Social WhaleTracking and Photo-Identification

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Outline

1. Key ideas
2. Motivation
3. State of the art
4. Online whale photo identification and tracking
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Key ideas proposed in this project

1. Use whale watchers photos for populating whales photo-id catalogue
2. Develop image processing methods for automatic photo identification
3. Automatically extract facts about whale-human encounter from news
4. Create free online resource
   - integrating photo-id catalogue and whale-human encounter facts
   - implementing whale tracking
   - causing positive social effect and popularizing whale studies

Motivation:
Whale tracking is important

- Estimating distribution
- Modelling patterns of abundance
- Monitoring migrating patterns
- Learning feeding habits
- Planning of conservation

Motivation:
Whale watching is a thriving touristic activity

Statistics in California

- 65 operators using 140+ boats (profit & non-profit)

Hoyt (2001) Whale watching: worldwide tourism numbers, expenditures, and expanding socioeconomic benefits. *Report International Fund for Animal Welfare (IFAW)*

Society values whales

- Whale watchers would pay a maximum of $23.72 a year to increase gray whale populations by 50%

Loomis&Larson (1998) *Marine Resource Economics*

- Seminars, festivals, education programs

State of the art:
Tracking great whales

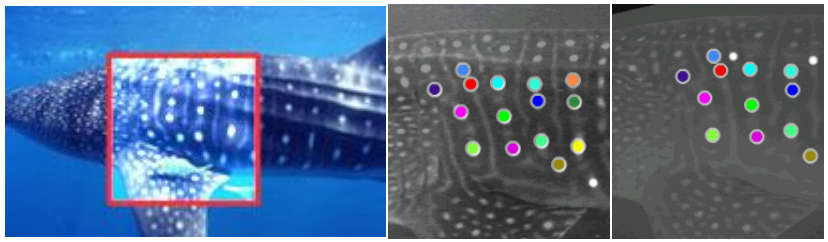
- Aerial surveys — Clarke et al. (2011) *Report NOAA, NMFS*
- Passive acoustic monitoring — Mellinger et al. (2007) *Oceanography*
- Radio tagging — Ray et al. (1978) *Science*, Watkins et al. (2002, 2006) *Mar Mamm Sci*
- Satellite tracking — Mouillot, Viale (2001) *Hydrobiologia*

State of the art:
Photo-identification of great whales

- Manual identification using natural markings
  - Blue whale — Sears et al. (1990) *Rep. Int. Whal. Commn.*; Olson (2009) *Int. Whaling Commission Report*
  - Right whale — Carroll et al (2011) *Mar Biol*
- Computer-assisted manual identification
  - Humpback whales, flukes images — Ranguelova et al. (2004)
- Automatic identification
  - Fluke Matcher software — Kniest et al. (2010) *Mar Mamm Sci*
  - Bowhead pattern match software — Hillman et al. (2008) Rep. Nat. Mar. Mammal Lab.

State of the art:
Automatic photo-identification of other species

- Zebra
  - Lahiri et al. (2011) Biometric Animal Databases from Field Photographs: Identification of Individual Zebra in the Wild
- Great apes
  - Loos et al. (2011) Identification of great apes using face recognition
- Whale shark
  - Speed et al. (2007) Spot the match – wildlife photo-identification using information theory. *Frontiers in Zoology*
  - ECOCEAN whale shark photo-id library (http://www.whaleshark.org)

