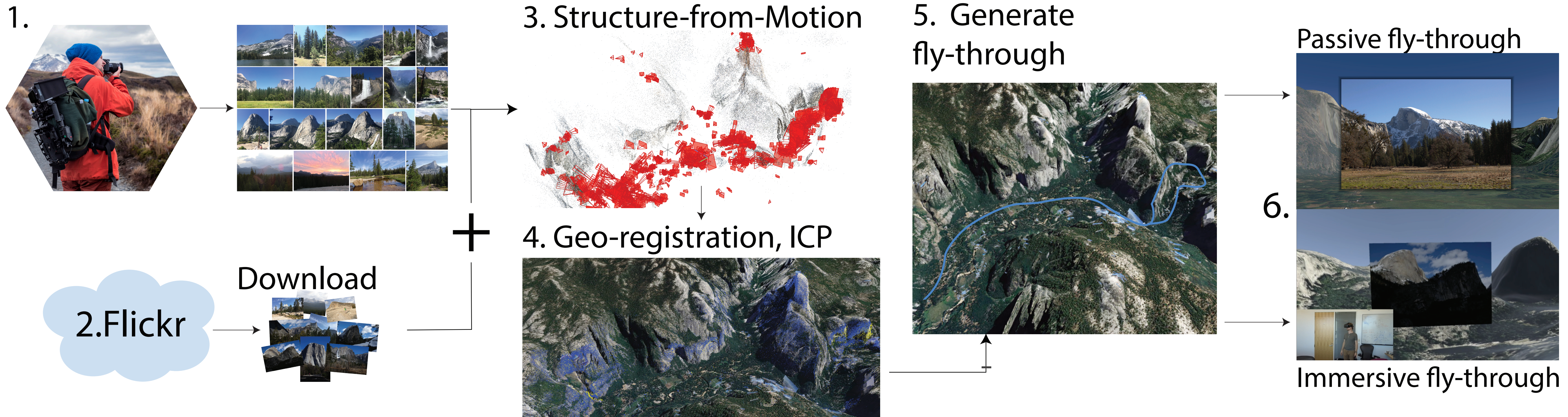
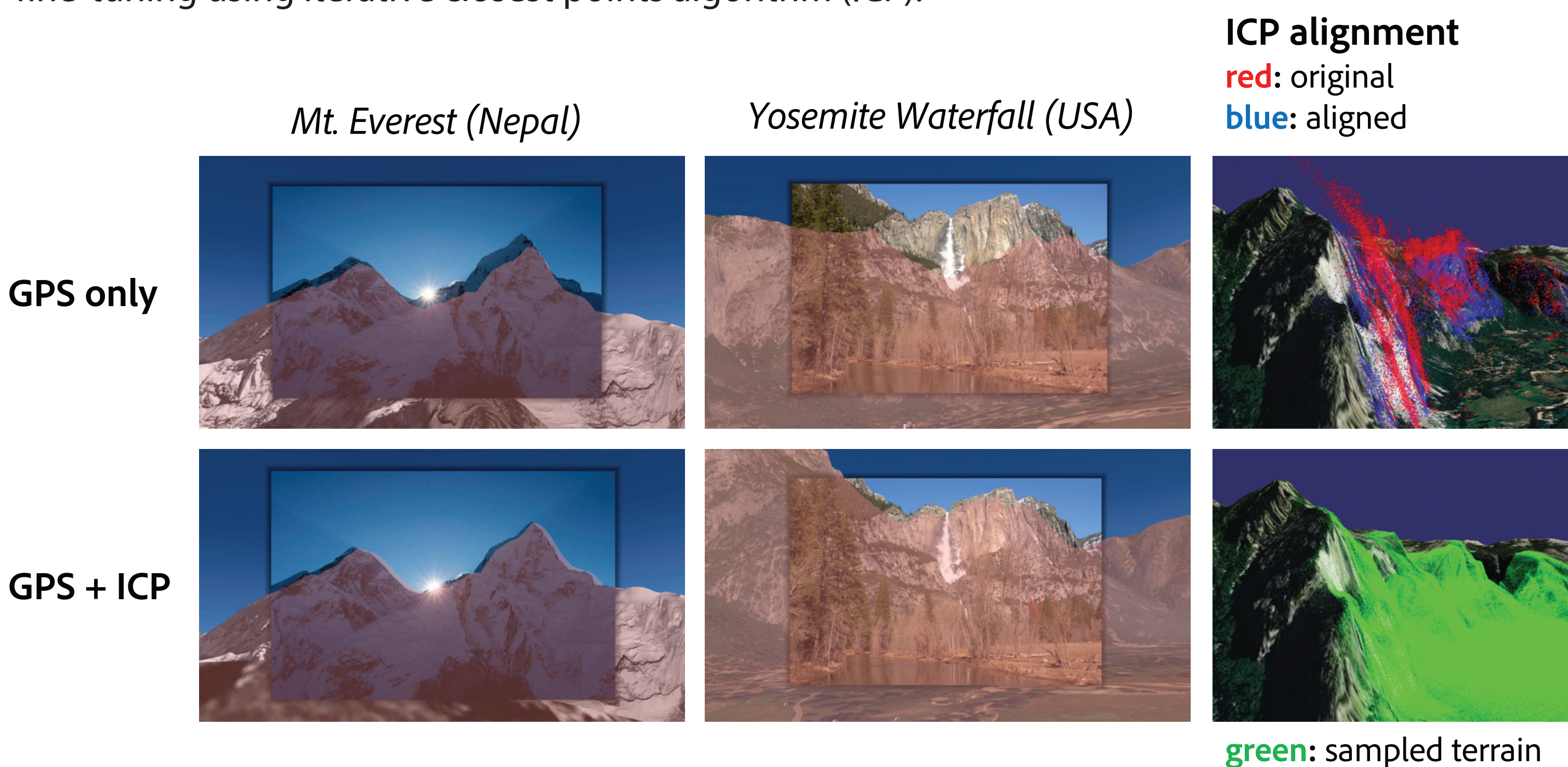


