Development Team

Ryan Kirkpatrick
Dali Xiao

Dang Nguyen
Min Jian Yang

What is IEA?
Input Spec
Design Overview
Demo
Sponsors

Development Team
What is IEA?

➢ IEA – Intelligent Engineering Assistant

➢ https://iea.ece.ucsb.edu/
What is IEA?

Manufacturing Process → Class Probe → Wafer Probe

Packaging → Burn-in → Final Test

Shipped to customers → Customer Returns

Production → Test → Interface

Findings

Autonomous System to execute the tasks

PPT Presentation

Analytic Workflow

yield issue
IEA Linguistics

The Speech Recognition and NLP Component

The AI System

Integration $\Rightarrow$ Autonomous Execution $\Rightarrow$ IEA

➢ Improve linguistic portion for deployment

➢ Make a robust, user-friendly, and intuitive NLP interface

➢ "Human-to-machine interface"
Usage Flow

Autonomous Analytic Portion

Presentation Portion

What is IEA?
Input Spec
Design Overview
Demo
Sponsors

Development Team
Input Spec to IEA Linguistics

Analytic Results

Product A
- Yield Excursion
- Failing Bin Analysis
- ...

Product B
- Wafer Pattern Analysis
- Correlation & Association Analysis
- ...

Development Team
- What is IEA?
- Design Overview
- Demo
- Sponsors

Input Spec

Input Spec to IEA Linguistics

Product A

- Yield Excursion
- Failing Bin Analysis
- ...
- ...

➢ Analytic Results
  - Locally Stored Results
    - Interesting
    - Non-interesting
    - Supporting
  - Infrastructure Data
    - Pointers for access non-local database

- Analytic Metadata
  - Attributes & parameters
  - Internal types
  - Various settings
(allow queries for analytic results not found on local data)
Design Overview

*GUI & Apps made for demo purposes and is not the main focus of this project
**Design Overview – Speech Handler**

- **Passive Listening**
  - Block user input while speaking
  - Listens to user after speaking
  - Repeat

- **Google S2T**
  - Converts speech to text
  - Returns different possible conversions
  - E.g. “way for” vs “wafer”

- **Text Sanitizer**
  - Improved vocabulary for our application context
  - Off-the-shelf tools are available
  - By implementing our own, for robustness and flexibility

- **Amazon Boto3 T2S**
  - Converts text to audio
  - Friendly development infrastructure
Design Overview – Interpretation Engine

- **Converts Text to System Commands**
  - Called “Intents”
  - An Intent usually triggers an async. PyQt Signal
  - Signal Example: \( \text{Signal(signalType, sender, receiver, payload)} \)

- **Google’s Dialogflow**
  - Neural Network NLP Model - API
  - Takes sanitized speech as input
  - Returns an Intent to our system

- **Ex. – Invoking an Intent:**
  1. “Change the plot color to red.” → Speech Handler
  2. Speech Handler → Dialogflow
  3. NLP Agent infers the most appropriate Intent + Entity
  4. System receives:
     - Intent: ChangeColor
     - Entity: “red”
## Dialogflow Trained Intents

<table>
<thead>
<tr>
<th><strong>Graphing Related Intents</strong></th>
<th><strong>Context Related Intents</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ChangeAxis</td>
<td>Default Fallback Intent</td>
</tr>
<tr>
<td>ChangeColor</td>
<td>DetectNotification</td>
</tr>
<tr>
<td>ChangeDataType</td>
<td>Yes</td>
</tr>
<tr>
<td>ChangeGraphType</td>
<td>GoBack</td>
</tr>
<tr>
<td>DetectParameter</td>
<td>Next Intent</td>
</tr>
<tr>
<td>OverlayGraph</td>
<td></td>
</tr>
<tr>
<td>PlotBinCount</td>
<td></td>
</tr>
<tr>
<td>PlotCorrelation</td>
<td></td>
</tr>
<tr>
<td>PlotLotYield</td>
<td></td>
</tr>
<tr>
<td>PlotWafer</td>
<td></td>
</tr>
<tr>
<td>ZoomIn</td>
<td></td>
</tr>
<tr>
<td>ZoomOut</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>System Related Intents</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Welcome Intent</td>
<td></td>
</tr>
<tr>
<td>Goodbye Intent</td>
<td></td>
</tr>
<tr>
<td>Help</td>
<td></td>
</tr>
<tr>
<td>Logout</td>
<td></td>
</tr>
</tbody>
</table>
Training Intents

➢ Training Data for Intents
  – we emulated Engineers and generated (Query, Intent) pairs
  – Each Query is composed of some Action and some Entity

➢ Example – ZoomIn Intent
  – “Can you zoom in to the first 5 plots?”
  – “Let’s enlarge the last plot.”

  – Actions:
    • “Zoom in”
    • “Magnify”
    • “Enlarge”
    • ...

  – Entities:
    • “First 5 plots”
    • “Last plot”
    • “Last 3 plots”
    • ...

Development Team
What is IEA?
Input Spec
Design Overview
Demo
Sponsors
Results

Approx. training time ~3m
Design Overview – Control Flow

- Keeps track of Context & States
  - Accesses analytic results/cache
  - Defines States/Flags
  - Definitions for Controllers
  - Definitions for Signals
  - “Interconnect” – facilitates signal passing

- Ex. – Context Tracking:
  - Remember color change for a type of graph
  - Enables “go back” & “continue” Intent
  - Appropriate follow-up questions
Features you’ll see:

- Reports findings triggered by a sudden drop in yield (excursion)
- User can request optional results
- User can interact with the system:
  - Changing the graph shown
  - Changing the color of the data shown
  - Zooming into specific aspects of graph
  - Keeps track of context – “Go back”
Thank you!!!

Li-C. Wang, Jay Shan, Jenny Zeng

Yogananda Isukapalli, Brandon Pon, Carrie Segal