

MATLAB TO PYTHON: INITIAL CODE TRANSLATION

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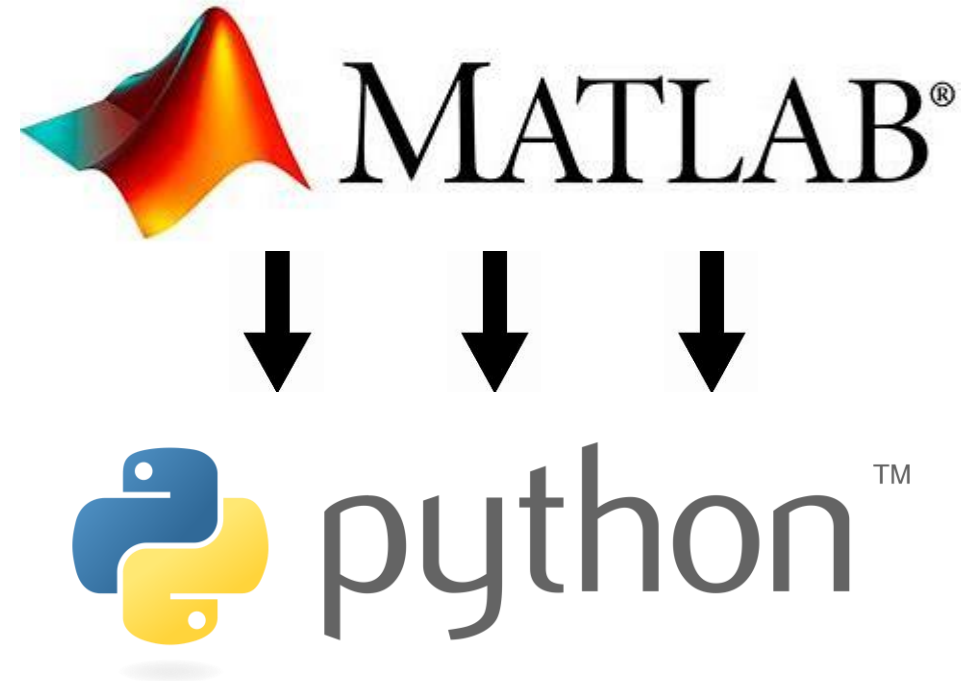
PROJECT HISTORY

- Started ~13 years ago
- Pennington Biomedical Research Center
 - Give patients nutritional data (appendicular lean mass, bone mineral density, body fat percentage)
 - Originally took body measurements by hand
 - Wanted a program to digitally measure body parts from body scans
 - Sima created a team consisting of electrical engineers, kinesiologist, mathematicians, and physicists making this program in Matlab