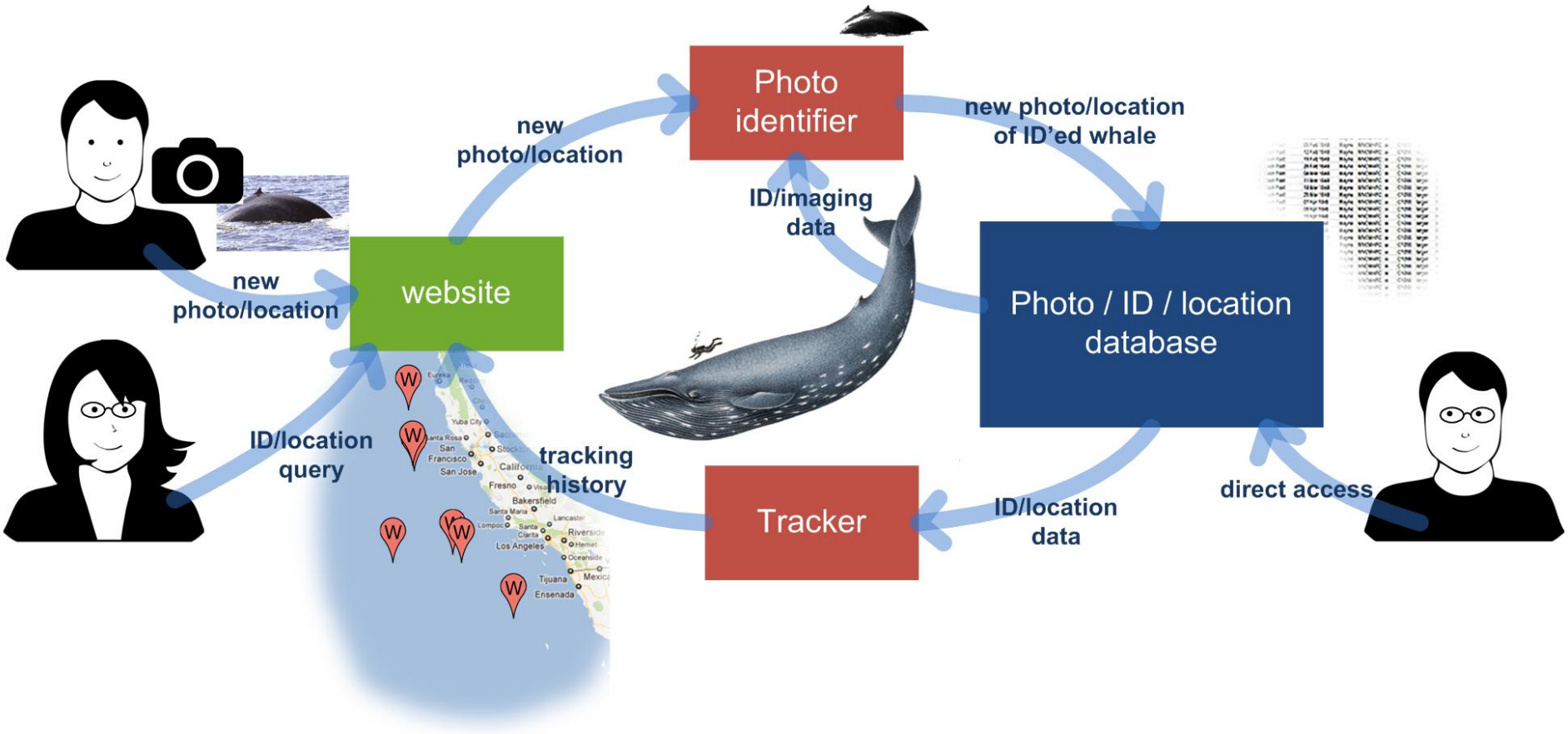


State of the art:
Existing whales photo-id catalogues

- Blue whale
  - Southwest Fisheries Science Center, as the result of IDCR/SOWER program: 22,784 photos, 323 individuals

