Perceptual Computing Definition

Add “Senses” to the “Brain”:
Eyes, Ears, Voice, Touch, Emotion and Context for an immersive, intuitive and exciting life-like experience.
Perceptual Computing Drives Innovations

Gesturing UI Navigation

Gesturing Entertainment

Social Facial Interaction

Education, Training & Exercising
Perceptual Computing Ecosystem

- Announced at IDF San Francisco 2012
- Intel Perceptual Computing Challenge for 1 Million $
  - Phase one (closed on February 20th 2013)
  - Phase two (closed for submissions July 1st 2013)
- Intel Ultimate Coder Challenge

https://perceptualchallenge.intel.com/
Perceptual Computing Ecosystem

- PerC Workshops & Hackathons around the globe (1H 2013)
  - Sacramento (US), San Francisco (US), Nizhny Novgorod (RU), Munich (GER)

- Intel Capital creates $100M fund to invest in Perceptual Computing

“This new fund will invest in start-ups and companies enabling these experiences, helping them with the business development support, global business network and technology expertise needed to scale for worldwide use.”

“Thalmic Labs Secures $14.5 Million in Series A Funding led by Spark Capital and Intel Capital” June 5, 2013
Intel® Perceptual Computing SDK 2013
http://www.intel.com/software/perceptual

Interacting with Your PC in Ways that the PC “Perceives” Your Intentions...

Speech Recognition

Facial Tracking

Close-range Tracking

Poses

Finger Tracking

Hand Tracking

Gesture

Augmented Reality
Intel® Perceptual Computing SDK Architecture

SDK Utilities
SDK Frameworks and Language Ports

SDK Interfaces

Core Services:
- Context
- Module Loading
- Synchronization
- Interoperability

I/O Modules
- Multiple Implementations Available

Algorithm Modules
- Multiple Implementations Available
Intel® Perceptual Computing SDK Interface Hierarchy

Applications

C# Port

Core Framework
- PXCMSession
- PXCMImage
- PXCMAudio

I/O
- PXCMCapture

Algorithms
- PXCMGesture
- PXCMFaceAnalysis
- PXCMVoiceRecognition
- PXCMVoiceTTS

Pipeline
- UtilMCapture
- UtilMPipeline

SDK Frameworks and Language Ports

SDK Utilities

SDK Interfaces

Unity* Port

PXCUPipeline(C)

Processing Port

UtilPipeline(C++)

openFrameworks Port

UtilCapture(C++)
## Intel® Perceptual Computing SDK Extensibility

<table>
<thead>
<tr>
<th>SDK Feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support multiple input devices</td>
<td>User can use multiple input devices and select the input device in their application</td>
</tr>
<tr>
<td>Manage input devices</td>
<td>Easily share camera between applications</td>
</tr>
<tr>
<td>Wrap multi middleware</td>
<td>Easily support multiple usage modes within single app (e.g., finger tracking + speech + face tracking) or between apps</td>
</tr>
</tbody>
</table>
| Extensible framework         | 1. Developers can plug in own algorithms  
2. New usage modes can be added  
3. New devices can be supported |
| Support multi framework      | Unity, Processing, OpenFrameworks                                                                                                   |
| Support multi programming language | C/C++, C#, Java*                                                                   |
Creative* Interactive Gesture Camera
For use with the Intel® Perceptual Computing SDK

Key Specs
• RGB resolution: 720p
• IR Depth resolution: QVGA (320x240)
• Frame Rate: 30fps
• Size: 4.27in x 2.03in x 2.11 in
• Weight: 9.56 oz.
• Power: single USB2.0

Order at: intel.com/software/perceptual

• Small, lightweight, low-power
• Tuned for close-range interactivity
• Designed with ease of setup and portability
• Includes:
  – HD Web camera
  – Depth sensor
  – Dual-array microphones
Depth Sensor

RAW Depth

Depth Smoothing
Creative* SENZ3D* camera package

Planned to hit market in Q3 2013

Preloaded with perceptual powered applications:

• Nuance* Dragon Assistant – adds voice control to the PC

• FastAccess 3D – login to Windows using your face as password

• Personified Skype experience – ability to replace background in video call with any image

• ...

• And ... **GAMES**!!! Including special DLC for Portal 2
Perceptual Computing Roadmap

Now

Soon
Privacy Notification

Human perception is different when camera is constantly on

Ability to notify user when SDK applications access to PII (Personal Identifiable Information)

Raise the bar so that users can be comfort
Demo tool: Remote Control

Objective: Demonstrate using following “Perceptual” to augment keyboard and mouse and let application perceptual computing aware

• Gesture
• Face Recognition
• Voice Recognition

Tool provided with sources
# Gesture Recognition
Hand & upper body tracking and recognition