Our virtual trip creation pipeline: 1. User takes photographs during a hike; 2. We augment the input collection with images downloaded from Flickr.com; 3. Camera positions and sparse 3D point cloud reconstruction using Structure from Motion; 4. Scene alignment with the terrain using iterative closest points algorithm (ICP); 5. Fly-through generation from the input photographs from the hike; 6. We export the fly-through to Google Earth or to our virtual reality viewer. Map data © 2018 Google, © Mapbox, © OpenStreetMap.



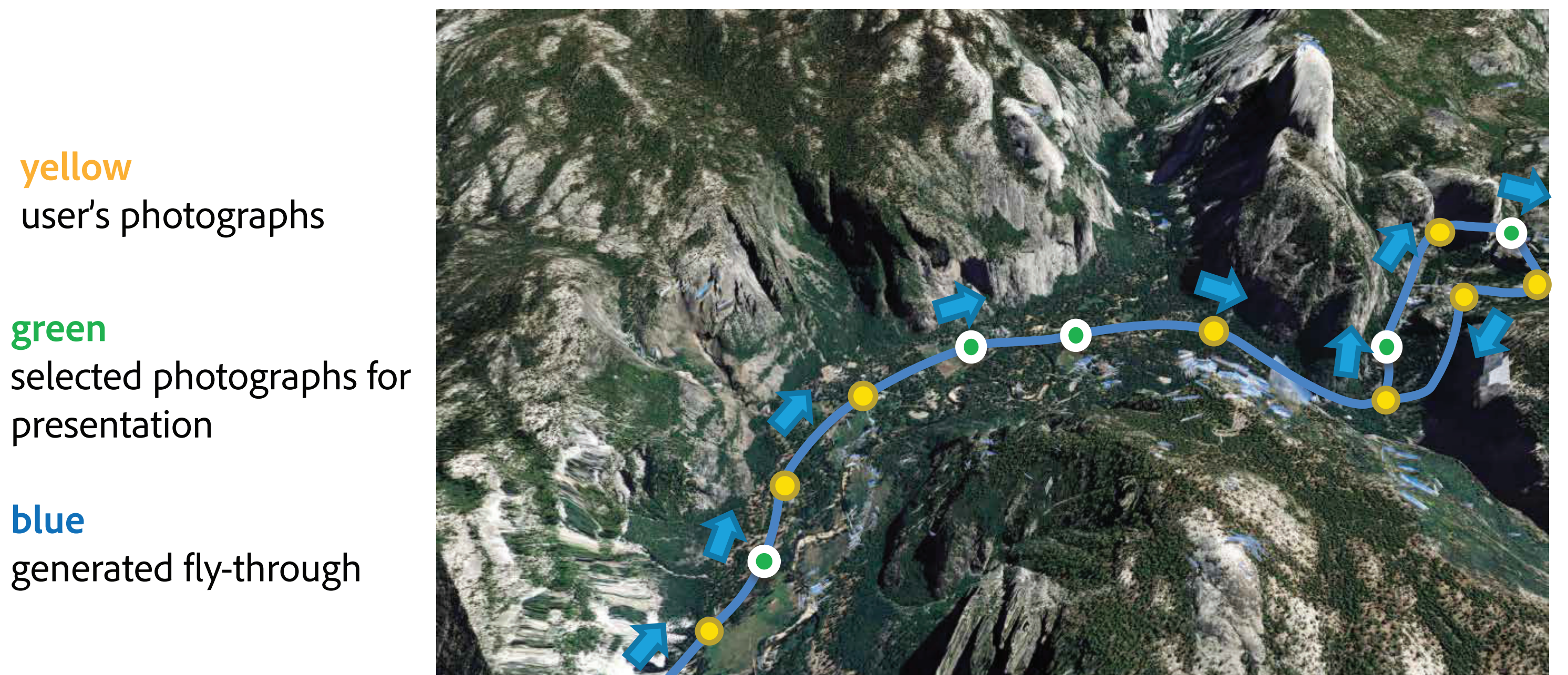
Geo-registration

Geo-registration using GPS coordinates of the photographs is usually not sufficient to obtain precise alignment with the terrain model. To mitigate the misalignment, we apply geometrical fine-tuning using iterative closest points algorithm (ICP).



