

Giving a Hand to Kinect

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Problem statement

Do not interfere with the action!

Microsoft Kinect

Given markerless visual observations,
detect and track in 3D
a performing hand

- 3D position/pose
- Full articulation

Unconstrained hand motion

Plus hand posture recognition!



Is this an **interesting** problem?

Theoretical interest

- Humans solve it, can computers solve it, too?

Practical interest in supporting the interpretation of human hand activities

- **Gesture Recognition**
- Human-Computer / Human-Robot interaction
- Sign language understanding
- Grasping
- Games
- ...



Is this an **easy** problem?

- Not really...
- A problem with high dimensionality...
- ... that needs to be solved based on relatively poor observations
 - Chromatically uniform appearance of the hand
 - Severe self occlusions
 - Severe hand/object occlusions (in case of hand/object interaction)
 - Distant views
 - Rapid hand motions



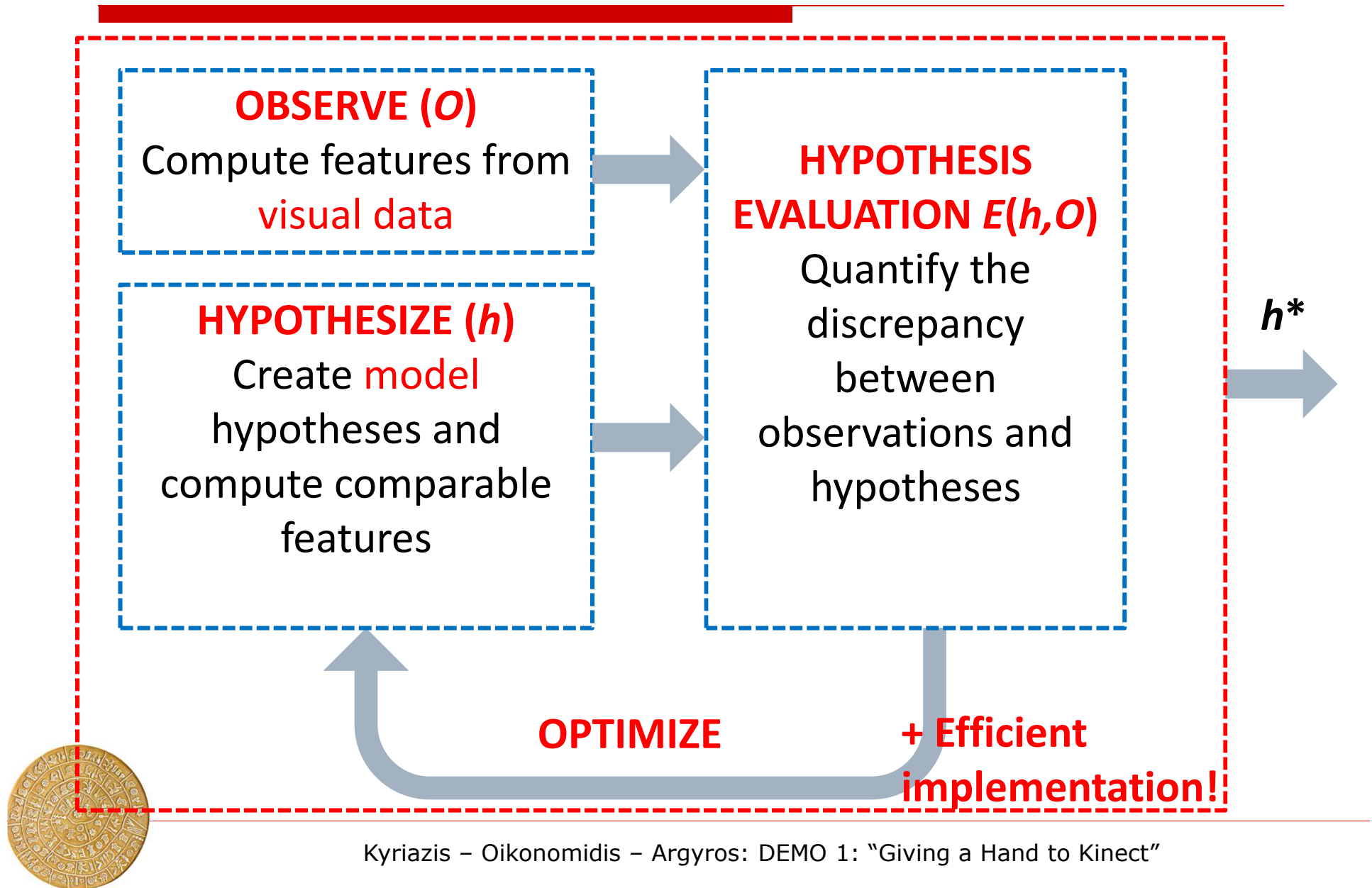
Tracking the articulation of hands

- Estimate the full 3D position, orientation and articulation (i.e., all joint angles of a performing hand)

	Multicamera setup	Kinect
A hand in isolation	ACCV'2010	BMVC'2011
A hand interacting with an object	ICCV'2011	CVPR'2012



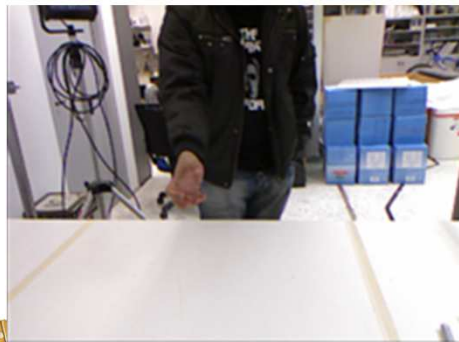
The proposed framework



3D hand tracking based on RGB-D images

- **The approach:**

- Get a Kinect frame as in (a), (b)
- Hand detection based on skin color and depth (c) [Argyros, ECCV 2004]
- Use the hand model of (d) (37 geometric primitives, 26 DoF)
- Fit the hand model (d) on the observation (c) with Particle Swarm Optimization to come up with the estimated hand pose (e)



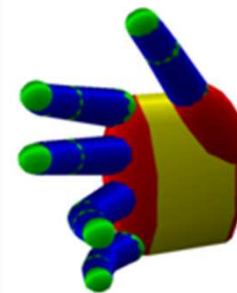
(a)



(b)



(c)



(d)



(e)



