

Amaze Your Users With Augmented Reality

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360iDev 2013

Contents

- Evolution of Smartphone Development And Augmented Reality
- Available Augmented Reality SDKs and Technologies
- Design Considerations
- Questions

Bio

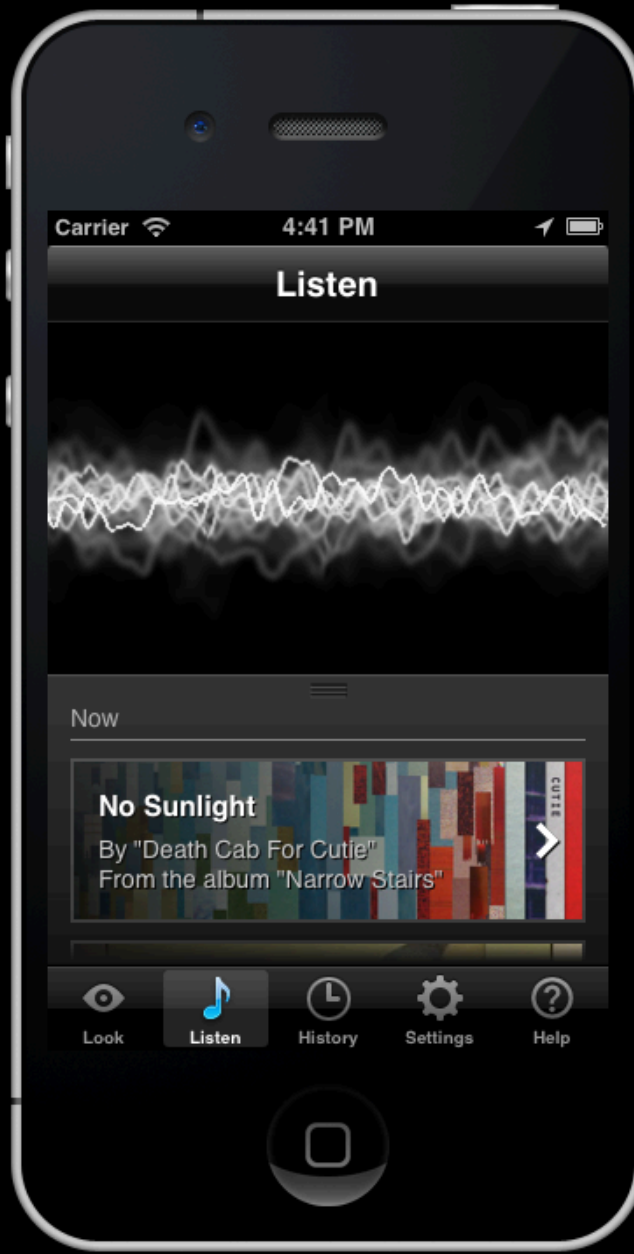
- Full time iOS/Android Developer.
- Moved to Objective-C/Cocoa in 2001.
- Started iOS development when the SDK was announced.
- Worked on shareware, database applications, Final Cut Pro, Photoshop and Premiere Plugins, and mobile development.
- Currently iOS Developer at Digimarc on the Application's Team.




Digimarc

- Research focused, publicly traded company based out of Beaverton, OR.
- Focused on Augmented Reality Research and SDKs.

Digimarc Discover

- Scans for barcodes
- Scans for our own special audio and visual content
- (Previously) Music Identification
- Saves content for later viewing



Carrier  4:41 PM  

Listen








Now

No Sunlight

By "Death Cab For Cutie"
From the album "Narrow Stairs"



-  Look
-  Listen
-  History
-  Settings
-  Help

Why Augmented Reality?



