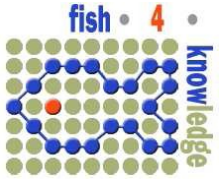
THE UNIVERSITY *of* EDINBURGH

Integration and Evaluation

Bas Boom and Jiyin He



THE UNIVERSITY *of* EDINBURGH

Introduction

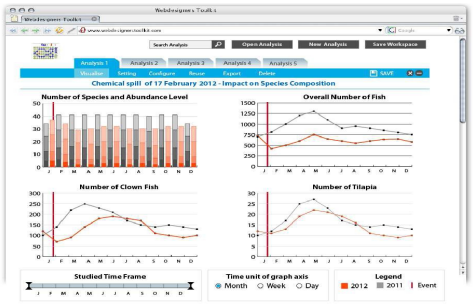
Computer Scientist

Components

Engineer

Integration

Marine Biologist



Evaluation

Components

Purpose:

Help the component of partners to cooperate

Freedom

Partners are responsible for their own components

Computer Scientist

Grand Design of Interaction

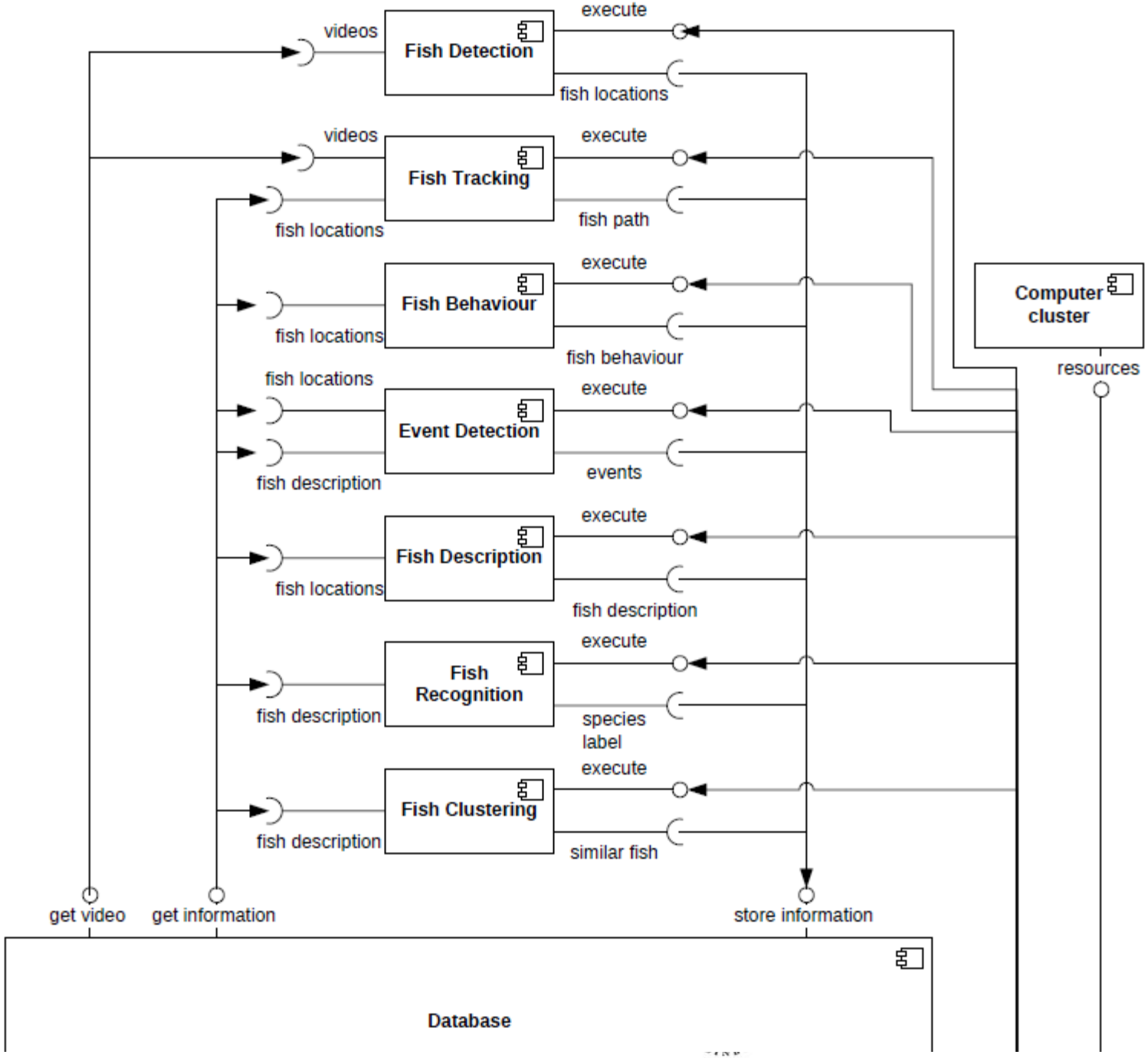
Communication

- Component retrieves input from storage facilities
- Component saves output in storage facilities

