

ATHENS Hackathon 2 Kickoff

SOUTHWEST RESEARCH INSTITUTE®

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ADVANCED SCIENCE. APPLIED TECHNOLOGY.

Program-Wide Goals

- Get performers in a room (virtually) and solve a common design challenge
- Second hackathon - focus on:
 - Integration – AI/ML tools & corpus system as design oracle
 - Exercise TAI tools & conventional/SME process in a time-constrained period
 - Exercise TA2 tools – following CRA TA2 presentation
- Basic approach and toolchains established
 - Harder (i.e. more realistic) challenge problem
 - Greater diversity of designs and higher performing designs

Process

- Preparation:
 - Round 2 with a revised UAV corpus
 - Components and seed designs via graph database & Gitlab
 - Automated evaluation workflow via Jenkins (OpenMETA and Direct2CAD)
 - Supporting tools – visualization, FDM to JSON, preprocessing
 - Ongoing discussions in our biweekly calls
 - Periodic updates distributed via Gitlab
- Business days from November 7-18
- Daily interactions planned
- Metrics/Scoring provided

Program-Wide Kickoff

- As of right now, final test bench path requirements are available
 - Delivered via a `git pull` to update the pipeline
- Flight path change – replaces current flight path 9
 - Old flight path 9 is now flight path 8
- Additional battery usage metric – bonus points for battery usage
 - Flight path is symmetrical, rewards an out-and-back without refueling
 - Applied in post-processing – scoring script is available but not applied in pipeline
- Further technical details on course details following this presentation



Program-Wide, Ongoing

- Mattermost room for discussion
 - Open source Slack equivalent
 - Tied to GitLab logins and hosted on Vanderbilt servers
 - Can be used for intra-team discussions or inter-team
 - Platform for real-time communication with ATHENS team
 - Link sent out to PIs
- Short daily calls
 - Address any reported corpus problems
 - No need for full program attendance, at least one representative per team
 - Pre-submitted questions are preferred



TAI – Deliverables on Day 10

- All graded pieces uploaded to GitLab repo per team by COB Friday, November 18
 - This allows for teams to version control and upload as needed before the final deadline
 - Team-specific links to be distributed in performer Mattermost channels (though currently available regardless)
- What makes a design?
 - The `data.zip` file resulting from the final test bench run through Jenkins
 - This contains the ADM representing the design, specific input parameters, CAD model of design, and FDM evaluation results
 - With this, we can replicate and confirm your design performance



TAI – Deliverables

- Top 5 overall performing designs
 - Path 9 is run twice, with and without a cargo load
 - Significant mass (and mass distribution) difference
 - Target speeds, accelerations, and control parameters can be tuned per path
- Up to 5 geometrically unique or interesting designs that produce nonzero point totals
 - Based on Phase I design challenge, expect to see good diversity
 - Opportunity to show breadth of the design space explored



TA1 – Deliverables, cont.

- Self-reported final metric: How many designs were evaluated (self-reported)? How was this number calculated?
 - Not every design needs to be run through final FDM test bench, so ATHENS doesn't know at this point
 - May be approximate, as long as reasoning is provided
- Reported per individual design (final submissions)
 - Effort on the design portion
 - Effort on the problem solving and debugging portion
 - How long it took overall
 - How much human intervention was required
- Note – our goal is to phase in TA2 access to data in this Hackathon



TAI – Deliverables, cont.

- 4:30 pm CT:

Quick status per team at end of each day in team Mattermost room

- What's your general status?
- Top score observed to date?
- Open issues?



TAI - Requirements

- Must supply final designs from full ATHENS pipeline runs. By doing this, we guarantee:
 - Made from only legal components from UAV corpus
 - Physically assemblies
 - Flight performance passes minimum performance goals
- With this, you must be able to run the full ATHENS pipeline
 - OpenMETA and Direct2CAD pipelines are both currently supported
 - Creo is required

TA3 (ATHENS) Role

- We are the control team
 - No fancy AI, just engineers with subject matter knowledge
- Will be building and iterating on a new design from scratch over the course of the Hackathon
- Also providing software support, limited to:
 - Hotfixes for performer located bugs
 - Sanity checks - can we replicate your results on our end?



ATHENS Role, Cont.

- Also providing our own design trajectory following the conclusion of the Hackathon
 - Sequence of designs we evaluated
 - Reasoning behind design decisions
 - What we were looking to improve/explore at different points
- Capture of applied subject matter expertise for program use
- Directly applicable for TA2s – use cases and how choices are made

ATHENS Role, cont.

- Post-hackathon, analysis of top performer designs
 - What was good?
 - What could have been improved?
 - Interesting concepts that could be further explored
 - Presented at the coming PI meeting

Post Hackathon Evaluation Process

- Clone teams' design submissions into evaluation workspace
- Upload designs into graph
- Run designs against appropriate workflow (UAM_Workflow vs Direct2CAD)
 - UAM_Workflows: Inputs are determined by inputADM.adm and output.csv
 - Direct2CAD: Study_Params and namedGraph.graphml
- Download artifacts and compare evaluation results against provided results

TA2 - Role

- CRA TA2 to present later in this kickoff
 - Automated integration with data evaluation pipelines
- Both TA2s to have access to design submissions
 - Post-analysis and visualization of design data
- Potential for some in-person interaction at the PI meeting
 - Interactivity, initial TAI/TA2 integrations
- Plan to use TA2 tools for development of our post-analysis as well



Resources

- GitLab
 - <https://git.isis.vanderbilt.edu/>
- General Documentation
 - <https://git.isis.vanderbilt.edu/SwRI/athens-documentation>
 - Wiki available with component variables and connector compatibilities
- Mattermost
 - <https://mattermost.isis.vanderbilt.edu/hackathon/>