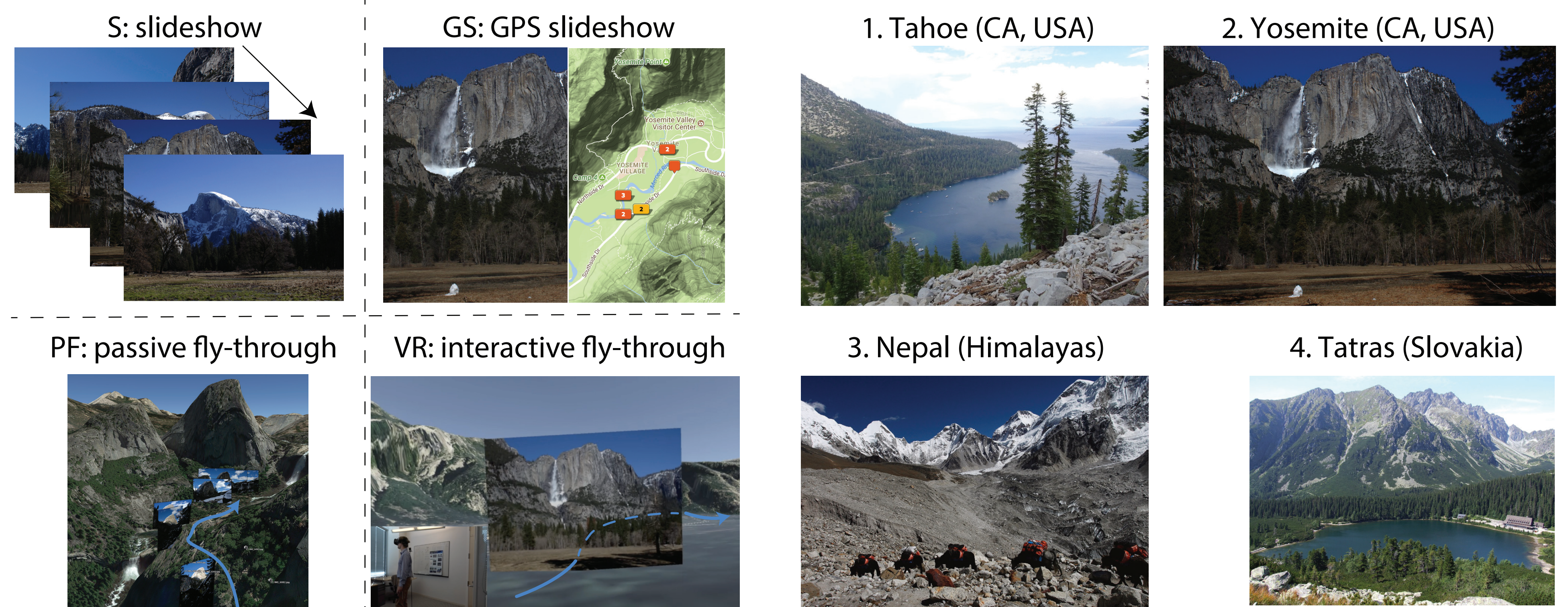
Fly-through creation

For creating the fly-through, we use all user photographs (green and yellow dots). The photographs are ordered using their timestamp and their positions are used as control points for calculating smooth camera path. During the fly-through, the camera will stop at user-selected photographs (green dots).