Nintendo 3DS Augmented Reality Games (erste Deutsche Version) - <http://www.youtube.com/watch?v=GryGuy3-Zlg>

Augmented Reality For The Rest Of Us

(But We'll Talk About How To Make 3D Characters Appear On A Card Too)

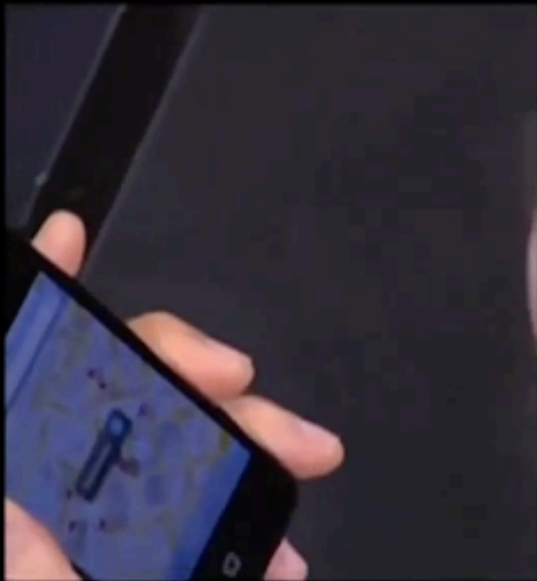
Early Mobile Development

- Concentration on navigating a “Network of Devices”
 - Email
 - Web Browser
 - Other Devices or Computers



iPhone

- Great for talking to devices!
 - Real web browser for talking to HTTP servers!
 - Bluetooth and Wifi for talking to headsets and Wifi routers!
 - iPod Dock Connector for talking to computers!
 - (Eventually) MobileMe for talking to the cloud!



Maps Demo

- Showed how a mobile device could interact with things around the user.
- Instead of abstracting devices, Maps abstracted physical things, providing a new view of the world around the user.
- Early technology stitched together existing technologies - maps, landmarks, place metadata - to provide a new abstraction for a physical environment and make for an amazing experience.

Network Of Devices

Network Of Things

But *Things* Don't Have
IP Addresses!

(Usually)

So How Do We Talk To
Things?

Augmented Reality

- “Augmented reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data.” - Wikipedia, http://en.wikipedia.org/wiki/Augmented_reality

TELUS LTE 4:54 PM 75%

today all missed

Wednesday, June 12th

Mostly sunny currently. The high will be 21°. It will be mostly clear tonight with a low of 12°.

Right now, it would take you about 1 hour to drive to Saint-Paul-d'Abbotsford.

Calendar


5

6

Carrier 12:18 PM

Done Mirrors

JT THE 20/20 EXPERIENCE AVAILABLE NOW iTunes



Mirrors Justin Timberlake Download on iTunes

THE 20/20 EXPERIENCE

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YouTube Videos



LEARNING iOS DESIGN
A Hands-On Guide for Programmers and Designers

Learning iOS Design: A Hands On Guide For Programmers And...

Product

Search

Context + Content

Context + Content

- Context is provided by the sensors on the device.
 - The Maps application finds waypoints around you based on location data provided by both GPS and the onboard Wifi.
- Content is the information the context is used to filter.
 - In the Maps application Apple's waypoint database is filtered by the user's current location.

But I write an SSH
client. Why does this
matter to me?

- Maybe your application can remember settings based on location.
- You could also scan content from printed materials to add convenience for your users.
- Remind your user about something that's nearby.
- Use sensors to build a usage pattern and have helpful information ready for your users before they ask for it.

So How Can We Use
These Sensors? (APIs)

Camera

- iOS devices include great, high quality image sensors that can be manipulated by AVFoundation API.
- All current Apple devices ship with front cameras, and most ship with rear cameras.
 - The lowest end iPod Touch current has no rear camera.

AVFoundation - built in AR!

- Apple has begun rolling out some AR functionality through CoreImage.
- iOS 6 defines a CIDetector class that currently only provides face recognition.
- API to pay attention to in future releases.

Barcodes

- Almost all products that are packaged have barcodes. This provides an easy path for any application that is product or shopping oriented.
- But identifying what item the barcode belongs to can be difficult. A barcode is a unique number, but it doesn't provide any other identifying information about a product.