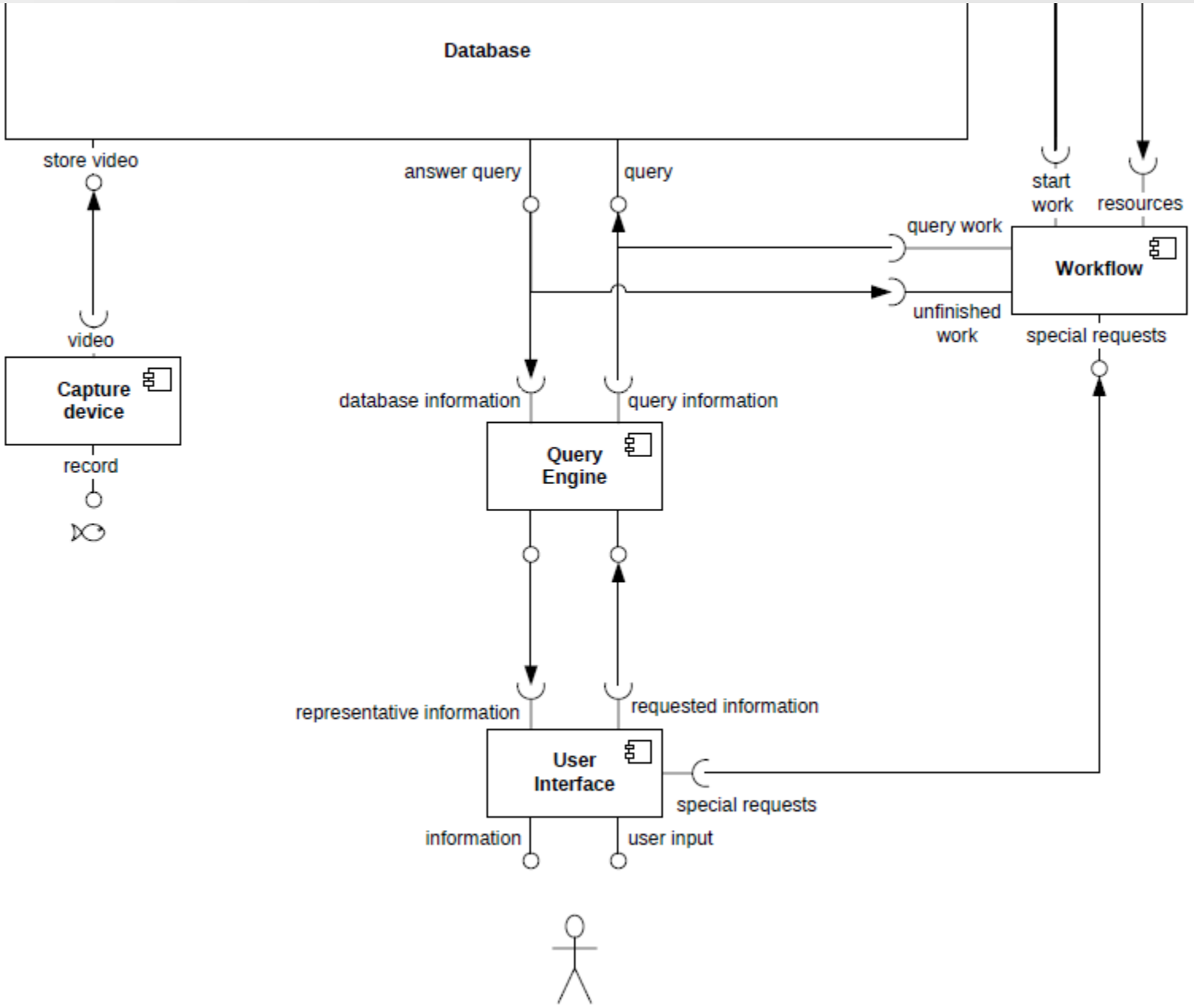
Storage Facilities

- Store all data (video, records, ontologies)
- Simple interface to query and store data
- Same Datastore Definitions use by everybody

Engineer


videos
Fish Detection
execute
fish locations
videos
Fish Tracking
execute
fish locations
fish path
Fish Behaviour
execute
fish locations
fish behaviour
Computer cluster
resources
fish locations
Event Detection
execute
fish description
events
Fish Description
execute
fish locations
fish description
Fish Recognition
execute
fish description
species label
Fish Clustering
execute
fish description
similar fish
get video
get information
store information
Database

Engineer


Database
store video
answer query
query
start work
resources
query work
Workflow
unfinished work
special requests
video
Capture device
record
database information
query information
Query Engine
representative information
requested information
User Interface
special requests
information
user input

Engineer

FishDetection
- VideoID INT(11)
- IDFrame INT(11)
- BoundingBox INT(11)
- FishContourPoints BLOB
- FishID INT(11)
- Timestamp TIMESTAMP

Indexes

Video
- ID INT(11)
- CameraID INT(11)
- TimeDate INT(11)
- FrameRate INT(11)
- FrameHeight INT(11)
- FrameWidth INT(11)
- Compression VARCHAR(50)
- FrameDepth INT(11)

Indexes

Fish
- ID INT(11)
- Type INT
- Complete INT(11)
- BestBoundingBox INT(11)
- BestContourPoints BLOB
- ComponentID INT(11)
- BestVideo INT
- BestFrame INT

Indexes

FeaturesVideo
- VideoID INT(11)
- FeatureID INT(11)
- DataFeatures INT(11)
- Rows INT(11)
- Columns INT
- Value VARCHAR(45)

Indexes

FeaturesFish
- FishID INT(11)
- FeatureID INT(11)
- DataFeatures INT(11)
- Rows INT(11)
- Columns INT

Indexes

Features
- ID INT(11)
- Type INT(11)
- Name VARCHAR(45)

Indexes

FishSpecie
- idFishSpecie INT
- Name VARCHAR(45)
- Behavior VARCHAR(45)

Indexes

Event_Fish
- IDEvent INT(11)
- Description VARCHAR(50)
- Type INT(11)
- VideoID INT(11)
- ComponentID INT(11)
- StartFrame INT
- EndFrame INT
- IDFishEvent INT

Indexes

Events
- idEvents INT
- Description VARCHAR(45)

Indexes

Event_Fish_Detection
- idEvent INT
- VideoID INT
- FrameID INT
- FishID INT

Indexes

Video Retrieval Interface

<< [Ecology Historical Vid

gad240.nchc.org.tw/tai/video_query/

[Ecology Historical Video Retrieval] 001380

Site	VideoNo	Resolution	Fps	Type	Date	Hour	Minute
[Site] select	[VideoNo] select	[Resolution] select	[Fps] select	[Type] select	[Date]select	[Hour] select	[Minute] select