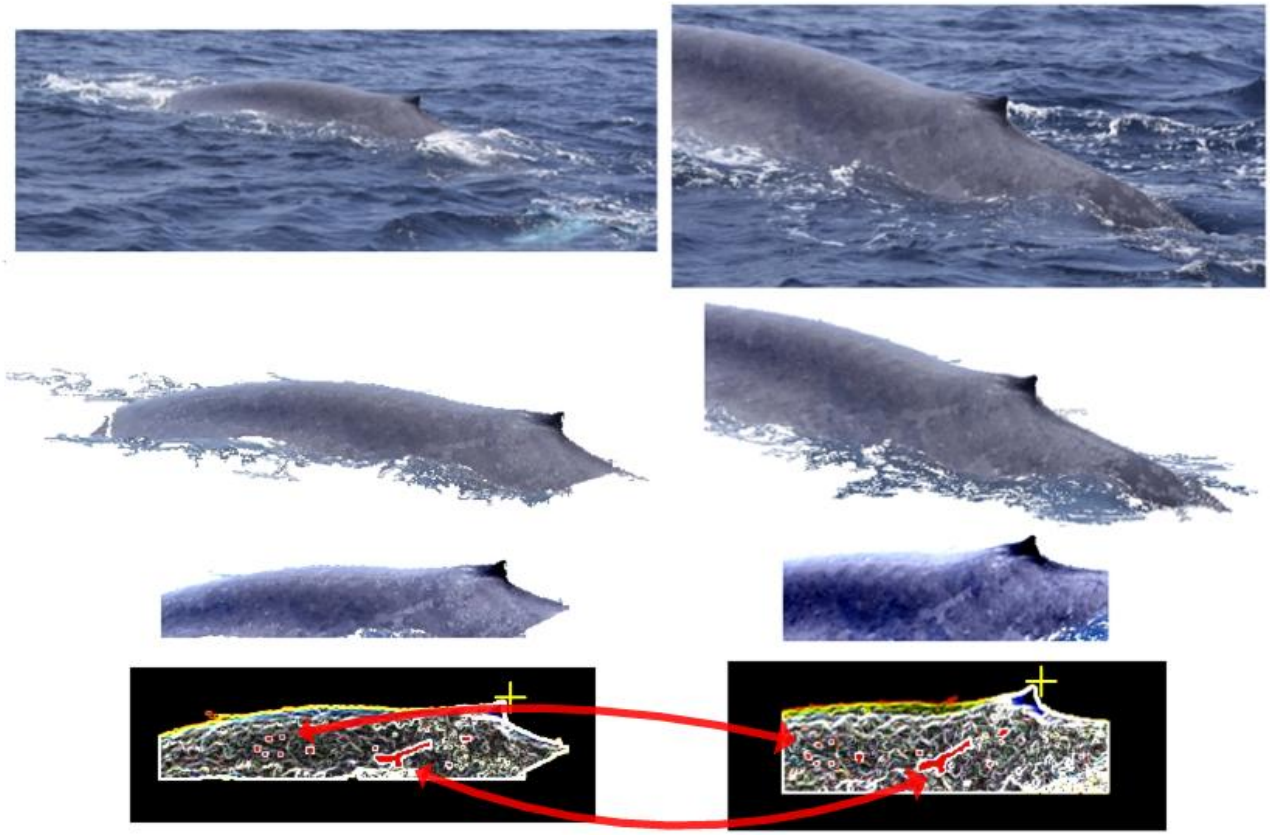
Project idea

Online whale photo identification and tracking



Automatic photo-identification

Image processing and machine learning algorithms



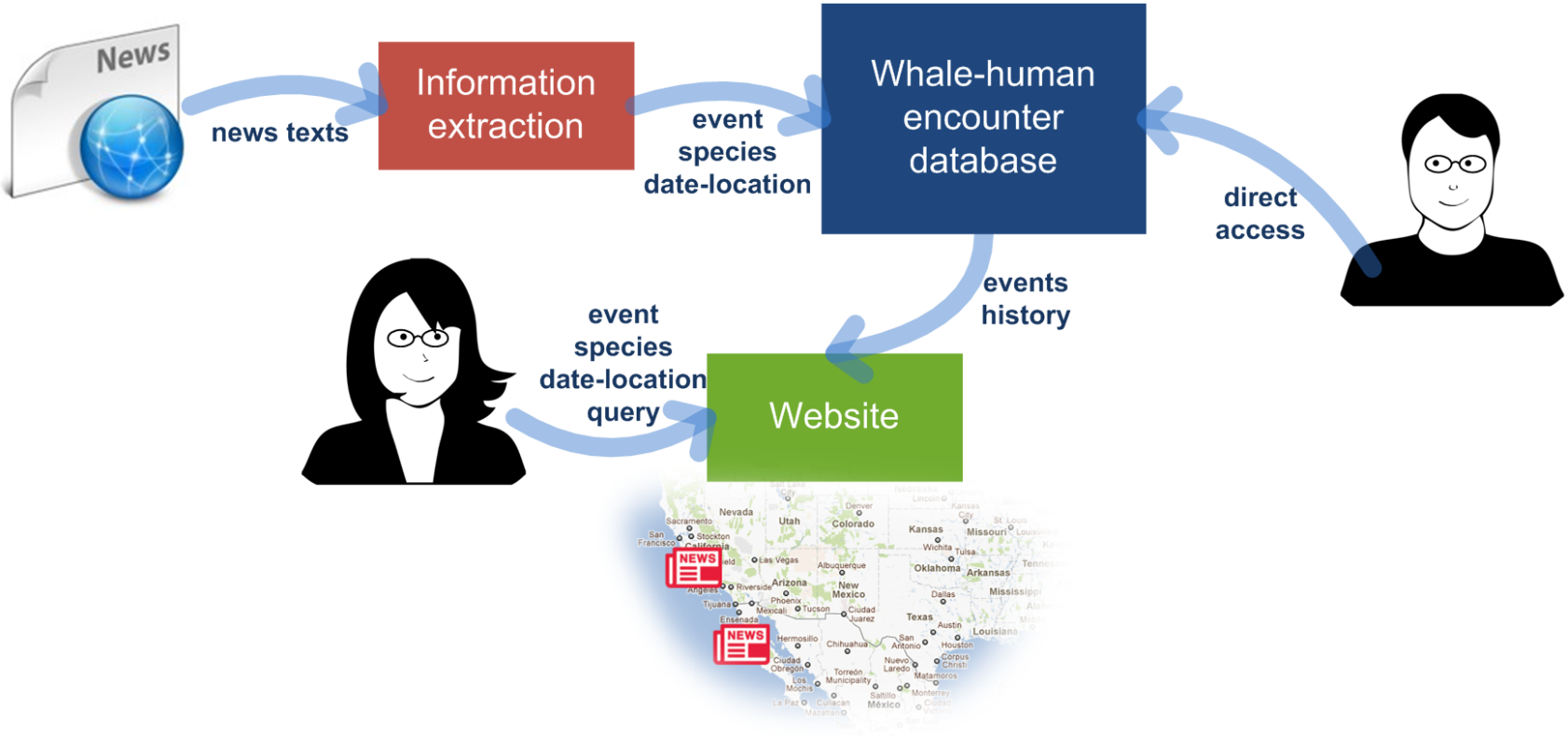
Original images

1. Whale detection

2. Co-registration

3. Matching

Tracking of online whale news



Automatic news processing

News text:

17 November 2011, **Whale is freed from fishing nets off Dunbar**

A 40ft-long whale has been successfully freed from fishing gear off the coast of East Lothian. The humpback was reported trapped in a boat's nets on Tuesday. It escaped but was then trapped again in a line of creels off the Dunbar coast. The whale had suffered serious injuries to its back and dorsal fin but experts believe it will make a full recovery.

Extracted information:

species: humpback
date: 11/17/2011
location: Dunbar, East Lothian, UK
event: accident
cause: fishing nets
link: http://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-15759179

Whale map


Species: gray whale
Event: accident
Location: Newport Beach
Date: 08/20/2012
→Show news article
Species: gray whale
ID: Alex1991
Location: 33.538533,-117.968445
Date: 07/01/2012
→Pictures, →Personal info, →Track
Irvine
Huntington Beach
Costa Mesa
Newport Beach
Lake Forest
Mission Viejo
Laguna Woods
Aliso Viejo
Laguna Niguel
San Juan Capistrano
Dana Point
Capistrano Beach
Capistrano Bight
Orange County Great Park
John Wayne Airport
Santiago Canyon
San Joaquin Hills
Shady Canyon
Crystal Cove State Park
Newport Coast
Ladera Ranch
Foothill Ranch
NEWS

Conclusions

Getting information about whales can be made easier by

- automatic photo-identification
- collecting photos from whale watchers
- automatic finding relevant news articles
- integrating collected data into public online resource
- visualizing data on a online interactive map