Barcodes

- There are some free-to-access databases that are crowd sourced.
- Retailers are a great channel for getting information on products based on UPC code.
 - Google Shopping can search for products based on UPC code.

Barcodes

- Retailer information can also be heavily guarded.
 - There is concern from retailers that having an API would let competitors run automated scripts to instantly price match.
- Delicious Monster (makers of Delicious Library) had their iPhone application yanked from the App Store because Amazon didn't want their API to be used on mobile devices.

Barcodes

- QR codes are another way to embed information on real world objects, and they're easy to create.
- They can hold any arbitrary data, not just URLs.
- They can also be ugly.

Barcodes

- Several SDKs available to read barcodes
 - Zxing (pronounced Zebra Crossing)
 - ZBar
- These APIs can read UPC, EAN, and QR codes, among many other types.

Digimarc Discover SDK

- Digimarc's Discover SDK allows you to read data from images that have been embedded with invisible "watermarks."
- Watermarks can be embedded into images via our web portal or a Photoshop plugin.

Digimarc Discover SDK

- On detection, a 32 bit or 64 bit id is derived from the hidden mark in the image. Once you have that payload, our servers can use that as a key to return your application actual content.
- Highly accurate, but the media that is being read must have been previously marked.
- API is designed so that any Discover enabled application can read any Discover enabled media, no siloing.

Digimarc Discover SDK

- Sports Illustrated Swimsuit Edition
- Cooking Light
- House Beautiful
- Packaging

Content Recognition/Metaio

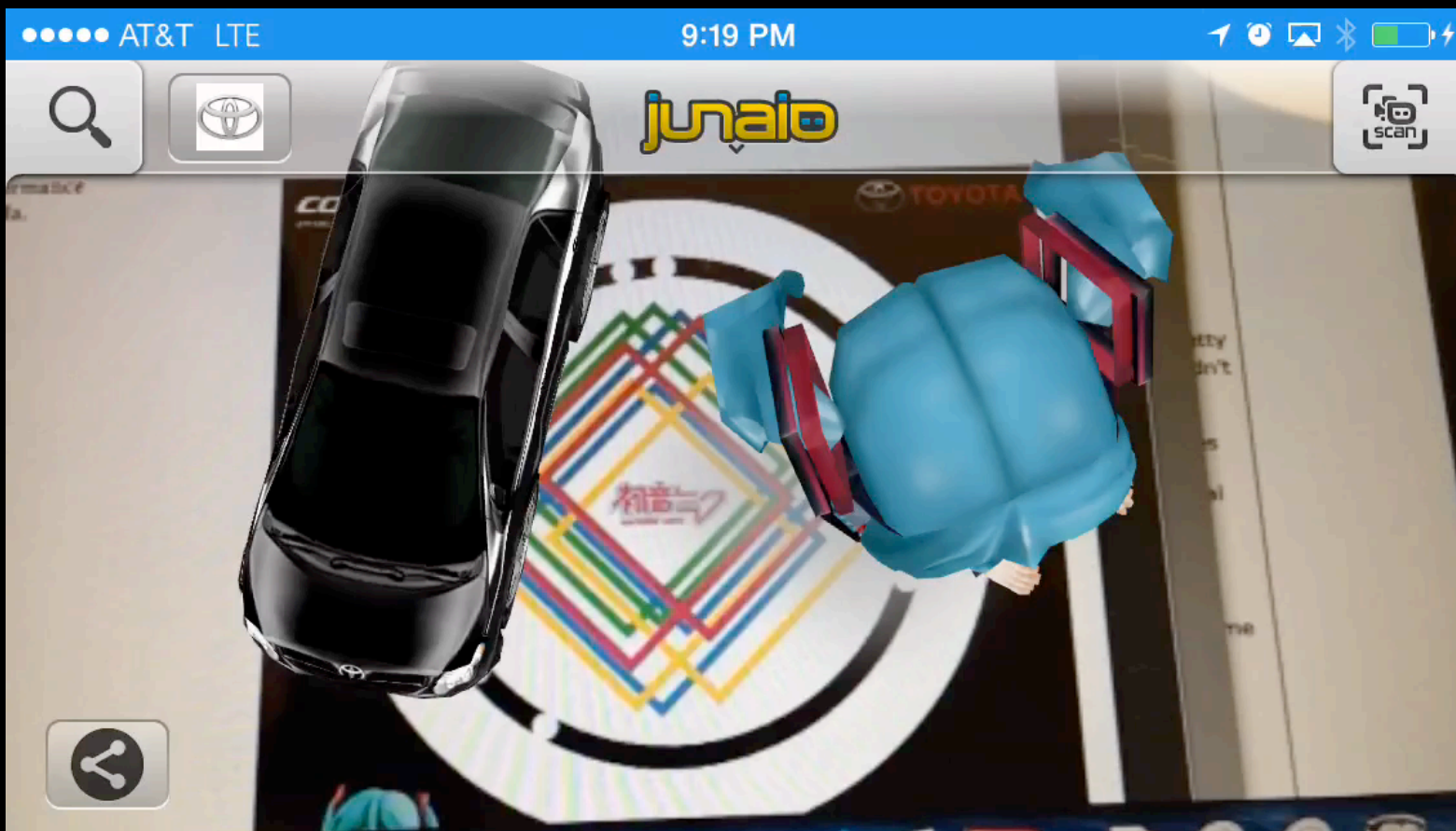
- Metaio is an augmented reality platform built around image recognition with an available SDK. Uses algorithms to try to match different characteristics of an image against a database.
- Several other comparable platforms such as Layar and Aurasma.
- Because Metaio knows more details about the image itself, the API can be used for projecting 3D objects or videos onto surfaces.

