

PhotoCity: Training Experts at Large-scale Image Acquisition Through a Competitive Game

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Introduction



- * The authors have developed a crowdsourcing game with purpose (GWAP) called “PhotoCity” which focus on using photos that are taken by the player to build a 3D model of a city.
- * The purposes of having 3D model:-
 - * If the building was torn down, we will know how it looked once from the snapshot.
 - * It can support urban planning and analysis of changes in cities over time.

Introduction

- * They emphasize on capturing/taking “new” photos because photos from other sources such as Flickr is sparsely taken and only famous landmarks are well-represented or sources like Google is highly cost.

Game Description

- * The core dynamic of the game is to involve players inspecting the state of the game world on a map, taking photos at locations of promising in-game value, uploading the photos to PhotoCity website, and then observing the results of their play.



Game Description

- * The game world of PhotoCity is a map of the real world overlaid with virtual castles and flags.
- * Each castle corresponds to one partially reconstructed 3D model of a real world building.
- * Flags represent a specific map locations in the real world which is automatically placed along the building walls to guide players.



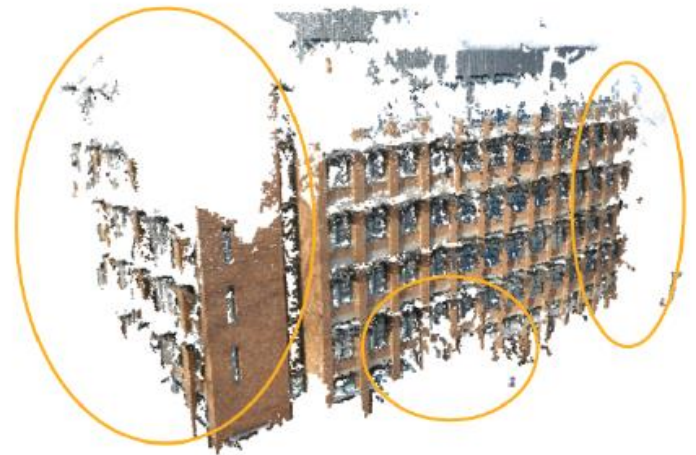
Game Description

- * Every photo is compared against 3D model when it is uploaded, the back end server estimates the 3D pose of that photo with respect to the current 3D model, then matches pixels in that photo to existing nearby photos in order to triangulate new points.
- * This process is to add new 3D points to the model.
- * The player will earn one game point for each new 3D point added.



3D Reconstruction

- * PhotoCity uses a computer vision technology which takes a set of photos and automatically reconstructs the viewpoint (position and orientation) from which each photo was taken.
- * This technology will automatically reconstruct 3D from 2D images.



Game Description

- * Players can also seed their own models by uploading a starting set of photos to the web of PhotoCity.
- * A starting set of photos is between 20-200 photos that capture just one side or corner of a building from all possible angles.
- * If the seed generation is successful, the game developers will approve the seed.
- * Benefit: Having many models give variety for players

Experiment

- * Total of 45 players
 - * 26 from University of Washington
 - * 19 from Cornell University
- * Duration of 6 weeks
 - * 3 weeks for 2 rounds
- * Prizes
 - * T-shirts for top 15 players
 - * Flickr Pro accounts for title-holders at each school

Results

- * PhotoCity started off with 4 buildings per campus and by the end of the competition, they had 119 more new seeds generated by the players.
 - * 64 new seeds from University of Washington
 - * 55 new seeds from Cornell University



(a) Lewis Hall (UW)



(b) Sage Chapel (Cornell)