Download The Video | Play The Video

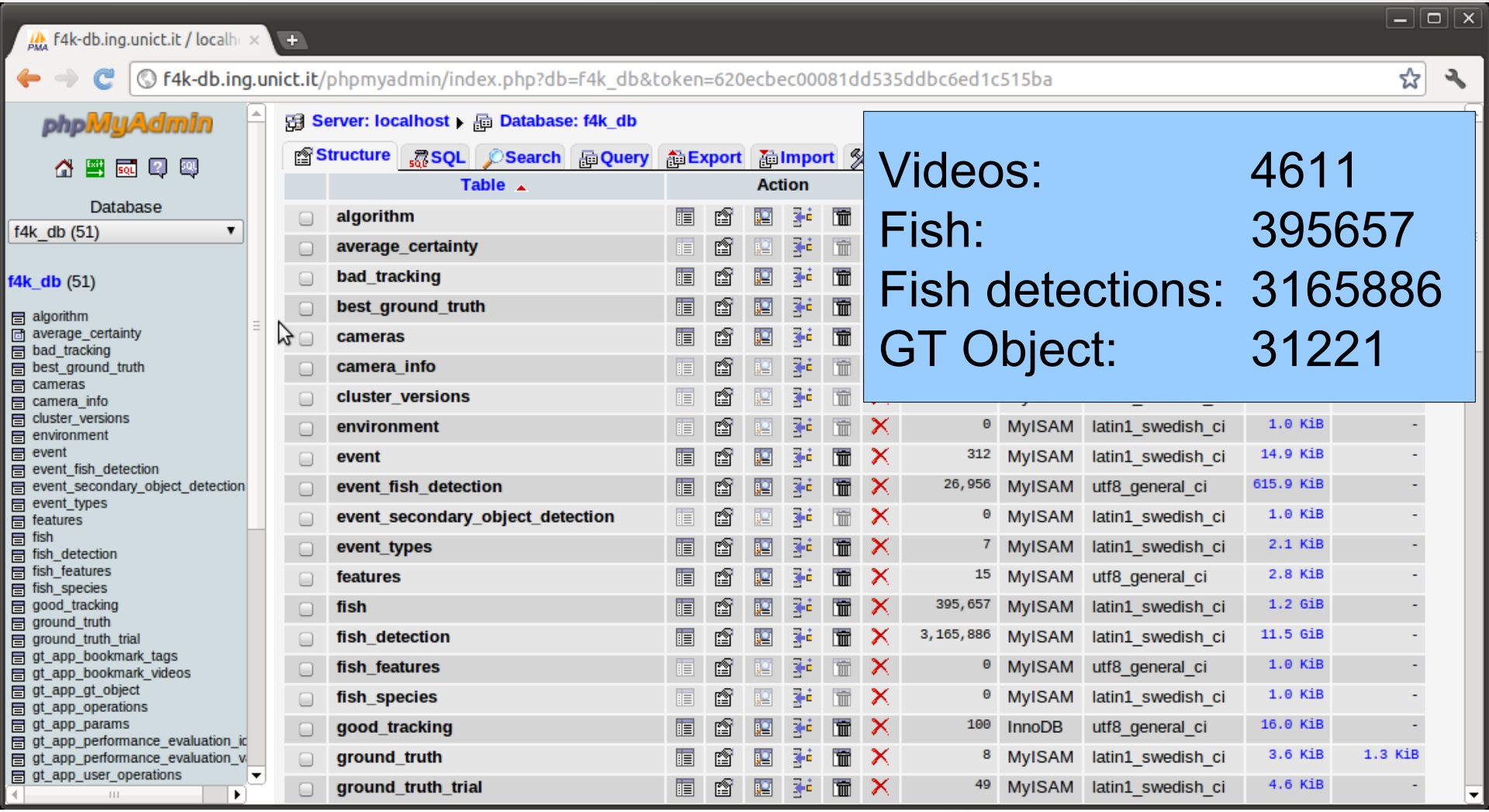
The following is alternative page, which generating video link for downloading and the video would be exactly exist.
DUMP page(Given the GET parameters with 5 fixed,1 unassigned)
Example:"http://gad240.nchc.org.tw/tai/video_query/dump.php?hid_site=NPP-3&hid_video=1&hid_resolution=2&hid_fps=24&hid_codec=1"

1.Version: V1.2
(1.Add cache to improve performance. 2.Add date suggestion when query miss 3.Add fps information)
2.Total number of the historical video clips in database : 440764 (2011-12-08 18:00:48)
3.The number of historical video clips in each site :

site_name_en	video_count(clips)	video_size(bytes)
NPP-3	166489	3859086062663
LanYu	78921	1899656724388
NMMBA	57228	2901140763565
HoBiHu	38997	833970688728
Total	341635	9493854239344

Engineer

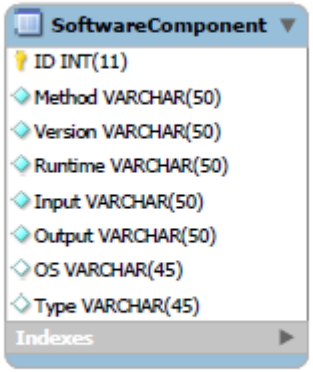
MySQL database



Database Table Components

Workflow Components:

Can execute other components using table



Database connection:

Check unprocessed data or unresolved queries in database

Engineer

Computer Scientist

Current Status

- ✓ Database in Catania (SQL)
- ✓ Interface to Videos (http)
- ✓ Database Definition (Deliverable 5.2)
- ✓ Cluster of computers in Taiwan
- ✓ GIT version management
- Components on cluster of computers
- Database solution scalable

Evaluation

Computer Scientist

Individual Components

- Creators are responsible for own evaluation
- (related Scientific Questions & Experiments)

Entire System

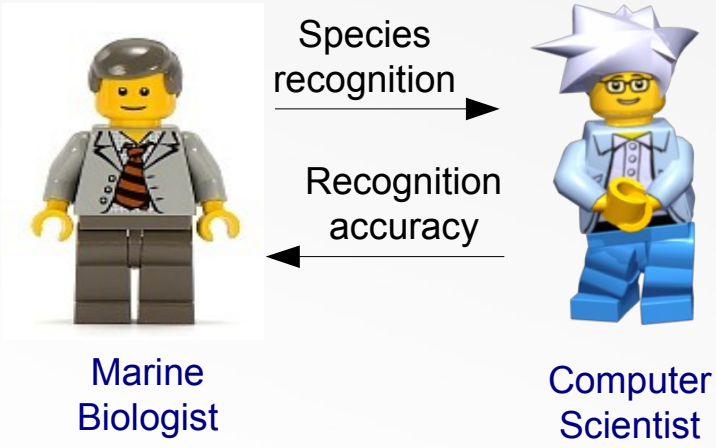
Marine Biologist

- Uncertainty in entire system due to computer vision components
- Meetings with Marine Biologists (third year)

