Crowdsourced Search and Rescue

A case study and analysis of a recent search in Southwestern British Columbia

The Subject

- August 10th 2010, 16:30, Tyler Wright is last seen
- intends to do the "Fools Gold Trail"
- a 5-7 day 50km hike



The Search

- August 18th 2010, he is reported missing

 last known position 2 hours from start of trail
- "Mutual Aid" activated immediately, starting
 - 16 days of searching
 - 11 SAR Teams
 - ~167 searchers (probably more)
 - ~2163 searcher hours
 - ~368 km² largest extent of area searched



The Search Area with Route

The Difference

- On Day 4, a private helicopter pilot, volunteered to fly the search area.
- recorded the flights with HD Cameras
- uploaded them to YouTube
- asked the world to join the search.

Presentation

- What happened
 - Equipment, process
- Context
 - Previous efforts
- Outcomes
 - Community involvement
- Possible improvements

Video 1

Crowdsourcing

Getting a group or community of individuals to perform a task usually done by an individual or team.

Examples

- Oxford English Dictionary,
 - 1858
 - 70 years,
 - 6 million submissions
- Coordinated by:
 - Editors (academics)
 - Filing cabinets
 - central location

- Wikipedia, 2001
 - 3.7 million articles,
 - 82,000 active contributors,
 - 270 languages
- Coordinated by:
 - Volunteer editors
 - MediaWiki software
 - The internet

reCaptcha



Characteristics

- Motivated, committed members

 usually working for free, or very little reward
- Focused task
- Tools & resources
- Quality control

Prior Work

- Jim Gray, January 2007
- Microsoft employee, famous computer scientist
- Lost at sea
- CEOs and millionaires assisted
 - Bill Gates, Larry Ellison
 - Amazon, Microsoft, Oracle, Google, etc
- Satellite imagery posted online
 - 12,000 volunteers
 - 87 gigapixels
 - each image 8192x8192
 - No results

Prior Work

- Steve Fossett, September 2007,
 - Famous aviator and adventurer
 - Disappeared flying in Nevada
- Google and Richard Branson intervened to provide satellite imagery
- 50,000 people examined 300,000 images
 @278 sq ft each
- Found using traditional means

Tyler Wright Search

- Community:
 - family, friends and dedicated volunteers
 - focused & united on a goal
- Task
 - short videos, generate "leads"
- Coordination
 - YouTube, Email, Blog posts
- Quality Control
 - volunteer hours to "vet" tips
 - professional grade video editing and viewing tools

Equipment & Systems

- GoPro Hero HD Camera
 - 1080p: 1920 x 1080
 - 137° wide angle, 30 FPS
 - 16:9 aspect ratio
- Video uploaded to YouTube
- Edited to 3 minute segments





Flight Path 2010-08-29

Video 2

Analysis

- Effort
 - ~40 hours flying
 - ~40 hours editing and processing video
 - ~40 hours following up leads
- Generating
 - 156 videos
 - 9.5 hours (average length 3:40)
 - 41,224 total views
 - 5702 max on one video
 - 43 minimum
 - 264 average

Distribution of Views

viewers

6000 4500 3000 1500 0

Helicopter Flight Video Viewers

Video

Viewers by Video Date

6000 4500 3000 1500 0

Helicopter Flight Video Viewers

viewers

Date

Performance

- ~800 tagged items
- ~200 warranted retrieving original video
- ~50 worth additional scrutiny
- 3 forwarded to SAR management
- 2 were already known
- 1 was singled out for further investigation

Discussion

Is this is "good" thing?

- Did it lead to good results
- Did it detract from the search effort
- Is it worth doing again?

Advantages

- Involves family, friend and community in the search
 - Safe way to participate
- Informs them of conditions and hazards
 - Misconceptions of "trail" and "park"
 - Encouraged not to attempt their own search
 - Appreciate size of task, and effort involved

Advantages

- Informs SAR community of terrain and hazards
- SAR Management can visualize the search area
- Familiarize out-of-area teams with terrain
- Identify hazards not seen on map or aerial photos
- Aid in planning for specialized search areas
 - Swift water, canyoneering, glacier travel

Disadvantages

- Immediacy
 - Processing, uploading and viewing time
 - Clues spotted hours after initial flight
- Usefulness
 - Of 800 tips, only 3 worth investigating
 - Bad tips could divert resources from search effort
- Time consuming
 - Effort to fly, process and upload video
 - Effort to process tips

Applicability

- Joseph Andrews, Salmon Valley (Prince George, BC), 10 days, August 4th 2002 never found
- Huckvale/Markoff, Mt Elizabeth, Kitimat, BC, 9 days, August 25th 2002 both deceased
- Spearhead Traverse, Whistler, BC, 6 days, March 19th 2004 found
- Samuel Black, Brandywine Mt, Whistler, BC, 6 days, August 20th 2004 found from the air

Applicability (cont'd)

- David Koch, Grouse Mountain, 12 days, May 25th 2005 deceased
- Alexis Creek, 5 days, 50 members, 15 teams, August 30th 2007 deceased
- Bagnall & Jette, Saxifrage Mt, Pemberton, BC, 10 days, Sept 13th 2010. never found
- Kienan Hebert, Sparwood, BC, 4 days, Sept 8th 2011 returned

Improvements

• Data gathering

• Data Processing

• Data Analysis

Data Gathering

- Higher resolution cameras
 - Camera with built-in GPS



- RED camera system, immense resolution
- 360° camera system
- Long line camera with gyroscopic stabilization
- Commercial pilots & aircraft
 - Better control and safety

Camera Resolutions



1080p is the Cyan (light bright blue) area

Data Processing

- Editing video
 - Automate breaking video into segments
- Uploading Data
 - High bandwidth fibre
 - Priority processing at YouTube
- Data Processing
 - Pre-filter likely area
 - Enhance detection using computational vision

Data Analysis

- Users tag items
 - Video offset (seconds), x/y location on screen
 - Geographic coordinates from flight data
- Items are reviewed
 - Ruled in: accepted for further review
 - Ruled out: expert opinion or already investigated
 - marked on the video as already detected
- Video and map coverage is tracked
 - Highlight areas/videos that need to be watched
 - Coordinate efforts to spread coverage

Community

- "Gamification"
 - Using video game techniques to encourage participation, engage users, and retain their efforts
- Engagement
 - Social media status for effort and clues found
- Retention
 - Display progress
 - Recognition of effort

Future Work

- Custom built web site
 - to engage users
 - coordinate efforts
- Spotters: "pass" training video w/ known targets
- Reviewers: review clues
- Coordinators:
 - vet reviewed clues
 - Subject matter experts
 - SAR liaison
- SAR teams/managers
 - Select area of high probability
 - Review vetted clues

Mock-up



Future Work

- User engagement
 - Feedback on coverage
 - Ruled out clues are tagged
 - Status gained for minutes and hours watched
 - Status for clues found
 - "Badges" for certain milestones
 - "promotion" to reviewer, moderator

Thanks to

- Bradley Friesen, former commercial pilot,
 - core idea
 - flying, cameras, video processing
- Dorian Banks, IT and technology specialist
 - core idea
 - processed video, analyzed tips, coordinated email
- Richard Laing, SAR Manager, Ridge Meadows SAR
 SAR Management perspective
- Wright family

Contact/Follow

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