Metaio Demo



Metaio Hello World: <http://docs.metaio.com/bin/view/Main/HelloAugmentedWorldExample>

Metaio Demo



Content Recognition/

- Image analysis algorithms specific to this sort of AR are making guesses as to which different images are supposed to match different pieces of content. Can lead to confusion of different images in an app.
- As an application's database of known images gets larger, risks of false positives increase.
- But if absolute reliability isn't required, and you do want features like 3D projection, this technology is a good choice.
- Doing this processing in the cloud is also possible (Google Goggles).

OCR

- Optical Character Recognition
 - Tesseract-ocr is an open source OCR SDK originally created by HP and now maintained by Google.
- Several real time text translation apps around OCR. One of the first was an iOS app called “Word Lens”.
- Many other use cases. Reading business cards, invoices, addresses, etc.

Word Lens



OpenCV

- “OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products.” - <http://opencv.org/about.html>

OpenCV

- “...can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc.” - <http://opencv.org/about.html>

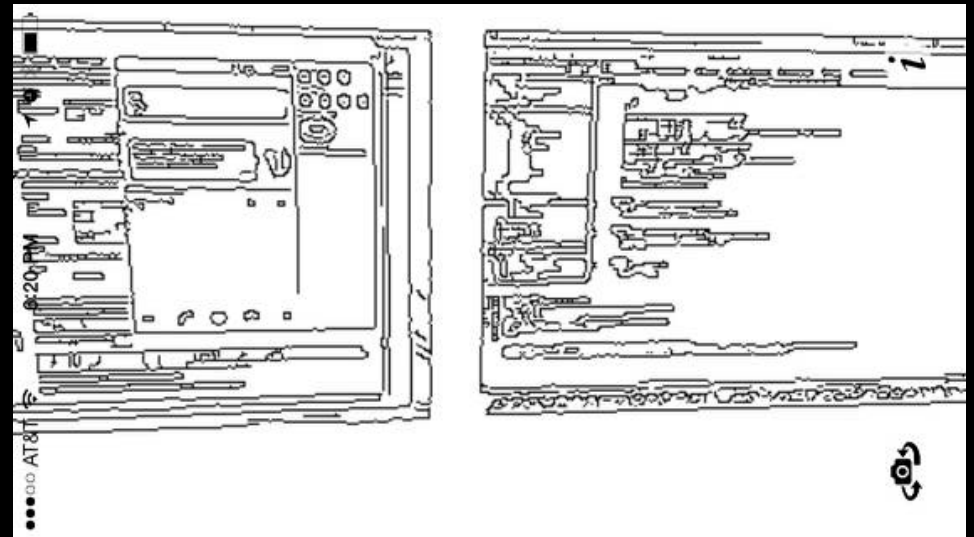
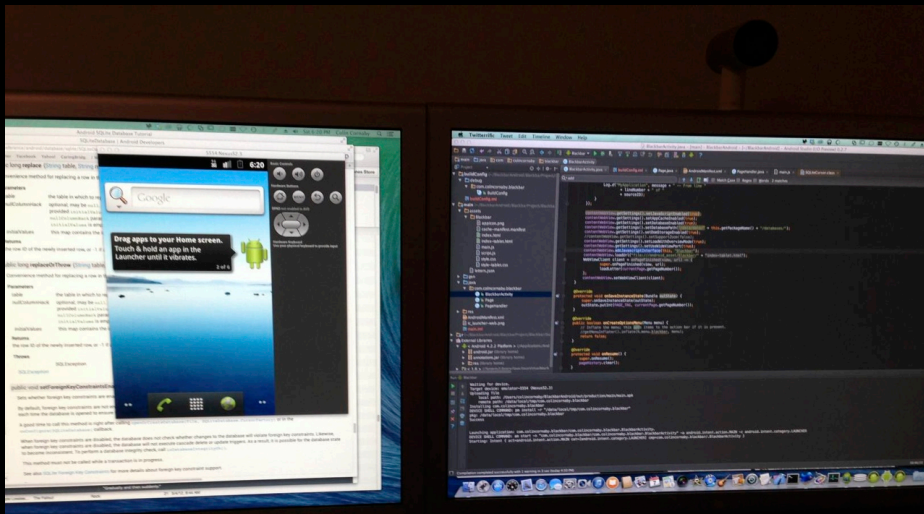
OpenCV

- Open source and constantly evolving.
- Work on the iOS version is still ongoing.
- The most bleeding edge, and possibly the most feature rich SDK for augmented reality.

