Office of the Director of National Intelligence

IARPA

BE THE FUTURE

Mercury Challenge Question and Answer Session | July 2018

MERCURY CHALLENGE

Introduction

Dr. John Beieler, IARPA Program Manager

Dr. Beieler is a program manager at the Intelligence Advanced Research Projects Activity (IARPA) focusing on human language technology, machine/deep learning, and forecasting. Before joining IARPA, John was a research scientist at the Johns Hopkins Human Language Technology Center of Excellence (HLTCOE). At the HLTCOE his work focused on information extraction and semantics in support of DoD research efforts. Prior to the HLTCOE, John was a data scientist at Caerus Associates. He has published and presented work in the social sciences and human language technology at multiple national and international venues. John received his doctorate and master's in political science from Pennsylvania State University, and a bachelor's in political science from Louisiana State University.

Peter Haglich, IARPA Technical Advisor

Peter Haglich is a technical advisor at the Intelligence Advanced Research Projects Activity (IARPA) focusing on predictive modeling and forecasting. Before joining IARPA he worked at Lockheed Martin Advanced Technology Laboratories as a data scientist and ontology engineer. As a former US Navy officer in submarines, Pete is a graduate of the US Naval Academy and earned his Masters in Mathematics and Statistics at the University of Massachusetts.

Representatives also present:

Members of the Challenge Team and our Subject Matter Experts (SMEs)

About IARPA

The Intelligence Advanced Research Projects Activity (IARPA) envisions and leads high-risk, high-payoff research that delivers innovative technology for future overwhelming intelligence advantage

+ Our problems are complex and multidisciplinary
+ We emphasize technical excellence & technical truth

Although best known for quantum computing, superconducting computing and forecasting tournaments – IARPA's research portfolio is diverse, including math, physics, chemistry, biology, neuroscience, linguistics, political science, cognitive psychology and more

For more information visit iarpa.gov

Today's Q&A Agenda

+ Challenge Overview
+ Challenge Timeline
+ Eligibility Requirements
+ Registration and Configuration
+ Team Information
+ Judging and Scoring
+ Prizes
+ Prize Requirements

MERCURY
CHALLENGE

Challenge Overview

Surprise events such as the fall of the Berlin Wall, Iraq's invasion of Kuwait, the civil unrest that gave rise to the Arab Spring, and Russian incursions into Ukraine, forced the U.S. government to respond rapidly, often in an absence of data related to the underlying causes of these events. The IARPA Mercury Challenge is looking for novel and advanced methods to provide early warning for the U.S. Government of such events in the Middle East and North Africa. The three specific event classes of interest are:

1. **Military Activity (MA)** in Egypt, Saudi Arabia, Iraq, Syria, Qatar, Lebanon, Jordan, and Bahrain:
   - Conflict – Incident where police, military, or other state/government security forces take action in some way; and
   - Force posture – A newsworthy action of police, military, or other state/government security forces that does not involve the use of deadly force.

2. **Non-violent Civil Unrest (CU)** in Egypt and Jordan, such as demonstrations, marches and protests:
   - Daily count of non-violent civil unrest events in Egypt
   - Weekly count of non-violent civil unrest events in Jordan
   - Weekly count of non-violent civil unrest events in a 75km radius of Tahrir Square, Egypt
   - Monthly count of non-violent civil unrest events in the Jordanian provinces of Amman, Madaba, and Irbid.

3. **Infectious disease** in Saudi Arabia: Weekly Middle East Respiratory System (MERS) count.

Challenge Timeline

Registration for the Mercury Challenge will begin in July 2018 and run until August 1st, 2018. On August 1st, the Mercury Challenge will formally launch.

The competition will be divided into three Periods. Each Period is scored independently, so being best during the First Period is no guarantee of being best in the Second or Third Periods. Final scores for each Period will be calculated seven days after the Period closes, and the winner calculations will begin.

