iSocial

Shared Content Risk in Social Networks and Access Control

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Online Social Networks

- **Facebook**: More than **1.2b** users currently

  More than **350m** photos uploaded daily.

Success of OSNs due to their **human-centric design:**

- **Users create their digital counterparts**
- **Connect and communicate with others**
- **Create and share their own original content**

Concerns regarding user privacy

- Most users don't care about their privacy
- Access control mechanisms are complicated
- Users are unaware of the **"true visibility"** of **published content.**

However, according to OSN design:

- The **uploader** is considered as **the owner**.
- Users can **control** only **self-disclosed information**.
  - Users **cannot** control **shared content** published by others

Conflict of interests

- The will of the uploader goes against the will of the depicted users.
- The privacy settings of a user are overridden by those of another user.

Scenario: The Sober Tagger

- Alice uploads photo - Bob request removal - Alice does not remove it.

Scenario: The Silent Tagger

- Alice does not tag Bob, thus Bob is never notified about the photo.

Scenario: The Group Photographer

- Bob set the photo as **"private"** – Alice set it as **"public"**
- **18%** allow friends-of-friends, **26%** public [Liu, IMC 11]

Scenario: The Accidental Over-sharer

- Users accidentally over-share content due to complex privacy settings.
- Sharing photos with much larger audience than they intended.
- **63%** of photos - wrong settings, **51%** of them public [Liu, IMC 11]

Scenario: The Friendly Stranger

- Both Alice and Bob set their privacy settings as **"friends".**
- If their social graphs do not overlap, "strangers" can access the photo.

Contributions of this work

- Conduct a user study about the tagging behaviour of the users.
  - Identify the risk users face due to conflicting privacy settings.
- Design a new fine-grained access control mechanism.
  - Enforce **face-level** access control (according to user's access-list).
  - Handles effectively the **conflicting visibility settings** of the users.
  - Can **inter-operate** with the existing access control mechanisms.
- Proof-of-concept application.
  - Demonstrate applicability of the approach within OSN infrastructure.

User study on photo-tagging behaviour

- FB application for collecting user data and photos.
  - **Photos and tags** both from the user and his friends.
  - Friend-list of the users
- Collected data from 128 users
  - About **4m** photos containing **4.6m** tags
- Average number of friends **344**
  - **7% - less than 100 friends**
  - **3% - more than 1000 friends (hubs)**

User study on photo-tagging behaviour

- Each user and his friends as a group
  - Average number of photos per group **31753**
  - **20%** of groups have more than **44700** photos
  - **4%** of groups have more than **100000** photos

  (1 every 3 photos is accidentally public)

- Tags within a photo collection (group)
  - Average: each group has **36102 tags** and **250 tagged users**
  - **20%** of groups have over **340** unique tagged users and over **50k photos**

Silent uploader scenario

Tags - Faces	1	2	3	4	5	6+
Photos (# of Faces)	**15.2%** (304)	**32.5%** (651)	**17.9%** (359)	**10.7%** (214)	**8.3%** (166)	**15.3%** (306)
Photos (# of Tags)	**87.6%** (1753)	**9.9%** (199)	**1.6%** (33)	**0.3%** (7)	**0.25%** (5)	**0.15%** (3)