Requirement for Evaluation

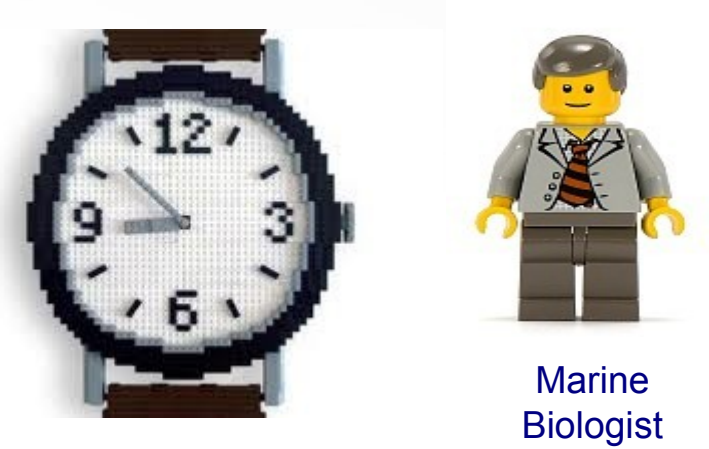
Domain Knowledge

Marine Biologist can recognise fish species



Limited Knowledge

Marine Biologist do not have much time to annotate species



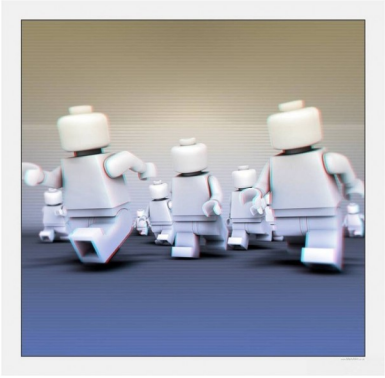
Alternative for Marine Biologists

Computers

- Low accuracy – No cost
- Cross Validation

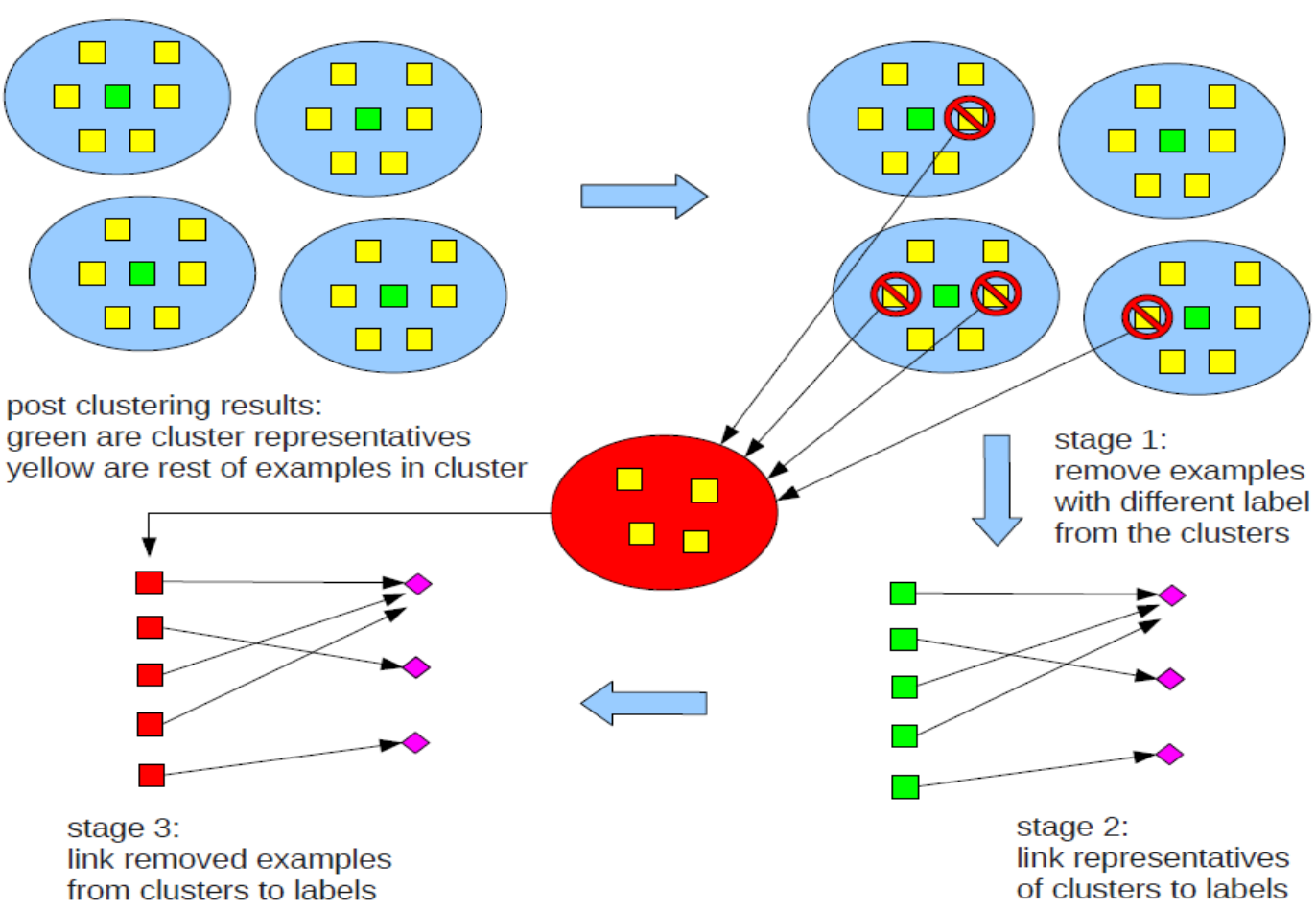
Crowd Sourcing

- Good accuracy
- Some cost in time or money

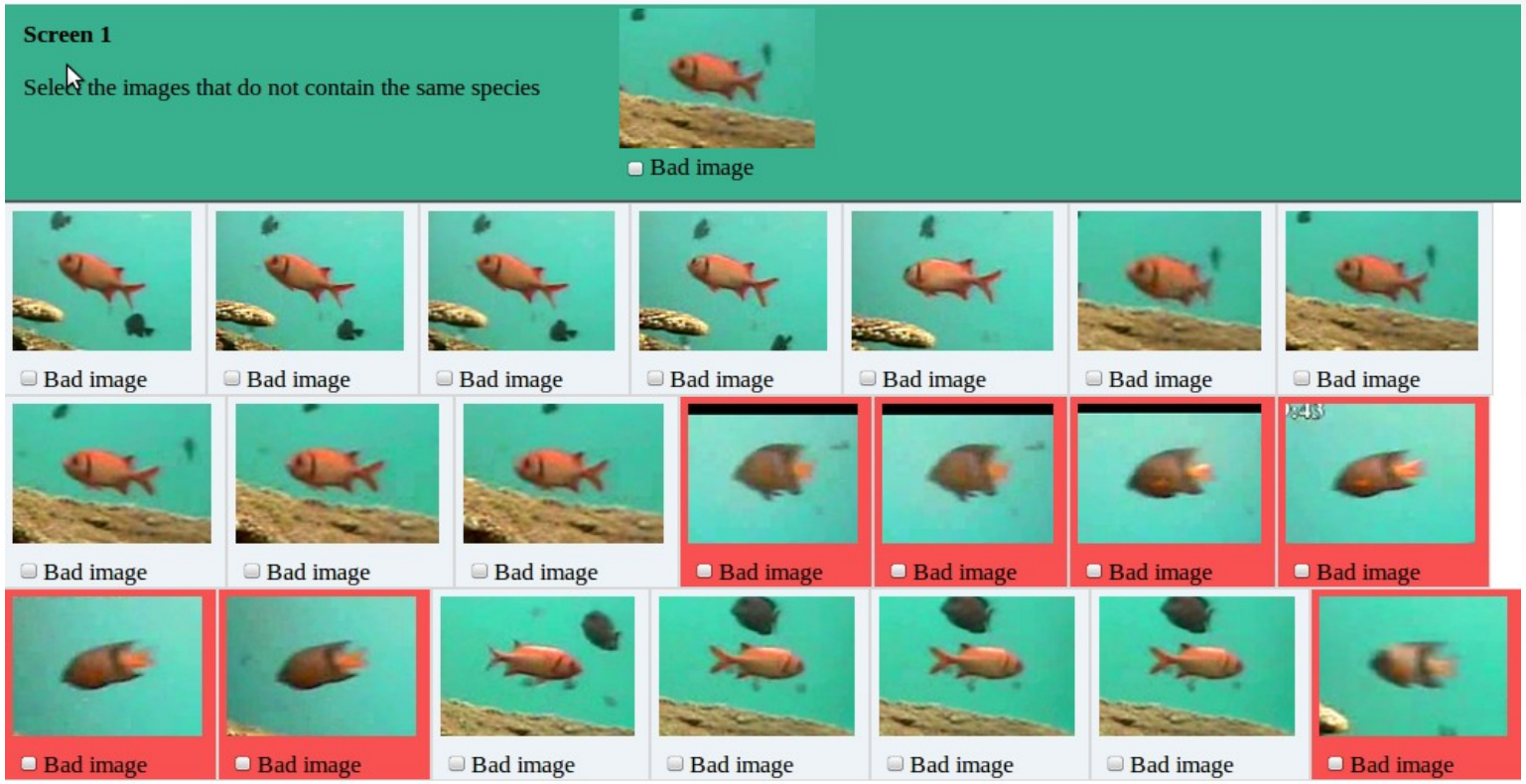


Combine Computer and Crowd Sourcing?