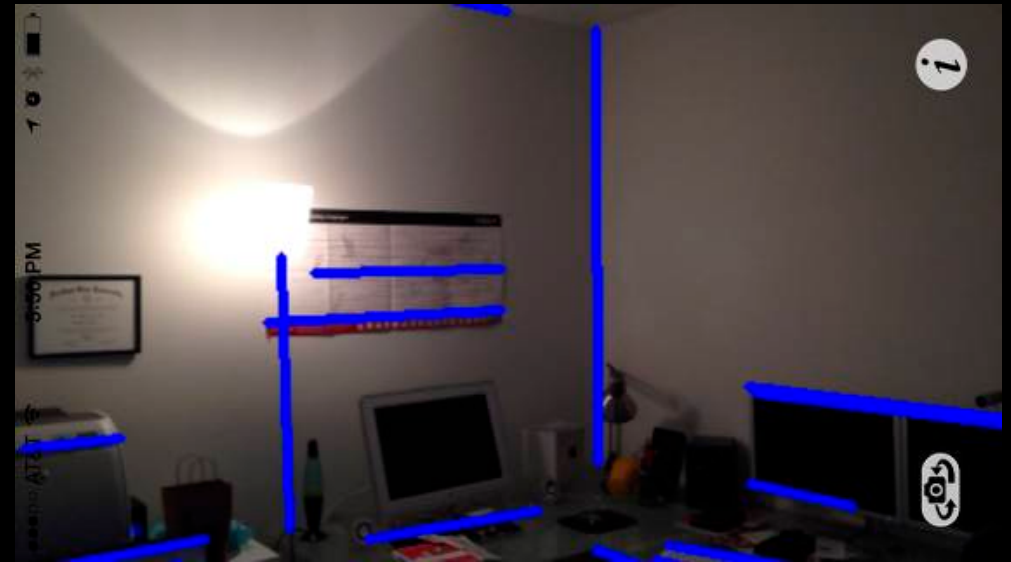
CVFunhouse

- Demo project for OpenCV on iOS
- <https://github.com/jeradesign/CVFunhouse>

Canny Edge Detection



Hough Transform



**Apps that Can See: Getting Data from CoreImage to Computer
Vision**

Carl Brown

Monday, 11:50, Salon C

Microphone/Audio

- All iOS devices have some sort of audio input.
- One advantage of audio is that it's the interaction with it is passive. It doesn't necessarily require the user to do anything special with the device.
- Audio recording is also a supported background mode.

Digimarc Discover Audio SDK

- Works very similarly to our image based SDK. Can recognize a payload that has been embedded into an audio track, and then our servers can provide a link to related content.
- Very reliable and very fast, as long as you can supply pre-hinted content.
 - Great for TV commercials, retailers, hinted music, etc.
- Hinted content can currently be created at our web portal.

Digimarc Discover Audio SDK

- Identification of Marked Content
 - Music Content
 - Radio
 - Television Shows/Commercials
- Locational Awareness

Gracernote

- The Gracernote SDK analyzes music through the microphone to try to identify the track.
 - It will also provide metadata such as the artist, album, current time in the track, etc.
- Available freely for non commercial use.

Gracernote/Entourage

- Entourage is a second API from Gracernote that tries to provide real time music recognition.
 - No button to hit, Entourage is built to be continuously listening.
- Contains capabilities for identifying TV content.
- Also has features to try to infer properties from audio. Is it music or speech? Did the track just change?

Accuracy

- Like image recognition, can suffer from accuracy issues.
- But it's the best way to build an app that understands content that you can't control or pre-hint.

Location

- Location can be used to build a great standalone or complimentary augmented reality experience.
- Apple's CoreLocation framework can provide coarse and fine grain location.
- On devices with GPS hardware this location can be very exact.
- Also supported as background mode. Can provide feedback based on entering a location or location changes.

Geocoding

Portland, OR



45°31'12''N 122°40'55''W

Reverse Geocoding

45°31'12"N 122°40'55"W



Portland, OR

Geocoding

- Both geocoding and reverse geocoding are supported by CoreLocation.
- You can even geocode and reverse geocode with the native Address Book API data structures.
- Note: Under iOS 5 and earlier, these requests are routed through Google, and they may have restrictions on how you can use these calls.

Location - Magnetometer

- Many iOS devices (iPhones and iPads) feature a Magnetometer sensor that can act as a compass.
- Typically used to infer what direction the user is facing in relation to points of interest in the world around them.

Magnetometer



<http://www.joinpad.net/augmented-reality-2/>

Augmented Reality Geolocation Math

Dalmo Cirne

Tuesday, 12:30, Salon C

Bluetooth LE Beacons

- Small, low power beacons suitable for providing micro location.
 - Bluetooth 4.0 means no pairing
- Pocket sized and last for years of a single battery
- Multiple Vendors
 - KS Technologies - <http://www.kstechnologies.com/products/ibeacon-alpha-program-participants-only>
 - Tōd - <https://www.todhq.com>



What does a beacon

- UUID
 - This identifies a beacon as yours.
- Major ID
 - Can be anything you want. Possible use as a category. Usual example is a store location, where UUID defines the store chain.
- Minor ID
 - Also anything you want. Usually a sub attribute of major - i.e. a store aisle.

Bluetooth LE Beacons

- Beacons last years on a single battery
- They're also portable
 - Carry one on you, stick one in your car, put one in your backpack, etc.
- Bluetooth LE means you don't have to pair them.

Beacon Distance

- You can test the wireless strength of a signal to imply distance from the beacon.
 - Common example: Beacon broadcasts from cash register in store. One action when the user enters the store, another action when they are at the cash register.

API for iOS?

