Automating Treatment Planning Workflow with Scripts

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Disclosures
- I am a cofounder, officer, and employee of Radformation, Inc.

About me
- ABR certified medical physicist
- Love programming
- Cofounded Radformation because

Automation: A Logic Puzzle
1. Identify the task
2. Identify available tools
3. Implement the solution

IMPORTANT: One of the greatest barriers to automation is unclear or inconsistent expectations
- e.g., can your team commit to using specific templates (structure IDs, dose constraints, etc.)?

Identify Available Tools - The API
- Scripting Application Programming Interfaces (APIs)
- Access product functionality directly
- Tight integration (efficiency)
- Very powerful & flexible
- BUT possible limitations requiring workarounds

Scripting
- Enormous power and flexibility
- ... but much higher barrier to entry
- Learning to program?
- ... but also very rewarding
- Lots of great resources to help you learn...
- If you can muster the motivation, time, and energy
- General advice: Divide and Conquer
- Break a task down into well-defined manageable units
- Explore the API & experiment
Varian Developer Community:

https://github.com/VarianAPIs: Example projects are extremely helpful

Explore the API

- Dig through to see what's available (and what's not!)
- Play with Visual Studio Intellisense
  - How do you get from your ScriptContext to your Image data?
  - How is the Image data presented?
  - Eclipse API is fairly low-level in some things
  - Trying Image data in an easily displayed format takes some work
  - Experiment with it e.g. Can you draw a CT slice from data pulled through the API
  - Other things are higher level (e.g. optimization, dose calculation functions) and easier to use

Script example - ClearCheck Live Demo

- ClearCheck Task:
  - Plan Analysis & Plan Report
  - TG-275 & TG-315-draft
  - Check Dose Constraints
  - Check Plan Parameters
  - Check Structures for Errors
  - Check for Collisions
  - Print Complete Plan Report

- Tools / Implementation:
  - Varian Eclipse™ API Read plan data
  - Programmed Analysis and Report Generation
  - Make it easy to configure templates

ClearCheck Constraint Check Results

- Manual Constraint Reporting:
  - 2% had >1% error
  - 0.8% had >10% error
- ClearCheck Constraint Reporting:
  - 0 errors
- Large decrease in time for definition, evaluation, and documentation of constraints

Script example - EZFluence Live Demo

- Task:
  - Automate 3D Conformal Planning (Field-in-Field or Electronic Compensator)
    - Breast
    - 4-Field Lung
    - Whole Brain
    - etc.

- Tools / Implementation:
  - Varian Eclipse™ API Read plan data, write back new plan data
  - Optimization algorithm exploration and experimentation

EZFluence Results

- Average of 90% reduction in planning time
  - Average of 1.7 minutes for EZFluence
  - Overall comparable or improved dosimetry (v1.1)
  - Lower V105% on larger breast patients
DIY Scripting Pitfalls

- Verification and Validation (Safety)
  - How can you be sure it works correctly & meets the end-user’s needs?
- Long-term Support
  - What happens if the developer leaves?
  - Will the tool break when software versions change?
- Department Buy-in

Summary

- Scripting is extremely powerful and has the potential to increase efficiency, quality, and safety.
- You have the power... it just takes:
  - Time
  - Energy
  - Department buy-in