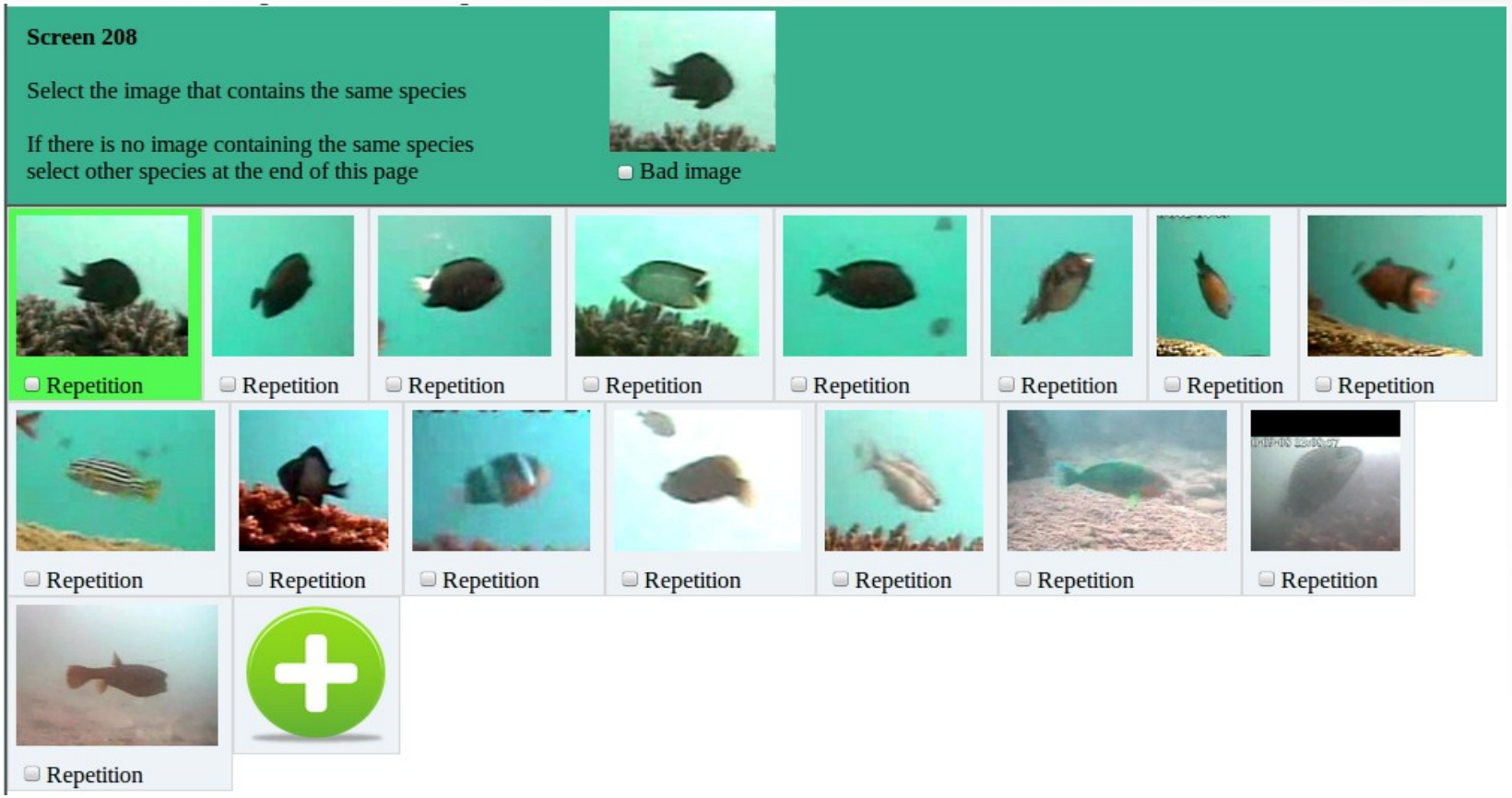
Clustering to support annotation



First Interface



Second Interface



Experiment setup

How many people?

- 6 person annotated all images, more person annotated part of database

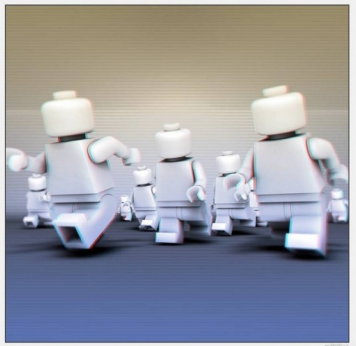