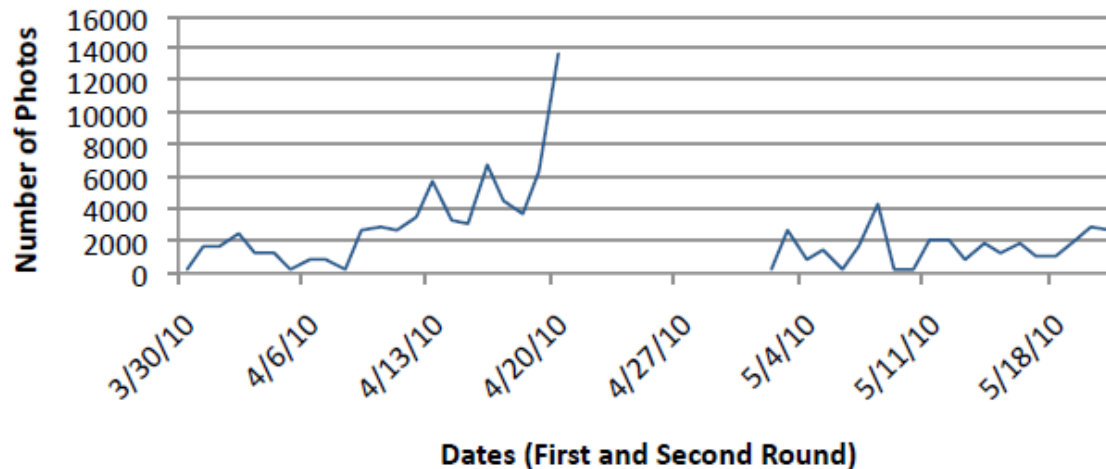


(c) Uris Library (Cornell)

Results

- * The below graph shows the number of photos being uploaded per day. At the end of the 1st round, there are 50 active models per campus, while in 2nd round, it is only 10 active buildings per campus

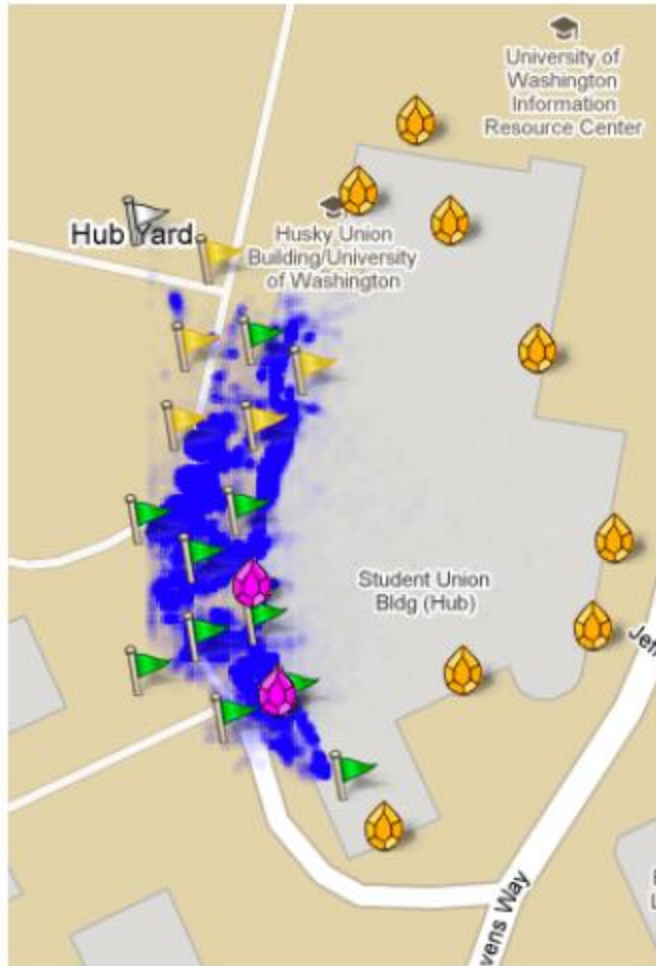
Number of Photos per Day



Results

- * At the end of the 1st round competition, the authors discovered that players seeded many buildings throughout the campus BUT most of the reconstructions were not complete.
- * The authors introduced new mechanic which is to collect gems.
- * Unlike flags, gems are manually placed on the far sides of the buildings.

Collecting Gems



Survey

- * 22 out of 45 participants response the survey
- * The authors concluded that PhotoCity made many participants to become more physically active than usual.
- * Survey questions include:-
 - * What motivated them to start playing and keep playing
 - * What strategies they developed to gain competitive advantage

Motivation

- * Competition
 - * Between schools (Cornell University and University of Washington)
 - * Between players
- * Interest in the resulting 3D models

Conclusion

- * PhotoCity is considered successful as they have small number of participants but can take on large-scale problems, which means that crowdsourcing is a viable mechanism for large-scale visual data collection.
- * They have designed various game mechanics that made players' in-game action productive and beneficial to their game purpose.