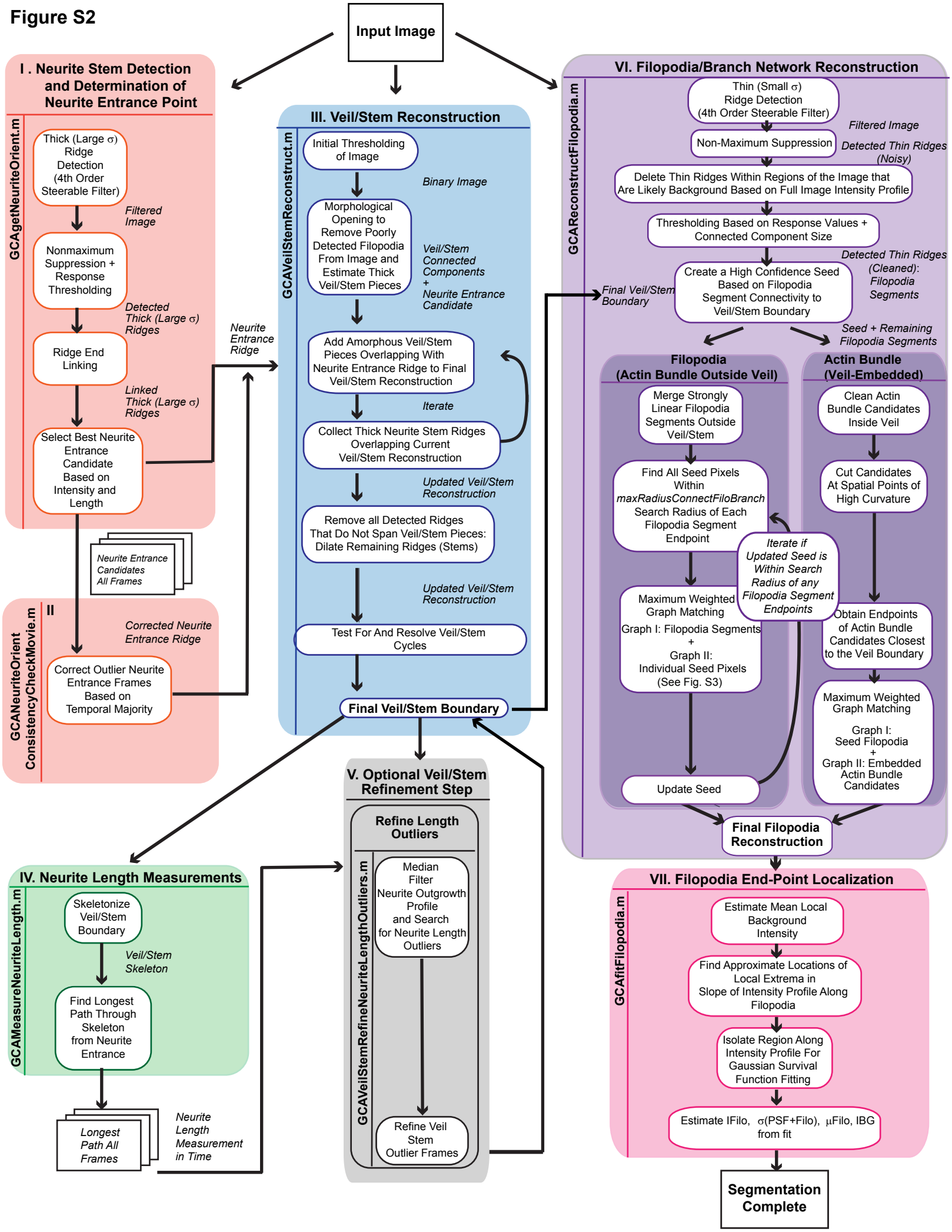
Figure S2


Input Image
I . Neurite Stem Detection and Determination of Neurite Entrance Point
GCAgetNeuriteOrient.m
Thick (Large σ) Ridge Detection (4th Order Steerable Filter)
Filtered Image
Nonmaximum Suppression + Response Thresholding
Detected Thick (Large σ) Ridges
Ridge End Linking
Linked Thick (Large σ) Ridges
Select Best Neurite Entrance Candidate Based on Intensity and Length
Neurite Entrance Candidates All Frames
II
GCANeuriteOrient ConsistencyCheckMovie.m
Corrected Neurite Entrance Ridge
Correct Outlier Neurite Entrance Frames Based on Temporal Majority
Neurite Entrance Ridge
III. Veil/Stem Reconstruction
GCAVeilStemReconstruct.m
Initial Thresholding of Image
Binary Image
Morphological Opening to Remove Poorly Detected Filopodia From Image and Estimate Thick Veil/Stem Pieces
Veil/Stem Connected Components + Neurite Entrance Candidate
Add Amorphous Veil/Stem Pieces Overlapping With Neurite Entrance Ridge to Final Veil/Stem Reconstruction
Iterate
Collect Thick Neurite Stem Ridges Overlapping Current Veil/Stem Reconstruction
Updated Veil/Stem Reconstruction
Remove all Detected Ridges That Do Not Span Veil/Stem Pieces: Dilate Remaining Ridges (Stems)
Updated Veil/Stem Reconstruction
Test For And Resolve Veil/Stem Cycles
Final Veil/Stem Boundary
VI. Filopodia/Branch Network Reconstruction
GCAReconstructFilopodia.m
Thin (Small σ) Ridge Detection (4th Order Steerable Filter)
Filtered Image
Non-Maximum Suppression
Detected Thin Ridges (Noisy)
Delete Thin Ridges Within Regions of the Image that Are Likely Background Based on Full Image Intensity Profile
Thresholding Based on Response Values + Connected Component Size