Total of **7,244** faces → **3.62 faces per photo**

2,331 faces have been tagged → **1.16 tags per photo**

At least 4 depicted faces in 34% of the photos

User study on photo-tagging behaviour

Friendly stranger scenario

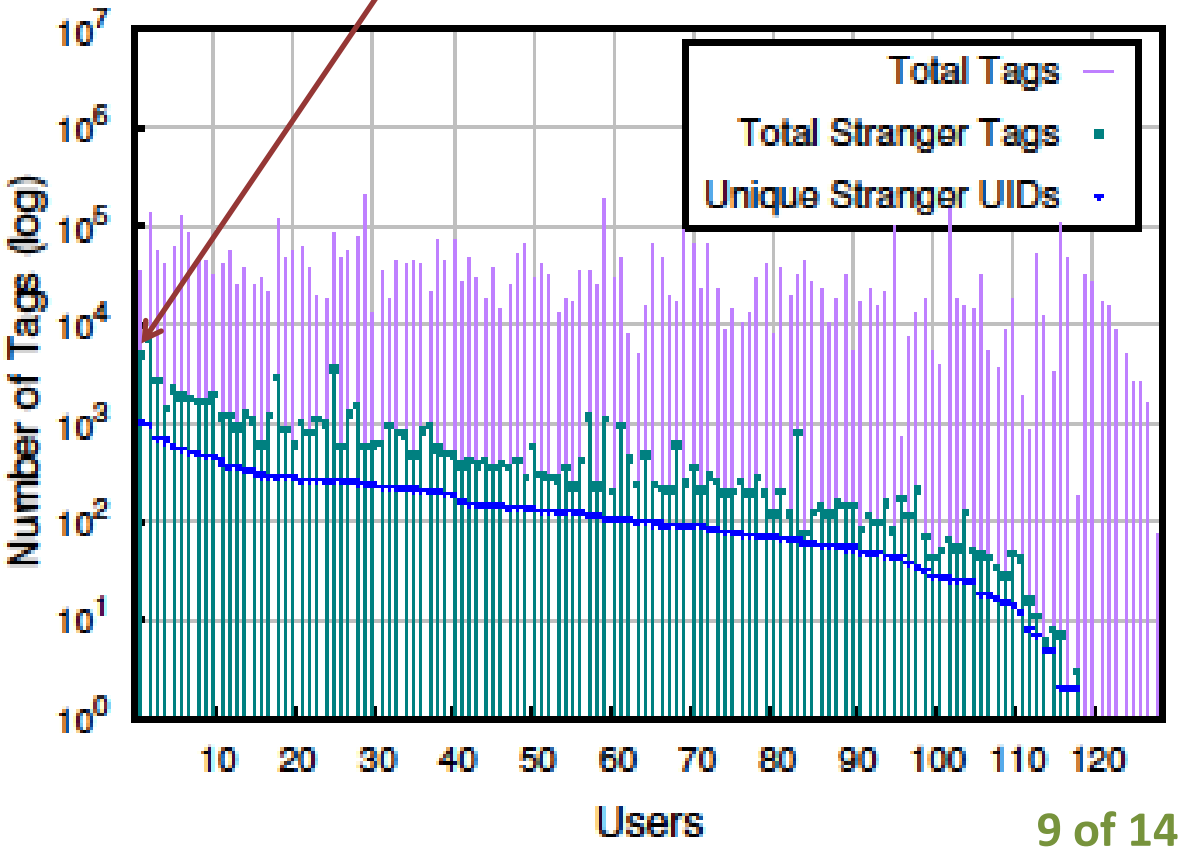
Users as “Adversaries”

Access to photos containing stranger’s information

92% of users have access to photos that contain tag of a stranger (non-friend).

Average: access to **647** photos of **169** different users (strangers)

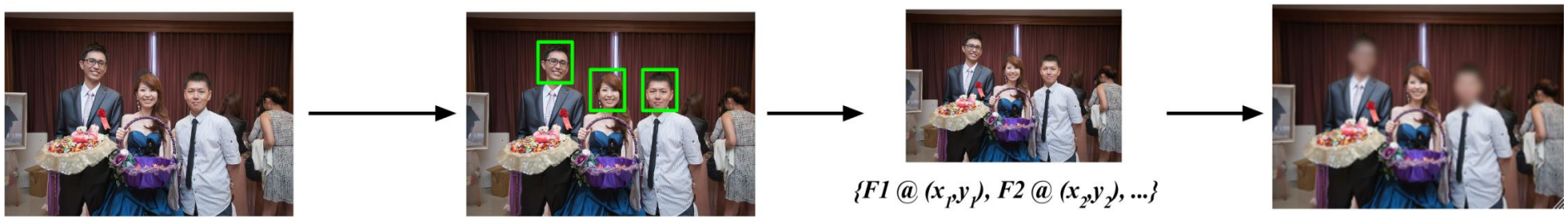
Almost **1900** photos containing **1100** strangers