How many images labeled?

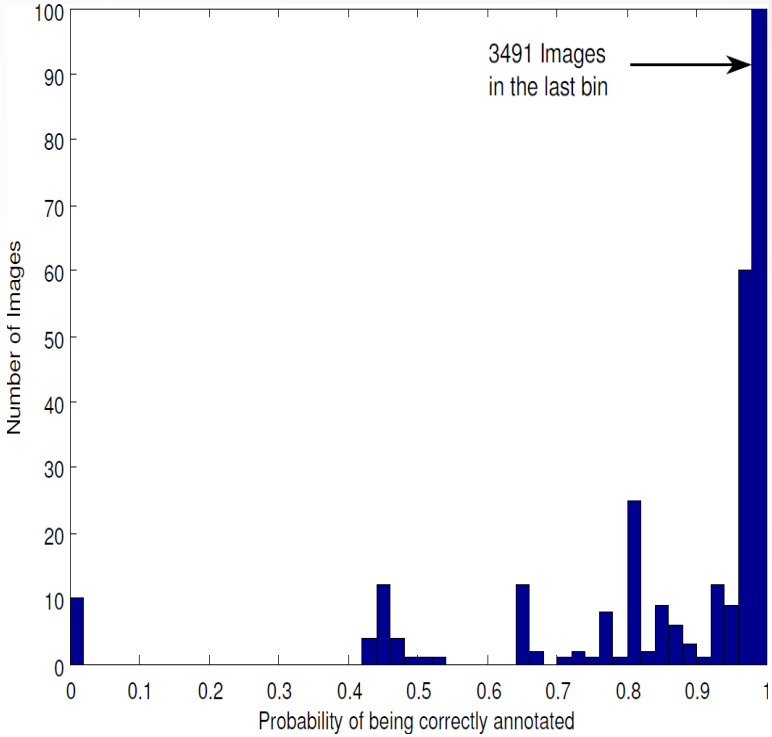
- 3678 fish images
- 158 labelled by marine biologists

User Performance

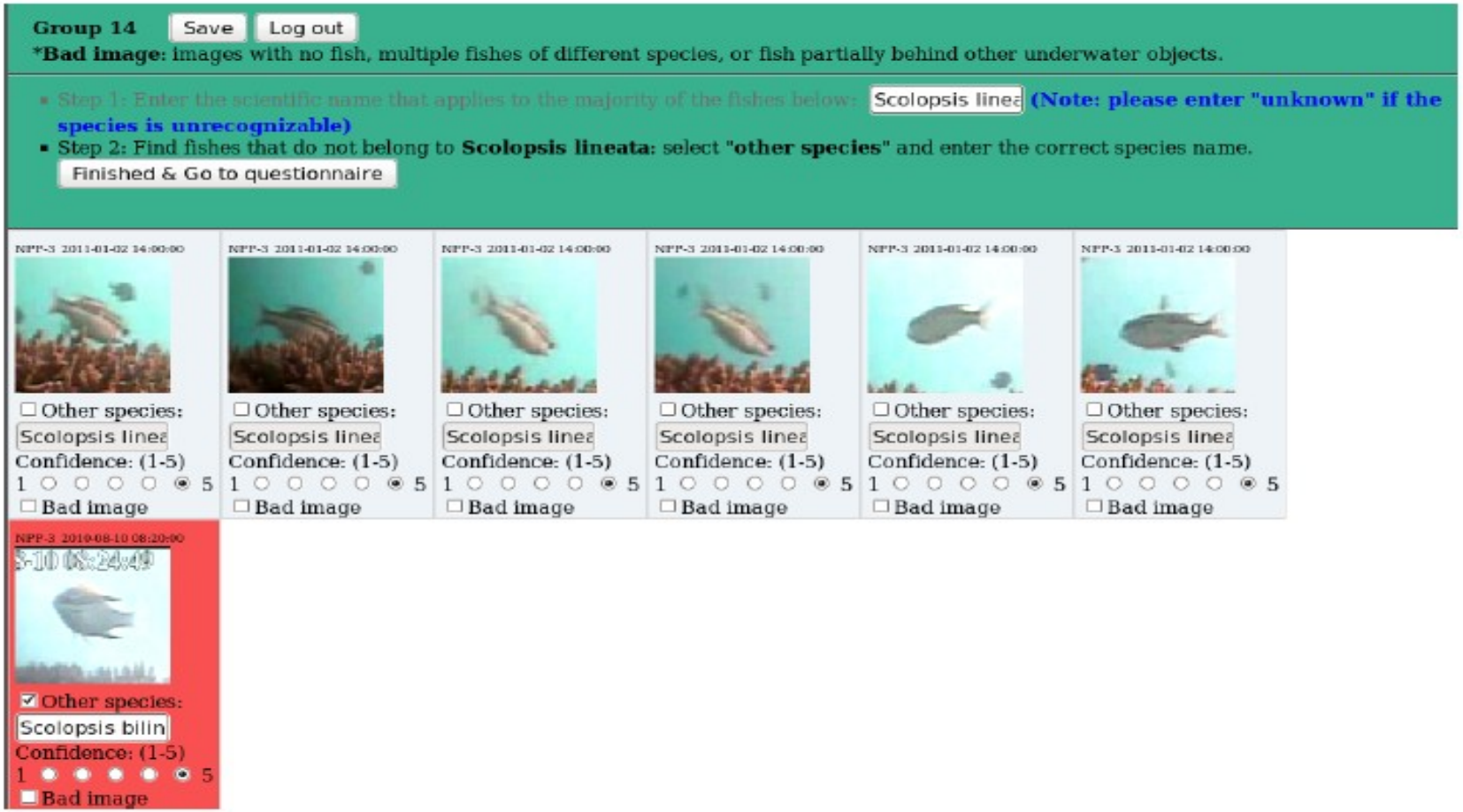
Measure probability of person being correct using annotations from biologists