Detected Thin Ridges (Cleaned): Filopodia Segments
Final Veil/Stem Boundary
Create a High Confidence Seed Based on Filopodia Segment Connectivity to Veil/Stem Boundary
Seed + Remaining Filopodia Segments
Filopodia (Actin Bundle Outside Veil)
Merge Strongly Linear Filopodia Segments Outside Veil/Stem
Find All Seed Pixels Within maxRadiusConnectFiloBranch Search Radius of Each Filopodia Segment Endpoint
Iterate if Updated Seed is Within Search Radius of any Filopodia Segment Endpoints
Maximum Weighted Graph Matching
Graph I: Filopodia Segments + Graph II: Individual Seed Pixels (See Fig. S3)
Update Seed
Actin Bundle (Veil-Embedded)
Clean Actin Bundle Candidates Inside Veil
Cut Candidates At Spatial Points of High Curvature
Obtain Endpoints of Actin Bundle Candidates Closest to the Veil Boundary
Maximum Weighted Graph Matching
Graph I: Seed Filopodia + Graph II: Embedded Actin Bundle Candidates
Final Filopodia Reconstruction
V. Optional Veil/Stem Refinement Step
Refine Length Outliers
GCAVeilStemRefineNeuriteLengthOutliers.m
Median Filter Neurite Outgrowth Profile and Search for Neurite Length Outliers
Refine Veil Stem Outlier Frames
IV. Neurite Length Measurements
GCAMeasureNeuriteLength.m
Skeletonize Veil/Stem Boundary
Veil/Stem Skeleton
Find Longest Path Through Skeleton from Neurite Entrance
Longest Path All Frames
Neurite Length Measurement in Time
VII. Filopodia End-Point Localization
GCAfitFilopodia.m
Estimate Mean Local Background Intensity
Find Approximate Locations of Local Extrema in Slope of Intensity Profile Along Filopodia
Isolate Region Along Intensity Profile For Gaussian Survival Function Fitting
Estimate IFilo, σ(PSF+Filo), μFilo, IBG from fit
Segmentation Complete