3D hand tracking based on the Kinect

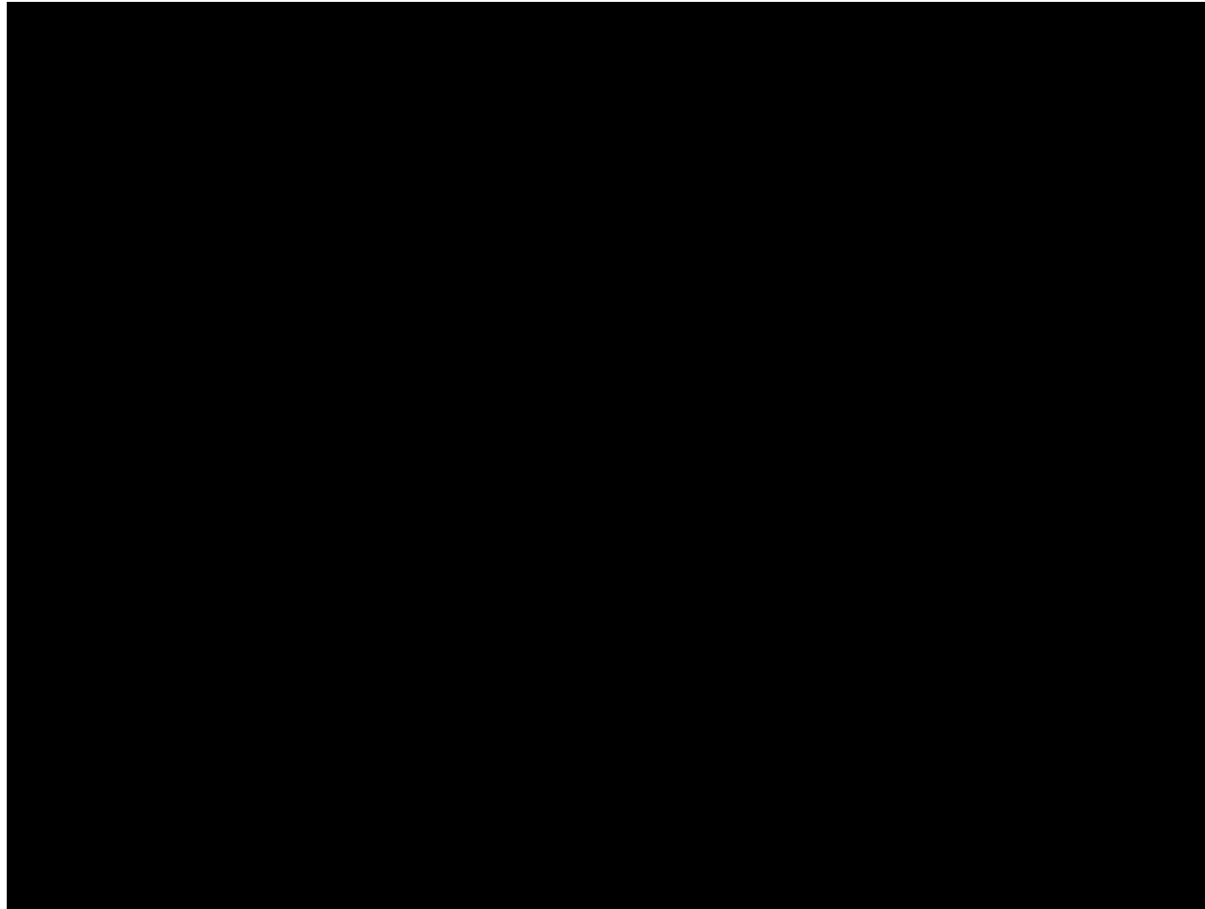
Efficient model-based 3D tracking of
hand articulations using Kinect



I. Oikonomidis, N. Kyriazis, A.A. Argyros, "Efficient model based 3D tracking of hand articulations using Kinect", BMVC 2011, UK, September 2011.

Kyriazis – Oikonomidis – Argyros: DEMO 1: "Giving a Hand to Kinect"

Tracking two strongly interacting hands

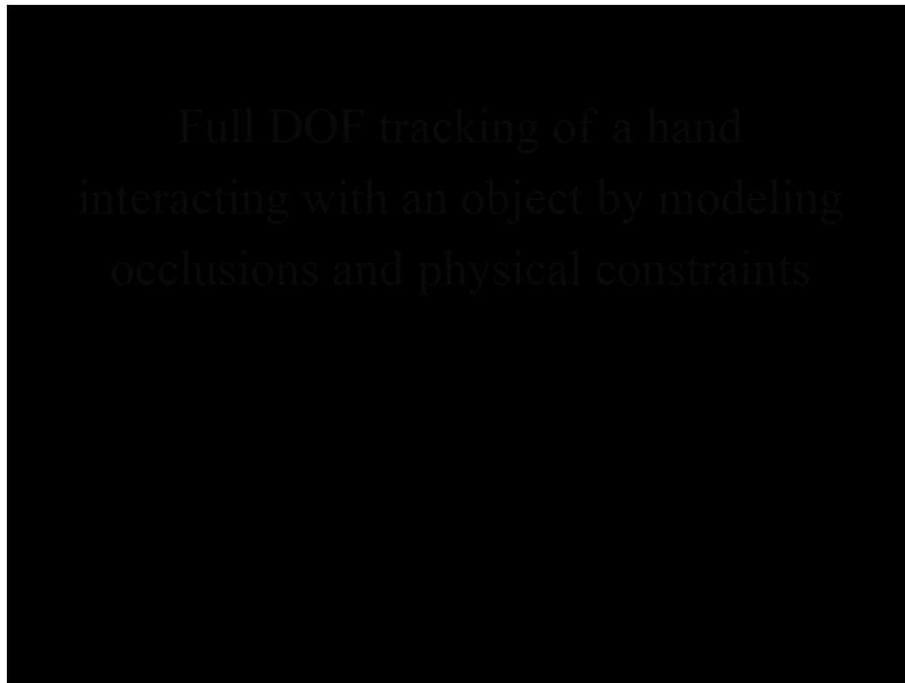


I. Oikonomidis, N. Kyriazis, A.A. Argyros, "Tracking the articulated motion of two strongly interacting hands", CVPR 2012, Rhode Island, USA, June 2012.

