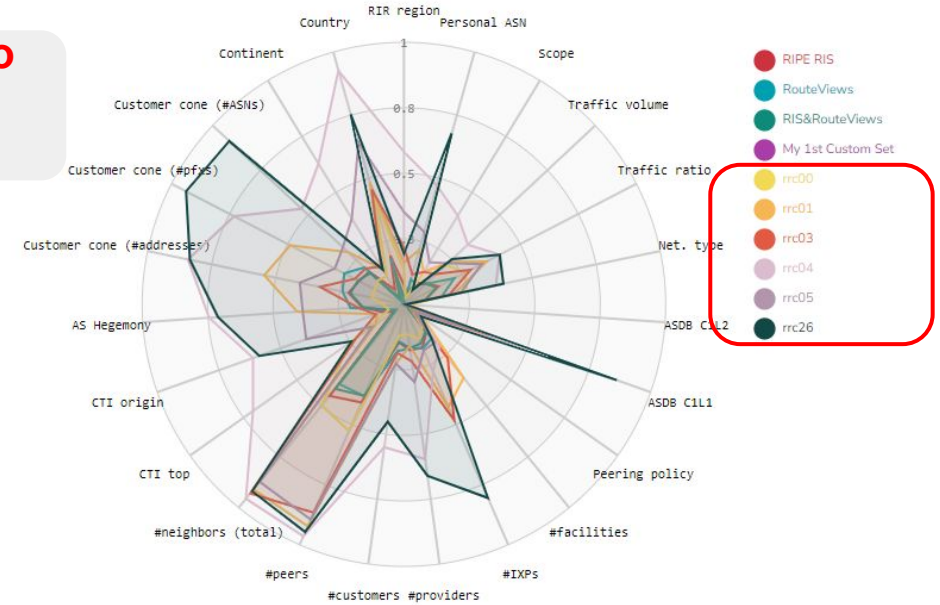
Custom Set #1 (ASNs)

Custom Set #2 (ASNs)

Custom Set #3 (ASNs)

select RRCs to show and compare

- Monitor sets
- RIPE RIS RouteViews RIS&RouteViews My 1st Custom Set My 2nd Custom Set My 3rd Custom Set rrc00 rrc01 rrc03
 - rrc04 rrc05 rrc06 rrc07 rrc10 rrc11 rrc12 rrc13 rrc15 rrc16 rrc18 rrc20 rrc21 rrc22
 - rrc23 rrc24 rrc25 rrc26
- Bias dimensions
- RIR region Country Continent Customer cone (#ASNs) Customer cone (#pfxs) Customer cone (#addresses) AS Hegemony
 - CTI origin CTI top #neighbors (total) #peers #customers #providers #IXPs #facilities Peering policy ASDB C1L1
 - ASDB C1L2 Net. type Traffic ratio Traffic volume Scope Personal ASN



Web App (4): Detailed pages for RIPE Atlas measurements

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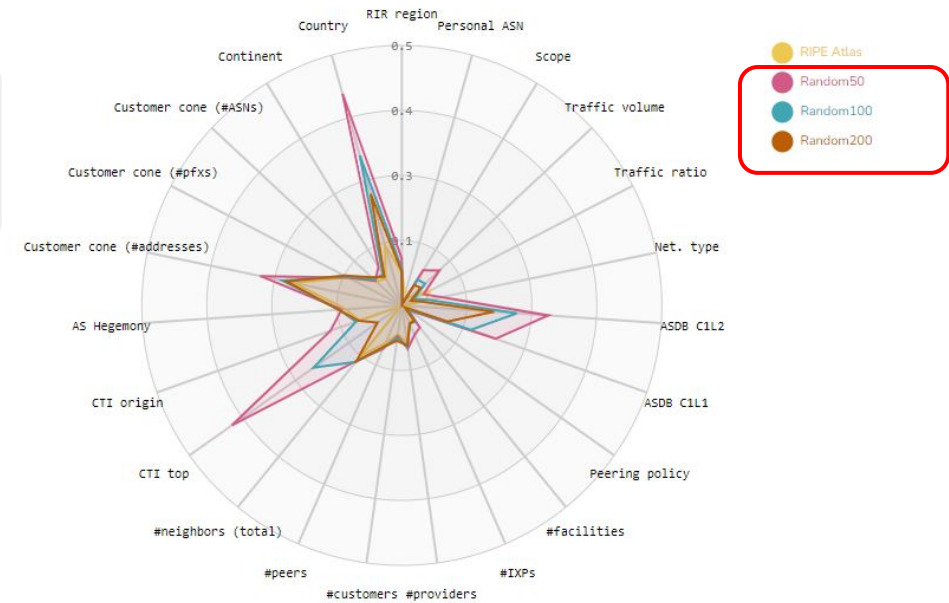
Custom Set #2 (ASNs)

Custom Set #3 (ASNs)

Monitor sets RIPE Atlas Random50 Random100 Random200 My 1st Custom Set My 2nd Custom Set My 3rd Custom Set

Bias dimensions RIR region Country Continent Customer cone (#ASNs) Customer cone (#pfxs) Customer cone (#addresses) AS Hegemony CTI origin CTI top #neighbors (total) #peers #customers #providers #IXPs #facilities Peering policy ASDB C1L1 ASDB C1L2 Net. type Traffic ratio Traffic volume Scope Personal ASN

select sets of random sampled Atlas probes





Summarizing...

- Our contributions
 - A web app to explore, understand, and mitigate bias
 - Website <https://ai4netmon.csd.auth.gr/>
 - Web app <https://app-ai4netmon.csd.auth.gr/>
- What next?
 - Use our Web app → tell us your experience / feedback
 - Ideas for extra functionality
 - Use cases: We need data to improve our unbiasing methods
 - Explore & mitigate bias in ML models based on measurements data

