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INDES & DIANA – Web Tracking prevention and user discrimination on the Web

Position type: Post-doctoral Fellow
Functional area : Sophia-Antipolis
Research field: Networks, Systems and Services, Distributed Computing
Project-team: INDES & DIANA

About Inria and the job

Inria, the French National Institute for computer science and applied mathematics, promotes "scientific excellence for technology transfer and society". Graduates from the world's top universities, Inria's 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

Work environment

INDES and DIANA are among 35 project-teams of INRIA Sophia Antipolis, a research center located in the south of France. INDES team works on security and programming languages for web applications, while DIANA's focus is on service transparency and open network architecture.

INDES website: https://team.inria.fr/indes/
DIANA website: https://team.inria.fr/diana/

Assignment

Context: "User discrimination on the Web: measurement, causation and prevention"

User discrimination is a strategy to provide personalized content to the user based on her profile. For example, price discrimination is a strategy to sell the same good at different prices optimized according to the buyer's profiles. Many e-commerce web sites such as hotel booking [1] or general retailers [2] have recently employed this technique. Typically, a buyer with higher revenues (inferred, for instance, from the brand of the computer she is using) or higher interests

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(inferred from her previous browsing history) will be proposed a higher price or her search results would be steered towards pricier products. Another example is a targeted advertisement, where user gets personalized ads based on her interests and profile. Recently, researchers have found that females get fewer ads with high paying jobs [3]. More generally, '*user discrimination*' is any strategy exploiting a user's profile to provide tailored content that ranges from price and search discrimination to targeted advertisement. Such discrimination might be acceptable if it is transparent to the users, but it becomes a concern if it is hidden from the users because it requires collection and sharing of users' personal information, which infringes privacy if there is no user consent.

The goal of this project is to protect users' interests and privacy by *measurement, root cause analysis* and *prevention*. First goal is to build a tool and infrastructure that allows users to automatically detect user discrimination. Second goal is to identify the root cause of user discrimination, that is, which information is exploited by the service to discriminate. This will shed light on the kind of profiles that are built on users. Third, based on our understanding of the discrimination techniques, a solution to prevent user discrimination across various sensitive categories will be proposed.

Job description

User discrimination is often implemented using web tracking technologies, hence the first step is to develop solutions against persistent web tracking that is mostly used in e-commerce and targeted advertisement. In particular, the following web tracking techniques must be covered:

- **Cookie and pixel tracking at the protocol level.** The task is to implement a web browser extension that eliminates cookies and 1x1 pixel images from third-party requests without breaking functionality of the websites. The solution should be rigorously tested and should also cover "cookie syncing" when the main site synchronizes cookies with the third parties [4].
- **Cookie stealing via JavaScript.** Often, trackers implement cookie stealing via JavaScript program (e.g., google analytics), where the cookies are transmitted as a parameter of the URL to a remote server [5]. The task is to implement and deploy a JavaScript monitor to prohibit cookie stealing.

The second step is to test and adapt the proposed web tracking protection to decrease user discrimination on the web. For this, the Postdoc will collaborate with another Postdoc in the project (see http://www-sop.inria.fr/members/Nataliia.Bielova/postDoc1.pdf), whose main goal is to identify features used for discrimination.

References
 [1] Measuring Price Discrimination and Steering on E-commerce Web Sites. Aniko Hannak, Gary Soeller, David Lazer, Alan Mislove, and Christo Wilson -IMC, 2014.
[2] Detecting price and search discrimination on the Internet. J. Mikians, L. Gyarmati, V. Erramilli, N. Laoutaris - ACM HotNets, 2012.
[3] Amit Datta, Michael Carl Tschantz, and Anupam Datta. Automated Experiments on Ad Privacy Settngs: A Tale of Opacity, Choice, and Discrimination. Privacy Enhancing Technologies Symposium PETS'15.
[4] Gunes Acar, Chris:an Eubank, Steven Englehardt, Marc Juarez, Arvind Narayanan, Claudia Diaz. The Web Never Forgets: Persistent Tracking Mechanisms in the Wild, ACM CCS'14

[5] Franziska Roesner, Tadayoshi Kohno, and David Wetherall. Detecting and Defending Against Third-Party Tracking on the Web. USENIX Symposium on Networked Systems Design and Implementation (NSDI'12).

Skills and profile

The applicant is required to have defended her Ph.D before January 1st, 2017. If not yet defended, she must mention the scheduled date of defense together with the composition of the jury.

- Excellent knowledge of web application architecture
- Good knowledge of web tracking technologies
- Good level of programming in JavaScript and web browser extensions development
- Background in language-based security is a plus

Advantages

- Scientific Resident card
- Business restaurant on site
- Financial support for transportation expenses
- Social and sport activities, French courses

Outstanding post-doc might have the opportunity to apply for the prestigious starting research position at Inria (http://www.inria.fr/en/institute/recruitment/offers/starting-research-positions/presentation).

Additional Information

- Net Salary per month: around 2120 € (health insurance included)
- Starting date : January 2017
- Duration: 1 year
- Location: Sophia Antipolis

Required documents and sending of the application

Please send your detailed Resume and Covering letter showing your interest and letters of recommendation:

- by email to : nataliia.bielova@inria.fr (Nataliia Bielova – Researcher INDES team)

- Applications will be admitted until the position is filled

Inria's disabilities policy: All positions at the institute are open to disabled people.

Security and defense procedure
In the interests of protecting its scientific and technological assets, Inria is a restricted-access establishment. Consequently, it follows special regulations for welcoming any person who wishes to

work with the institute. The final acceptance of each candidate thus depends on applying this security and defense procedure.

<u>Warning</u>
Applications must be submitted online on the Inria website. Processing applications submitted by other channels is not guaranteed.