Kyriazis – Oikonomidis – Argyros: DEMO 1: "Giving a Hand to Kinect"

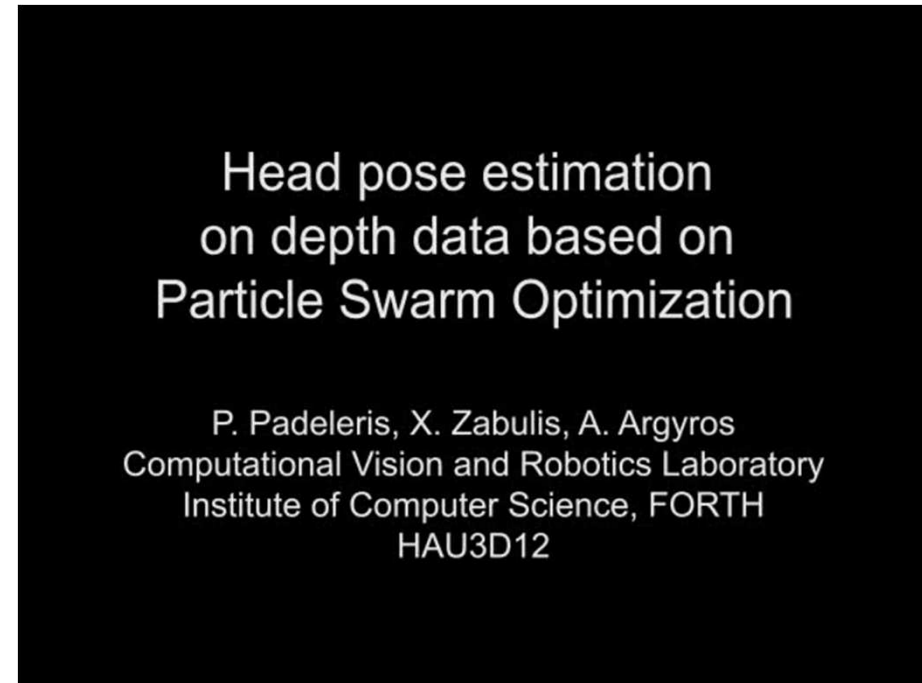
Same framework, other related problems

Tracking a hand in interaction with objects



I. Oikonomidis, N. Kyriazis, A.A. Argyros, "Full DOF tracking of a hand interacting with an object by modeling occlusions and physical constraints", ICCV 2011,

3D Head pose estimation



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P. Padeleris, X. Zabulis and A.A. Argyros, "Head pose estimation on depth data based on Particle Swarm Optimization", in HAU3D'2012 (CVPR 2012 workshop)



3D hand tracking within ChaLearn

- ❑ **Relevance:** Fundamental importance to gesture recognition
- ❑ **Usefulness:** Enabling technology for a diverse number of applications, several requests for cooperation from EU/US/Asia research labs and companies...
- ❑ **Technical and scientific contribution:** CVPR, ICCV, BMVC, ACCV, ...
- ❑ **Novelty/originality:** The first to demonstrate that a model-based approach can lead to practical hand tracking systems
- ❑ **Quality of implementation:** Demonstrator available for download (<http://cvrlcode.ics.forth.gr/handtracking>), a **library + API is on the way!**



... still

- *“The proposed demo is **not a gesture recognition system** per se but **a robust 3D hand tracking system** which is however an essential component for many gesture recognition systems” (20/10/2012)*

- So, we developed a hand posture recognition system (in 2 days!) and brought it to you:
 - Select your preferred hand postures at run time
 - See how the system recognizes them



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Thank you for your attention!

We are not only looking **at** people...
... we are also looking **for** people!!!

If interested, contact me:

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