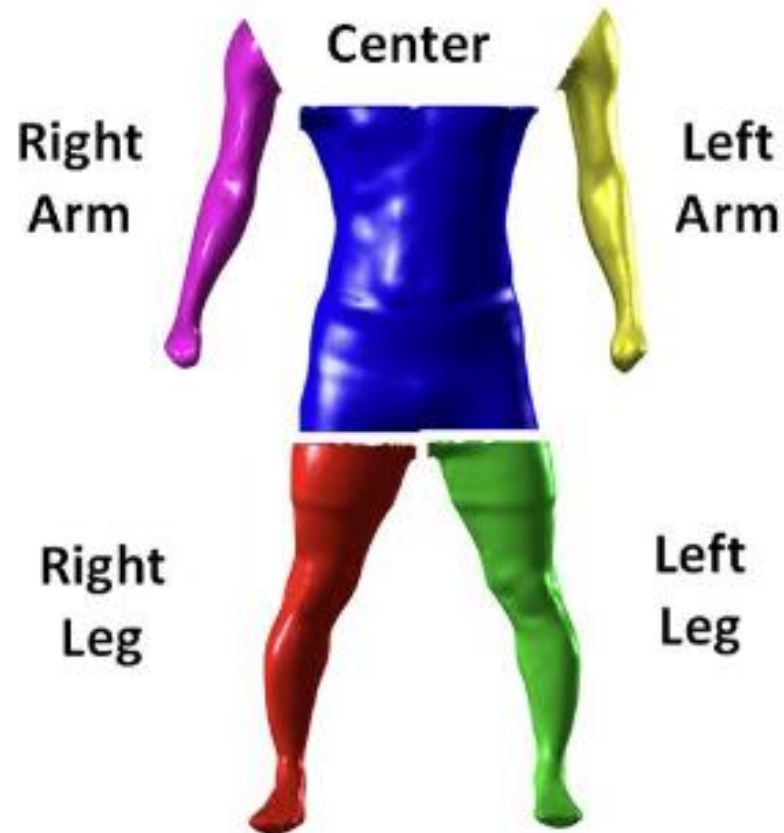


PROJECT GOAL

- Translate the Matlab code into Python
- Benefits of Python
 - Matlab licensing
 - Open source
 - Stand-alone
 - Cloud-based software



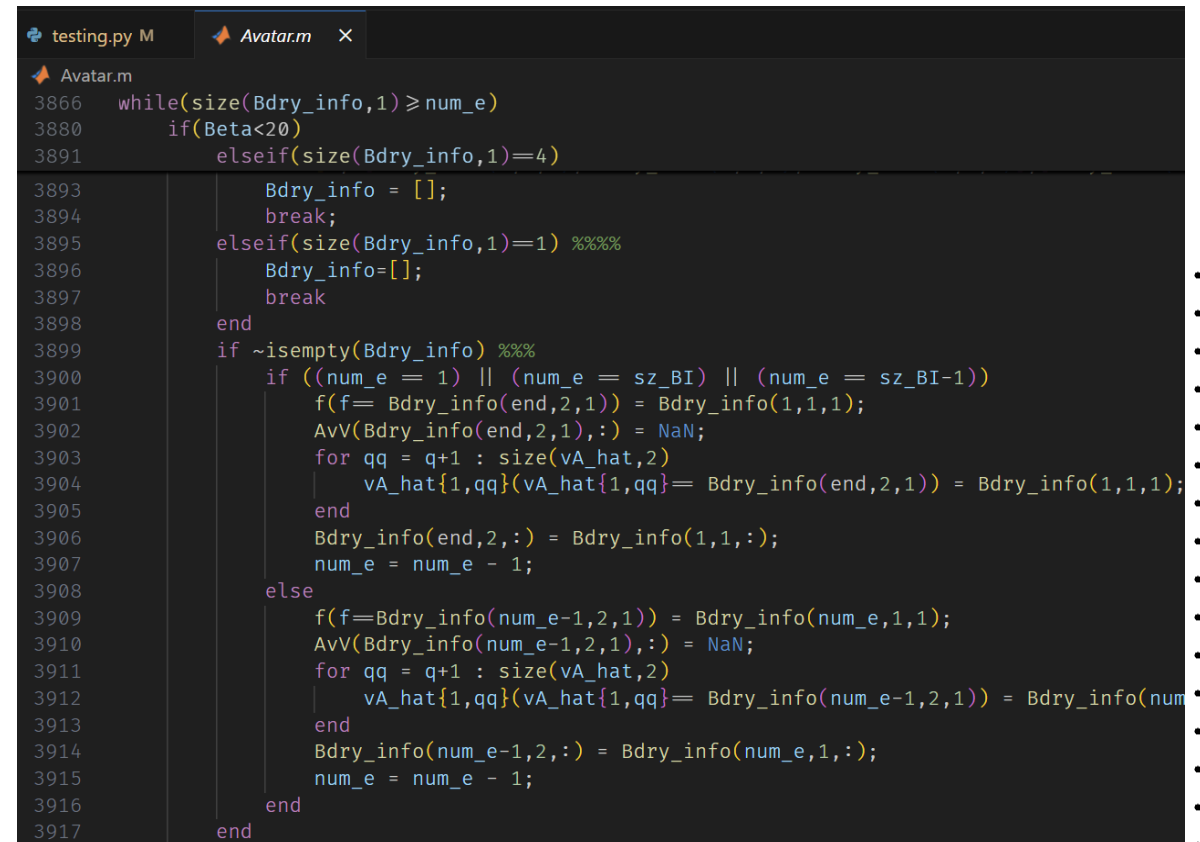
WHAT DOES THE CODE DO?