<table>
<thead>
<tr>
<th>Blob</th>
<th>Intermediate images and parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Background</td>
</tr>
<tr>
<td></td>
<td>• Left/Right Hands</td>
</tr>
<tr>
<td></td>
<td>• Objects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GeoNode</th>
<th>Geometric nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Fingertips, palm center, upper body</td>
</tr>
<tr>
<td></td>
<td>- 2D &amp; 3D coordinates, normal, etc.</td>
</tr>
<tr>
<td></td>
<td>• Hand grab: upper, middle, lower</td>
</tr>
<tr>
<td></td>
<td>• Hand openness</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gesture</th>
<th>Predefined gestures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• THUMB UP/DOWN, PEACE, BIG5</td>
</tr>
<tr>
<td></td>
<td>• WAVE, SWIPE LEFT/RIGHT, CIRCLE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alert</th>
<th>Predefined alerts when object touching boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• FOV_LEFT/__RIGHT/__TOP/__BOTTOM</td>
</tr>
<tr>
<td></td>
<td>• FOV_BLOCKED/__OK</td>
</tr>
<tr>
<td></td>
<td>• GEONODE_ACTIVE/INACTIVE</td>
</tr>
</tbody>
</table>
The Finger Skeleton and Data

**QueryNodeData()**
- PXCPPoint3DF32 positionWorld;
- PXCPPoint3DF32 positionImage;
- pxcU64 timeStamp;
- pxcU32 confidence;
- pxcF32 radius;
- Label body;
- PXCPPoint3DF32 normal;
- pxcU32 openness;

**QueryBlobData()**
- pxcU64 timeStamp;
- pxcU32 labelBackground;
- pxcU32 labelLeftHand
- pxcU32 labelRightHand

**QueryBlobImage()**
- PXCIImage** image;
Face Tracking and Analysis

Multiple face detection/tracking

Landmark detection
• 6/7-point detection including eyes, nose, and mouth

Facial attribute detection
• Age-group including baby/youth/adult/senior
• Gender detection
• Smile/blink detection

Face recognition
• Similarity among a set of faces
Voice Recognition and Synthesis

Nuance* Voice Command and Control
• Recognize within a list of predefined commands.

Nuance* Voice Dictation
• Recognize short sentences (<30 seconds).

Nuance* Voice Synthesis
• Text to speech
2D/3D Object Tracking

Track any 2D planer surfaces
• Report position, orientation and other parameters

Track limited 3D objects
• Based on 3D models

Track face orientations
Experimental modules

- The Intel® Skeletal Hand Tracking Library

Your own module?

• Each module implements interface derived from `PXCBase`

• Start from documentation related to “Module Development”

• Module can be registered or loaded on demand

• Core framework helps with asynchronous execution: `PXCSchedulerService`

• Module can be hardware accelerated: `PXCAccelerator`
HelloWorld

C++

class MyPipeline: public UtilPipeline {
public:
    MyPipeline(void):UtilPipeline() {
        EnableGesture();
    }

    virtual void PXCAPI OnGesture (PXCGesture::Gesture *data) {
        printf_s("%d\n", data->label);
    }
};

int wmain(int argc, WCHAR* argv[]) {
    MyPipeline pipeline;
    pipeline.LoopFrames();

    return 0;
}

C#

class MyPipeline: UtilMPipeline {
    public MyPipeline():base() {
        EnableGesture();
    }

    public override void OnGesture (ref PXCMGesture.Gesture data) {
        Console.WriteLine(data.label);
    }
};

class Program {
    static void Main(string[] args) {
        MyPipeline pipeline=new MyPipeline();
        pipeline.LoopFrames();
        pipeline.Dispose();
    }
}
How Do I Get Started?

1. Download the Intel® Perceptual Computing SDK 2013 from [intel.com/software/perceptual](http://intel.com/software/perceptual). It includes:
   - Intel Perceptual Computing API
   - Usage Modes Supported:
     - Gesture Recognition
     - Facial Tracking and Analysis
     - Voice Recognition
     - Augmented Reality
   - Documentation
   - Perceptual Computing Demos/Samples

2. Order a Creative Interactive Gesture Camera Developer Kit:
   - Order a camera at [intel.com/software/perceptual](http://intel.com/software/perceptual)

3. Get the Help You Need Getting Started:
   - Documentation, Tutorials, Showcase Apps
   - Support Forum: [intel.com/software/perceptual](http://intel.com/software/perceptual)
Intel® Perceptual Computing SDK Website

Your One-stop Shop for Information & Support

• FREE Download of SDK
• Camera Ordering
• Product Briefs
• Getting Started Guide
• Tutorials
• Showcase Apps
• Support Forum

intel.com/software/perceptual
Demo Stand: Experience different demos

Objective: experience different Demos/Samples in the different areas developed by using the Intel® Perceptual Computing SDK.

• Kung Pow Kevin
• A Million Minions
• Lightning
• Solar System
• Ballista
• ...

![Demo Stand Images]
Demo Stand: Experience Different Demos—Unity*

Augmented Farm

Head-Coupled Perspective

Glass Balls

......
Summary and Intel® Perceptual Computing SDK Future

What we are learning today

- Experience “Perceptual”
- Know details about existing modules
- Aware about possibility to create your own module
- Experience various usage from different demos/samples
- Know how to start to use Intel Perceptual Computing SDK and get resources for **free**

Intel Perceptual Computing SDK future roadmap

- More features and improvements will be supported
- More devices will be supported
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