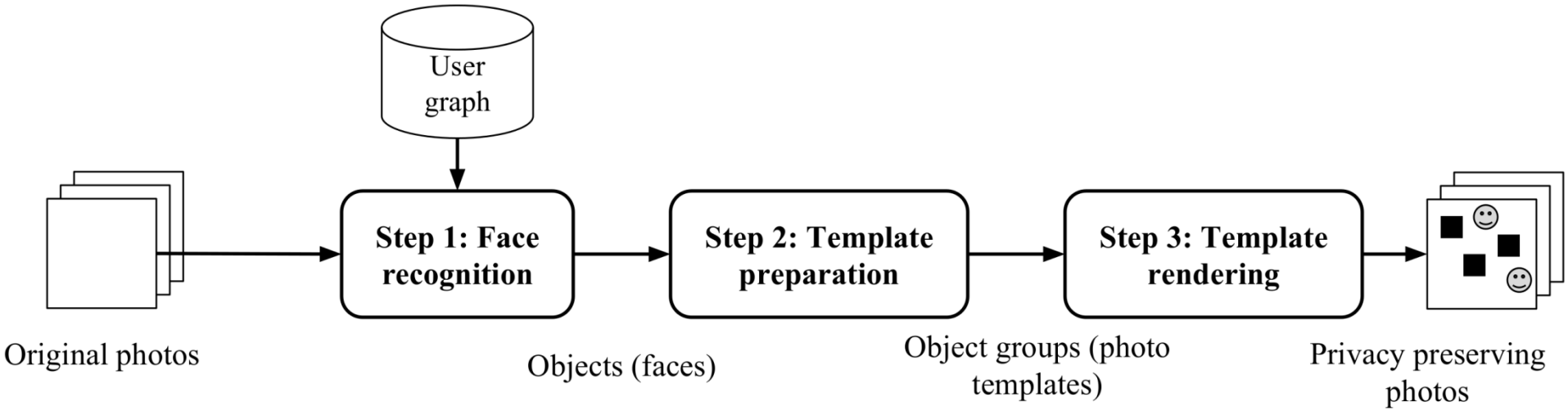
Proposed Access Control Mechanism

- Each user's face is considered as PII.
- **Switches the granularity** of the access control …

  … from the level of a **photo** to that of users' **faces**.
- User's privacy settings are not overridden by others.



Proposed Access Control Mechanism



Step 1: Face Recognition

Step 2: Template Preparation

- Auto-tagging the identified faces - face verification.
- The users are automatically notified to verify the face validity.

Overview of the access control approach

Step 2: Template Preparation (cont)

- Each tagged user defines face-level privacy settings.
- For each tagged face a layer is created (face is hidden/blurred out).
- Photo template consisted from original photo and the created layers.

Step 3: Template Rendering

- Determine in constant time the hidden faces (access control matrix)
- The photo is rendered selectively according to who is viewing it.
- The requested photo is created "**on the fly**".
- Superimposing the required layers, on top of the original photo.

However,

This approach can be used **only on shared photos**

It affects the user experience as the presented photos are modified.

Thus,

- We study new approaches for collaborative access control
- The rules are defined and enforced collectively.
- A more generic model, not only for photos.

Summary

- **Tagged users affect the visibility** of the photos

Conflict of interests

- The will of the uploader goes against the will of the depicted users.
- The privacy settings of a user are overridden by those of another user.

We propose a new fine-grained access control mechanism.

- Enforce **face-level** access control (according to user's access-list).
- Handles effectively the **conflicting visibility settings** of the users.
- Can **inter-operate** with the existing access control mechanisms of SNs.

Previous work

- Survey on user behaviour, ownership and privacy issues. **[Besmer, SOUPS 08]**
- A "negotiation" mechanism. Out-of-band request to the uploader to hide the photo.
- Does not effectively solve conflict of interests. **[Besmer, SIGCHI 10]**

Rule-based access control

- Users annotate photos with custom descriptive tags. AC rules according to these tags.
- Access control on photo-level . **[Klemperer, SIGCHI 12]**

Rule-based mechanism / similar to recommendation systems

- AC policy according to rules. Classifies new photos and predicts an acceptable rule.

[Squicciarini, HT' 11]

Security rules for content-based access control

- Uses the SWRL language. The owner sets complex Positive and Negative rules.
- Mechanism for resolving conflicting rules. Depends on the owner to set attributes /rules

[Al Bouna, SITIS 12]

User study on photo-tagging behaviour

Silent uploader scenario

- Randomly select 2000 photos
- The set is good representative