- The code is used by Pennington (and some other organizations) to get measurements of different areas of the body. (ex. Upper arm, thigh, torso, etc.)
- From the points of the obj file, first there is a triangularization, then with the triangularization we can throw a plane in there and get a convex hull of the intersection. With this we can measure the circumference of different biomarkers on the body.

DOCUMENTATION

- We've focused on adding code that can be understandable both from a syntax and comments.
- We've trimmed many of the redundancies present in the MATLAB code and added some of our own documentation.
- We have accumulated papers that somewhat document the methodology that the codebase uses. We hope these can be used as a metric for accuracy in future implementations.

A screenshot of a code editor with two tabs: 'testing.py M' and 'Avatar.m'. The 'Avatar.m' tab is active, showing MATLAB code. The code is a function that processes boundary information. It starts with a while loop that continues as long as the size of 'Bdry_info' is greater than or equal to 'num_e'. Inside this loop, there are conditional statements. One branch checks if 'Beta' is less than 20. Another branch checks if the size of 'Bdry_info' is 4. A third branch checks if the size of 'Bdry_info' is 1, in which case it resets 'Bdry_info' to an empty array and breaks the loop. A final branch checks if 'Bdry_info' is not empty. Inside this branch, there is a nested if statement that checks if 'num_e' is 1, equal to 'sz_BI', or equal to 'sz_BI-1'. If true, it updates 'Bdry_info' and 'AvV'. If false, it updates 'Bdry_info' and 'AvV' based on the previous state. The code is well-commented and uses clear variable names.

```
3866 while(size(Bdry_info,1) ≥ num_e)
3880     if(Beta<20)
3891         elseif(size(Bdry_info,1)=4)
3893             Bdry_info = [];
3894             break;
3895         elseif(size(Bdry_info,1)=1) %%%%
3896             Bdry_info=[];
3897             break
3898         end
3899     if ~isempty(Bdry_info) %%%%
3900         if ((num_e == 1) || (num_e == sz_BI) || (num_e == sz_BI-1))
3901             f(f= Bdry_info(end,2,1)) = Bdry_info(1,1,1);
3902             AvV(Bdry_info(end,2,1),:) = NaN;
3903             for qq = q+1 : size(vA_hat,2)
3904                 vA_hat{1,qq}(vA_hat{1,qq}= Bdry_info(end,2,1)) = Bdry_info(1,1,1);
3905             end
3906             Bdry_info(end,2,:) = Bdry_info(1,1,:);
3907             num_e = num_e - 1;
3908         else
3909             f(f=Bdry_info(num_e-1,2,1)) = Bdry_info(num_e,1,1);
3910             AvV(Bdry_info(num_e-1,2,1),:) = NaN;
3911             for qq = q+1 : size(vA_hat,2)
3912                 vA_hat{1,qq}(vA_hat{1,qq}= Bdry_info(num_e-1,2,1)) = Bdry_info(num_e,1,1);
3913             end
3914             Bdry_info(num_e-1,2,:) = Bdry_info(num_e,1,:);
3915             num_e = num_e - 1;
3916         end
3917     end
```

OUR CODE

We estimate that we've implemented **10-25%** of the MATLAB code in Python, notable method implementations include functions that:

- Fix the body orientation
- Visualize the mesh object
- Locate various regions on mesh file

Some of the tools we are using to design our code are the Conda environment manager, vscode for MATLAB side by side integration with Python, Git for version control, and GitHub for repository hosting.

DIFFICULTIES/OBSTACLES WE'VE ENCOUNTERED

- Over 8,000 lines of code
- No data to run program/missing functions
- No documentation/confusing comments
- Limited experience with either language
- Limited contact with original programmers



MOVING FORWARD

- Some of the core structural methods have been implemented in Python, some of the things that can be improved include:
 - Determining semimajor and minor axes for mesh orientation
 - Visualization of volumes instead of points
 - Refining broad region locations (armpit, crotch, etc.)
 - Narrowing down for individual measurements
- Future improvements may include a more mathematical implementation of various mesh fixing operations.



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