Presentation modes

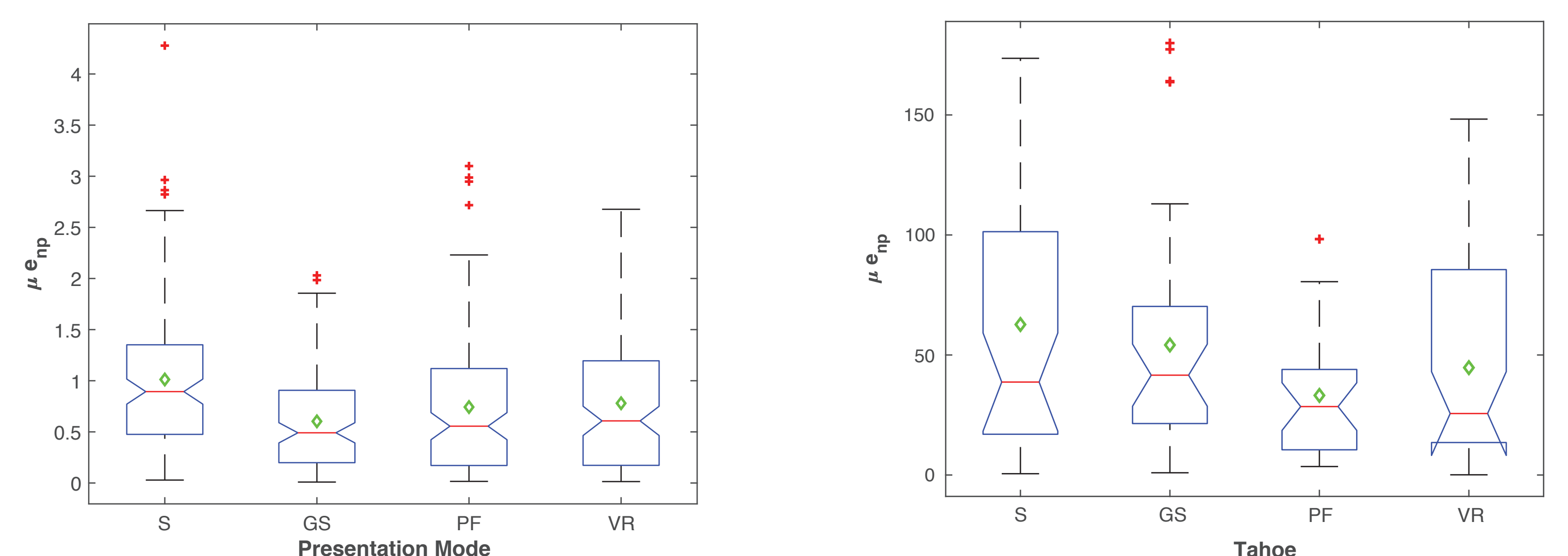
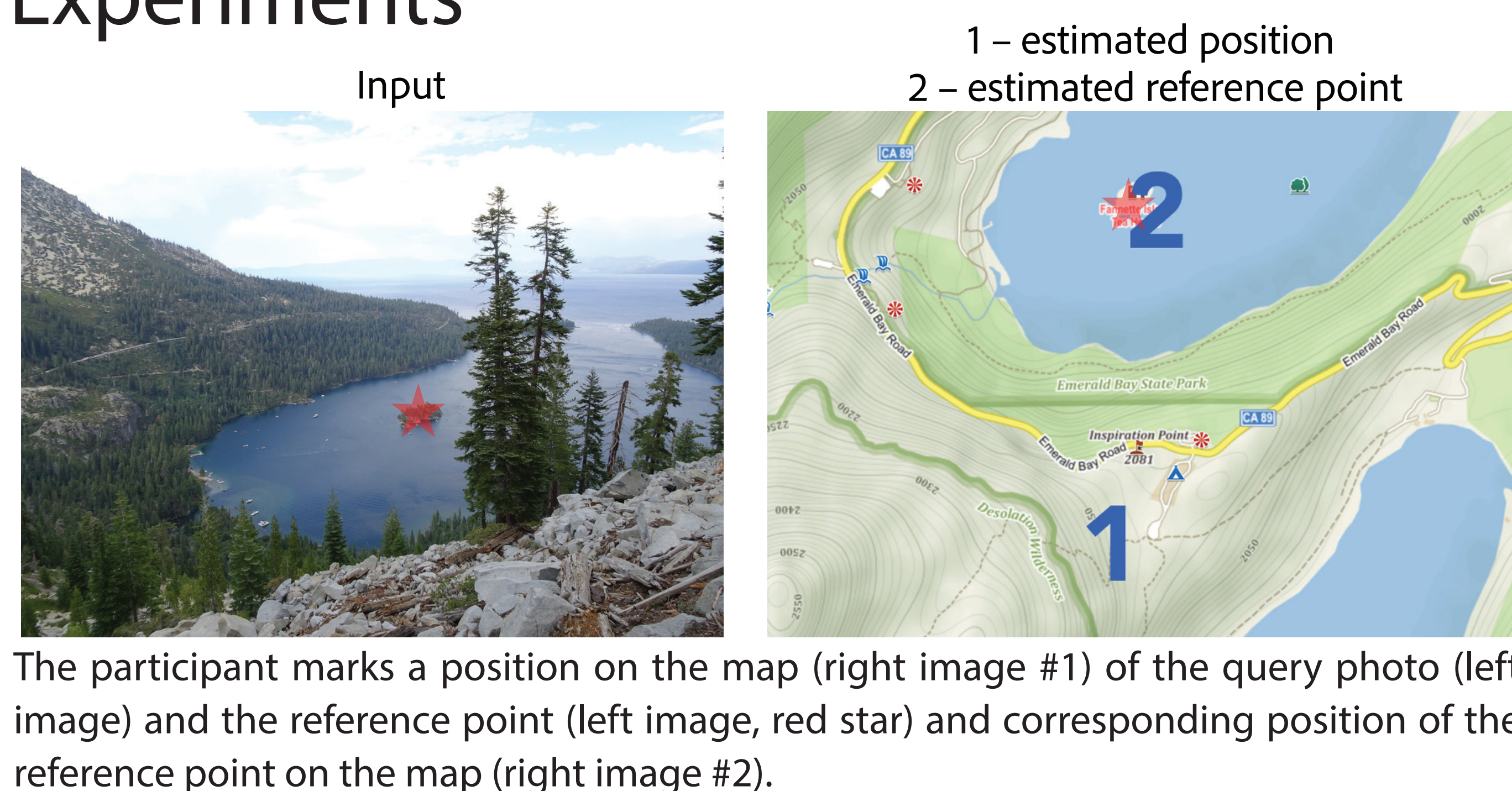
We experimented with four modes of presentation. As a baseline we used Slideshow (S) where photographs were presented sequentially, and GPS slideshow (GS) with a map showing the position of currently shown photograph. In a user evaluation study, we compare the baselines with our novel modes of presentation. Passive fly-through (PF): photographs aligned with the terrain are presented in a passive presentation. Interactive fly-through (VR): the user can freely look around the virtual environment with aligned photographs.



Datasets

For our experiments, we created four datasets. We captured our own photographs at the Lake Tahoe (USA), in the Yosemite Valley (USA), and in Himalayas (Nepal). We also captured a dataset of Flickr images from High Tatra mountains in Slovakia.

Experiments



Left: Repeated measures scenario comparing differences between normalized positional error on different modes of presentation. Right: comparison of heading errors achieved by presentation modes.

Acknowledgements

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