Bluetooth Beacons



Bluetooth Beacons



CoreLocation

Bluetooth Beacons



CoreLocation

Location is a supported background mode

Bluetooth Beacons



More Frameworks?

Bluetooth Beacons



iOS Device As Beacon?

KST Technologies - 360iDev

- KS Technologies has hidden several Bluetooth beacons around 360iDev.
- Play with the technology - especially if you're on iOS 7!

Write Your Own!

- iOS has a lot of tools for creating great augmented reality experiences from scratch!
 - Grand Central Dispatch for harnessing multiple cores
 - Accelerate/NEON for fast processing of audio or video frames
 - CoreAudio/AudioUnits for best in class audio processing
 - AVFoundation for video sources

Design Considerations

Power Usage

- CPU Power is advancing, and batteries aren't.
- Will a user expect your application to last all day?
- Write better, more battery friendly algorithms.
- Or use lower power sensors to inform higher powered sensors.
 - Accelerometer or basic microphone data doesn't require much power to acquire.

Understanding Context

- Some information your application ingests might need to be processed.
 - OCR could read any string, and your application may not understand the content.
 - A QR code could contain any information.

QR code example



<http://apple.com>

BEGIN:VCARD
VERSION:3.0
N:Appleseed;Johnny

The quick brown fox...

QR code example

- How do we know if a QR code contains a URL?
 - ✗ It starts with http or https
 - ✗ Ask if iOS can handle this URL
 - ✗ It ends in .com
 - ✗ It has a TLD

```
NSDataDetector *detector = [NSDataDetector  
    dataDetectorWithTypes:NSTextCheckingTypeLink  
    error:&error];  
  
NSArray *matches = [detector matchesInString:string  
    options:0 range:NSMakeRange(0, [string length])];
```


Data Detectors

- Data Detectors are a great hidden gem on iOS.
- Given any arbitrary string, a data detector can find and sanitize dates, addresses, links, phone numbers, and transit information.
 - A basic use might be coding an OCR app that could recognize a phone number or a link off a printed page, and then understand and use the content!
- Wrapped in the NSDataDetector class.

Privacy

- Device sensors may collect a lot of data on the user, and require usage of data that has been collected by the user.
- Still an open question. What is the right balance for users?
- If you're collecting data or using device sensors, be clear about what you are doing, why you're doing it, and what data is being collected.
- iOS will ask the user's permission automatically for many different sensors.

Gamification

- Bridging virtual gaming to the real world.
 - Scavenger hunt model
 - Foursquare, Facebook, etc.
- Great way to keep users interacting with your brand or your physical presence.

Mis-identification

- Technologies that use algorithms to guess what content is can sometimes guess wrong.
 - Music identification SDKs and apps can get a song wrong.
 - Image matching algorithms can get confused and return the wrong result.

No Results

- A song matching application may not be able to get a result in a room that's too noisy.
- A barcode reader might not be able to read a barcode that's on certain surfaces, or a QR code that is too complex.
- Users might try and use your application with objects that your application was never designed to work with.

Manage Expectations

- Make clear to the user what sorts of objects your application is intended to work with.
- Depending on the technology you are using, assume your application could be wrong.
- Gracefully provide feedback to the user.
 - Infer behaviors. If the user hasn't triggered any behaviors in your application, they could be trying to interact with something your application doesn't understand.

What's Next?

Wearable Computing

- Google Glass and the iWatch
 - Opens the door to true always-on augmented reality.
 - Phones are great devices, but you have to take your phone out of your pocket and activate the right app.

Wearable Computing

- Other Devices Just Provide Sensor Input From the World Around You Or Your Own Body
 - Fuelband
 - Fitbit
 - Glucose Meters

Apps that Can See: Getting Data from CoreImage to Computer Vision

Carl Brown

Monday, 11:50, Salon C

Augmented Reality Geolocation Math

Dalmo Cirne

Tuesday, 12:30, Salon C

Take the Red Pill and Leave the Matrix: Writing Apps for the Physical World

Carl Brown

Tuesday, 5:10, General Session

Questions?

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Digimarc

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