Combining annotation of multiple persons





Interface for Marine Biologists



THE UNIVERSITY of EDINBURGH

Experimental setup

Three marine biologists from Taiwan with over 10 years research experience

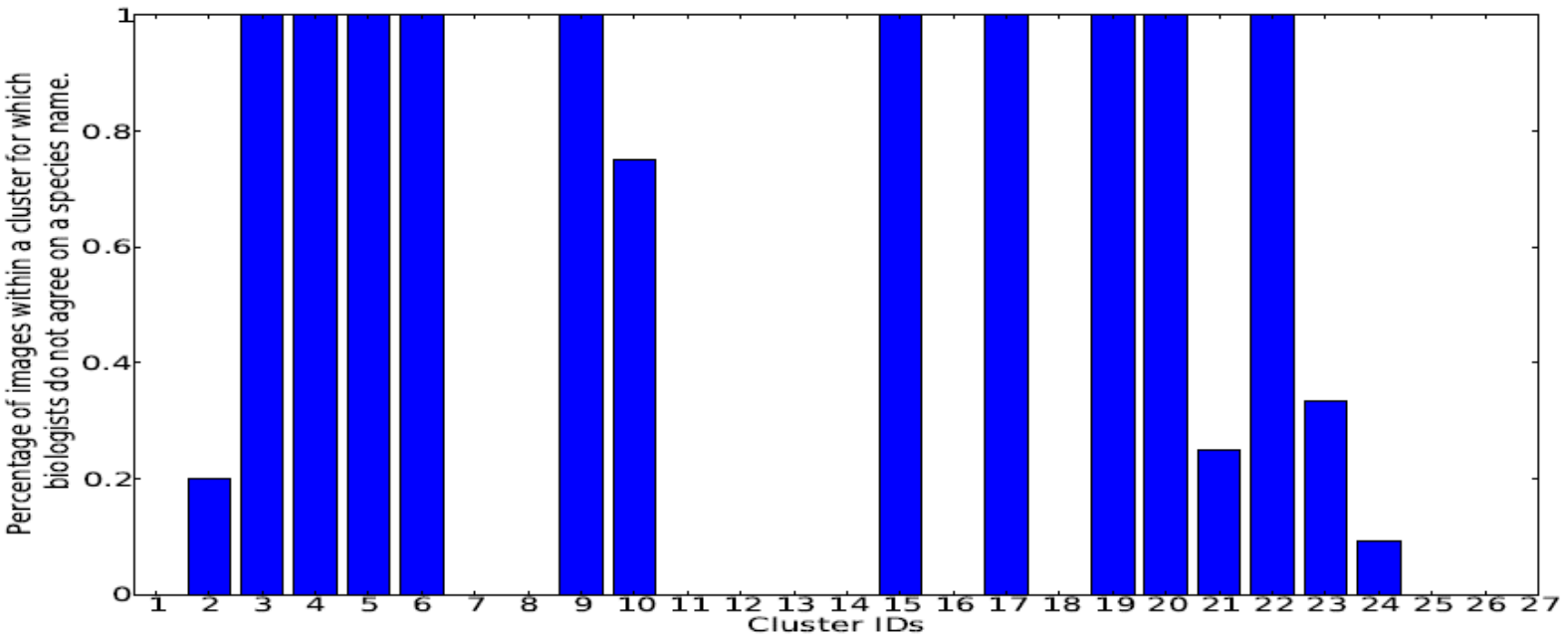
27 manually constructed clusters

For each cluster, at most 30 images are randomly sampled to be shown to the biologists