+ **Period 1:** August 7, 2018* – October 31, 2018
  - Note, the challenge begins on August 1, but scoring begins on August 7
+ **Period 2:** November 1, 2018 – January 31, 2019
+ **Period 3:** February 1, 2018 – April 30, 2019

JULY 2018
Registration Begins

AUGUST 1, 2018
Mercury Challenge launches

OCTOBER 31, 2018
First scoring period ends

JANUARY 31, 2019
Second scoring period ends

APRIL 30, 2019
Third scoring period ends

LATE SPRING 2019
Winners announced

Eligibility Requirements

Who can participate?

+ An individual or Team (all team members must be 18 years of age and over)
+ An incorporated entity
+ United States as well as International participants

Who is NOT able to compete?

+ Individuals or teams from the countries prohibited on the U.S. State Department's State Sponsors of Terrorism list
+ Companies and their Contractors that are supporting this challenge
+ A federal entity or federal employee acting within the scope of their employment. An individual or entity shall not be deemed ineligible because the individual or entity used federal facilities or consulted with federal employees during a competition if the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis.

Please be sure to read the entire Challenge Rules Document for teaming requirements, guidance for international Solvers and additional eligibility criteria

Quick Start Guide: Registration and Configuration

1. If you're not already a Topcoder Member, sign up here: https://accounts.topcoder.com/member
2. Visit the pre-registration page here: https://www.topcoder.com/mercury-challenge and fill out the form at the bottom with the handle you chose when signing up as a Topcoder member
3. Once you've completed the signup, you will be redirected to the GitHub repository for the challenge. This repository contains everything you need to get started building and training your model.
4. Download the repository contents and follow the included README instructions to setup the scoring code locally
5. Read the included Handbook for all of the details about the challenge
6. Check out the forum to ask questions and chat with others in the challenge: http://apps.topcoder.com/forums/?module=ThreadList&forumID=630604&mc=0
7. Start building and training your model! Topcoder will start accepting submissions on **August 1st**

Register for the Mercury Challenge at Topcoder

Judging and Scoring – Military Activity

The Mercury Challenge will compare participant submissions against a “base rate” model. Base Rate models are models that only use information included in the history of observed events.

Military Activity (MA) Judging Metrics

+ Lead Time (LT): Number of days between the date the forecast was produced and the date the actual event was reported
+ Recall: The number of forecasts that matched actual events divided by the total number of actual events
+ Precision: The number of forecasts that matched actual events divided by the total number of forecasts issued
+ F-Score: The harmonic mean of Precision and Recall:

$$F \equiv \frac{2 \times Precision \times Recall}{Precision + Recall}$$

+ Quality Score (QS): The similarity of warning details to event details in terms of the distance between the warning location and the event location, the number of days between the warning Event Date and the actual Event Date, and agreement between warning and event actor, target, and event subtype. QS is measured on a scale of 0.0 to 4.0.

Judging and Scoring – Civil Unrest Events and Disease

The Mercury Challenge will compare participant submissions against a “base rate” model. Base Rate models are models that only use information included in the history of observed events.

Count Forecast (CU Events and Disease) Judging Metrics

+ Lead Time: Average number of days between the date the forecasted count was submitted and the effective Event Date, defined as:
  - Egypt Daily CU: The date being forecasted.
  - Weekly Counts: The week is defined as the International Organization for Standardization (ISO) week, which starts on Monday and ends on Sunday. Weekly CU counts use Wednesday as the reference day for determining the Event Date. Disease events follow Epidemiological Week (EW) which uses Sunday as the reference day. For example, consider the week that starts on 28 May 2018 and ends on 3 June 2018. The Event Date for CU counts is 30 May 2018 and the Event Date for Disease events is 3 June 2018.
  - Monthly Counts: The effective Event Date is the 15th of the month.

+ Quality Score: Average quality score of each valid forecast (ranges from 0.0 to 4.0), which is based on the difference between the forecast count and the actual count.