Agreement between Biologists

9/27 - disagree on all images at species level

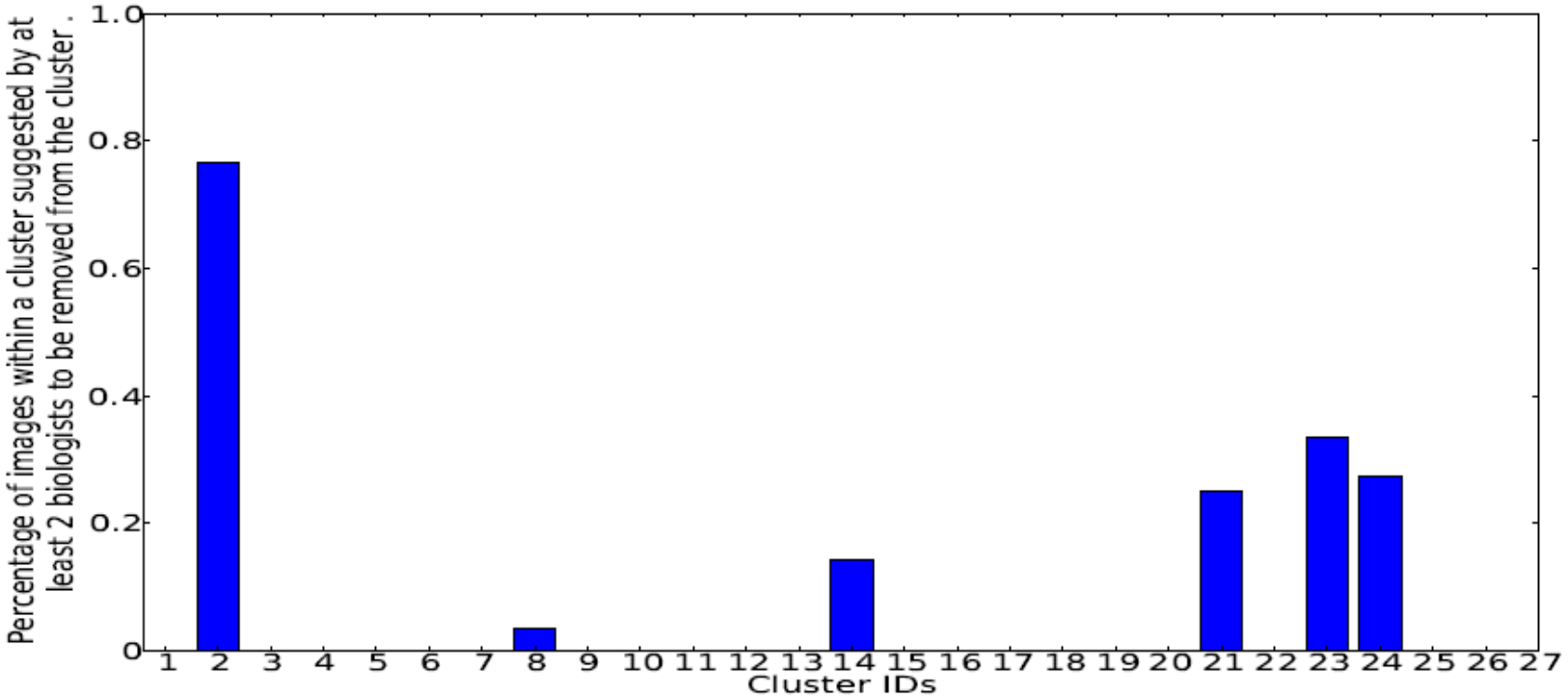
7/9 - agree at a family/genus level



User Performance

21/27 clusters – approved by biologists

Clustering difficulty != recognition difficulty



Questionnaire for biologists

What makes recognition difficult?

- 21/27 cases: low resolution
- 17/27 cases: there exist very similar species

What helps?

- 24/27 cases: features of the fish
- 15/27 cases: experience
- 5/27 cases: location
- 3/27 cases: better resolution

Future Work

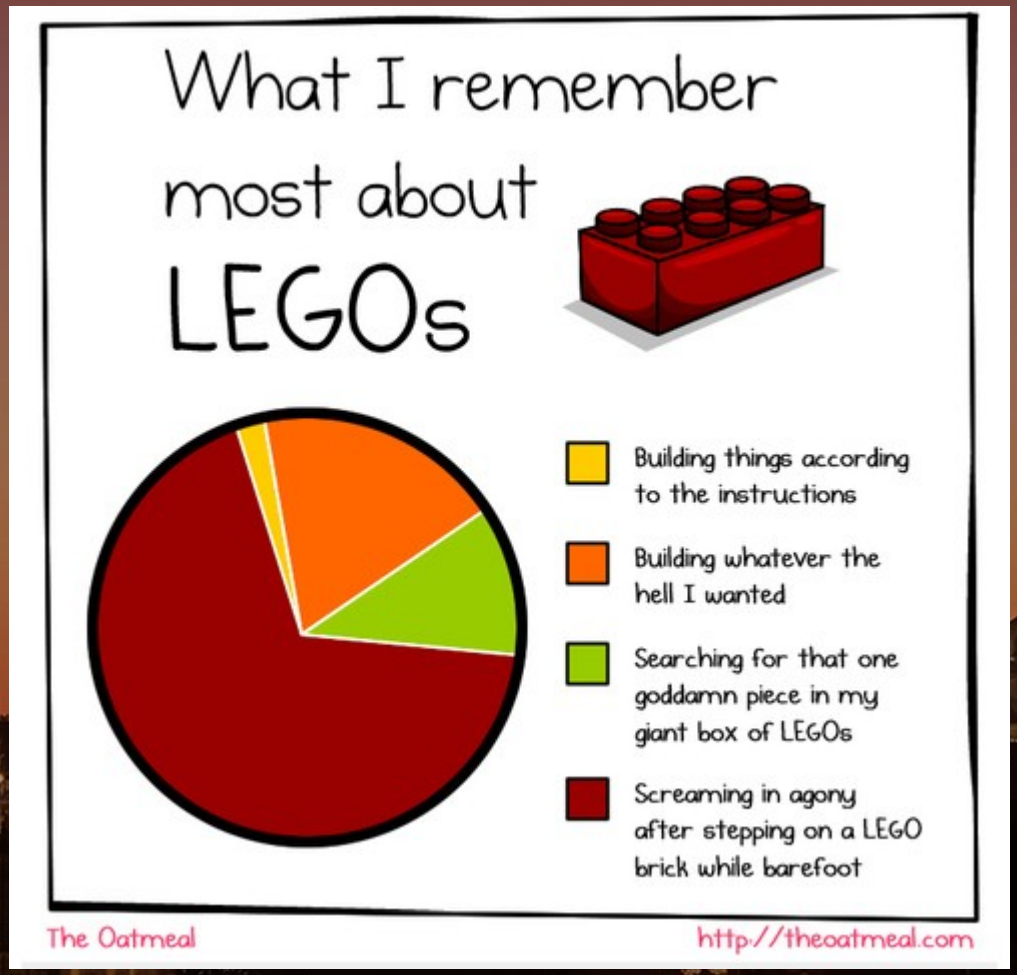
Start running the components on the clusters in Taiwan

Running/Combining/Testing of different component

Large scale database solution

First working system at the end of next year

Question


What I remember most about LEGOs
Building things according to the instructions
Building whatever the hell I wanted
Searching for that one goddamn piece in my giant box of LEGOs
Screaming in agony after stepping on a LEGO brick while barefoot
The Oatmeal
http://theoatmeal.com

THE UNIVERSITY *of* EDINBURGH