Prizes

Participants with the best winning solutions will be eligible to win from a prize pool of $100,000, which will be distributed across a series of very difficult country/event combinations. For example: “Predict Non-violent Civil Unrest events in Egypt, but far away from Cairo, during the month of August 2018.

Challenge participants can win prizes for having top scores across thirteen separate categories. The top scorers after each scoring period will earn the Top Prize for that given period. Regular and early participation will provide more chances of winning!

Read the full Prize Calculation Documentation for all the details on prizes, including Prize Requirements and Class Category Eligibility.

PERIOD 1 PRIZE PURSE	$21,000
PERIOD 2 PRIZE PURSE	$29,000
PERIOD 3 PRIZE PURSE	$50,000
BEST UNDERGRAD	$4,000
TOTAL WINNERS	30

Scoring Period 1 Distribution

Please note that each competitor is limited to winning one (1) prize per scoring period. In the event that a competitor wins more than one category, they will receive the award with the highest prize amount.

Country	Class Type	# of Winners	Prize Amount
1st Place (All Countries)	Best Overall	1	$7,000
2nd Place (All Countries)	Best Overall	1	$5,000
3rd Place (All Countries)	Best Overall	1	$3,000
Egypt	Military Activity (MA)	1	$2,000
Saudi Arabia	Military Activity (MA)	1	$2,000
Lebanon	Military Activity (MA)	1	$2,000

Scoring Period 2 Distribution

Please note that each competitor is limited to winning one (1) prize per scoring period. In the event that a competitor wins more than one category, they will receive the award with the highest prize amount.

Country	Class Type	# of Winners	Prize Amount
1st Place (All Countries)	Best Overall	1	$10,000
2nd Place (All Countries)	Best Overall	1	$5,000
Egypt	Military Activity (MA)	1	$2,000
Saudi Arabia	Military Activity (MA)	1	$2,000
Lebanon	Military Activity (MA)	1	$2,000
Syria	Military Activity (MA)	1	$2,000
Iraq	Military Activity (MA)	1	$2,000
Egypt - Daily	Civil Unrest (CU)	1	$2,000
Egypt - Weekly 75km Tahrir	Civil Unrest (CU)	1	$2,000

Scoring Period 3 Distribution

Please note that each competitor is limited to winning one (1) prize per scoring period. In the event that a competitor wins more than one category, they will receive the award with the highest prize amount.

Country	Class Type	# of Winners	Prize Amount
1st Place (All Countries)	Best Overall	1	$20,000
Best Undergrad Prize (All Countries)	Best Overall	1	$4,000
Egypt	Military Activity (MA)	1	$2,000
Saudi Arabia	Military Activity (MA)	1	$2,000
Lebanon	Military Activity (MA)	1	$2,000
Syria	Military Activity (MA)	1	$2,000
Iraq	Military Activity (MA)	1	$2,000
Qatar	Military Activity (MA)	1	$2,000
Jordan	Military Activity (MA)	1	$2,000
Bahrain	Military Activity (MA)	1	$2,000
Egypt - Daily	Civil Unrest (CU)	1	$2,000
Egypt - Weekly 75km Tahrir	Civil Unrest (CU)	1	$2,000
Jordan - Weekly	Civil Unrest (CU)	1	$2,000
Jordan - Monthly	Civil Unrest (CU)	1	$2,000
Infectious Disease In Saudi Arabia	Disease (CU)	1	$2,000

Important Links

+ **Mercury Challenge Microsite -** Place for all challenge-related information and updates
  http://iarpa.gov/challenges/mercury.html

+ **Topcoder Registration Page -** Register for the challenge
  https://www.topcoder.com/mercury-challenge

+ **Topcoder Mercury Challenge Forum** - Connect with other challengers and ask questions
  http://apps.topcoder.com/forums/?module=ThreadList&forumID=630604&mc=0

+ **Mercury Challenge GitHub Repository -** Get technical updates and code here
  https://github.com/planetmercury/mercury-challenge

Have More Questions?

Contact us at
mercury-challenge@iarpa.gov