# Map Manager: Software to visualize, annotate, and analyze 3D image time-series

@ mapmanager.net

# Introduction

Neuroscience research is increasingly dependent on 3D imaging with continual advances in microscopy producing progressively larger datasets. A major bottleneck in the analysis of 3D image data is its segmentation into discrete 3D annotations. This bottleneck is particularly problematic for time-series datasets acquired with in vivo two-photon microscopy. Map Manager is powerful and easy to use software to manually annotate, analyze, and curate 3D image time-series annotations. Once a database of annotations is created, Map Manager provides a rich set of curation tools including searching, plotting, and report generation. A key benefit of Map Manager is that large datasets can be managed with a focus on quality-control of annotations.

### **Key Features**

- Graphical user interface
- Curate annotations to approach 100% accuracy
- Annotation have tags including notes and user types
- Flexible annotation searching and plotting
- All image stacks, annotation lists and plots are linked - Semi-automatically connect corresponding
- annotations between time-points
- Export annotations with text reports for customized analysis

## Methods

Map Manager is implemented in Igor Pro 6/7 (Wavemetrics) and runs on Microsoft Windows and macOS. ImageJ/Fiji<sup>1</sup> macros are provided to convert raw 3D image volumes (1-3 color channels) to Tiff for import, including: Zeiss, Nikon, Olympus, Bruker, and ScanImage. For spine scoring, dendritic segment are traced in ImageJ/Fiji with a modified version of Simple Neurite Tracer<sup>2</sup>. All files are saved as text to allow easy import into other programs to implement new and customized analysis.



# **Stack Browser**

Load Tiff Folder	D	ldx	Name	Z	С	Zoom	vx	vy	vz	Date	Time
		0	F09S11_15108_001	15	1	2.5	0.216	0.216	2	20150108	14:23:41
Folder		1	F09S11_15108_002	16	1	2.5	0.216	0.216	2	20150108	14:25:13
X20150108_F09S11		2	F09S11_15108_003	16	1	2.5	0.216	0.216	2	20150108	14:28:09
X20150112_F12S31		3	F09S11_15108_004	16	1	2.5	0.216	0.216	2	20150108	14:28:54
X20150112_F12S41		4	F09S11_15108_005	16	1	2.5	0.216	0.216	2	20150108	14:29:48
		5	F09S11_15108_006	16	1	2.5	0.216	0.216	2	20150108	14:30:34
		6	F09S11_15108_007	16	1	2.5	0.216	0.216	2	20150108	14:31:18
		7	F09S11_15108_008	16	1	2.5	0.216	0.216	2	20150108	14:32:09
		8	F09S11_15108_009	16	1	2.5	0.216	0.216	2	20150108	14:32:53
		9	F09S11_15108_010	37	1	5.5	0.098	0.098	0.75	20150108	14:35:07
		10	F09S11_15108_011	34	1	5.5	0.098	0.098	0.75	20150108	14:37:51
		11	F09S11_15108_012	30	1	5.5	0.098	0.098	0.75	20150108	14:40:21
		12	F09S11_15108_013	42	1	5.5	0.098	0.098	0.75	20150108	14:42:37
		13	F09S11_15108_014	34	1	5.5	0.098	0.098	0.75	20150108	14:46:10
		14	F09S11_15108_015	39	1	5.5	0.098	0.098	0.75	20150108	14:48:58





Segn	nent	All ᅌ	Or
ldx	dbld	roiType	is
0	103	spineROI	
1	104	spineROI	
2	105	spineROI	
3	106	spineROI	
4	107	spineROI	
5	108	spineROI	
6	109	spineROI	
7	110	spineROI	
8	111	spineROI	1
9	112	spineROI	
10	113	spineROI	
11	114	spineROI	
12	115	spineROI	
Note	•		
Erro	r		

Object Type spineROI
◯ Stack ◯ All Stacks
Map All Maps
Include Bad
Annotations
All Bad
Notes *
Closeness Within (u
User Bool 1 2
User Type 1 ᅌ
Map Spines
Map Spines
Map Spines Addition Subt
Map Spines Addition Subtr Persistent Tra
Map Spines Addition Subt Persistent Tra Bad Runs
Map Spines Addition Subt Persistent Tra Bad Runs Re Added Withir
Map Spines Addition Subtr Persistent Tra Bad Runs Re Added Within Jumping
Map Spines Addition Subt Persistent Tra Bad Runs Re Added Within Jumping Changing User Type
Map Spines Addition Subt Persistent Tra Bad Runs Re Added Within Jumping Changing User Type
Map Spines Addition Subt Persistent Tra Bad Runs Re Added Within Jumping Changing User Type
Map Spines Addition Subt Persistent Tra Bad Runs Re Added Within Jumping Changing User Type

	Index	
	1	
	2	
	3	
-		

		0.8
nsity	(ur	0.6
e Dei	nes/µ	0.4
Spin	ids)	0.2
		0.0

Robert H. Cudmore. The Solomon H. Snyder Department of Neuroscience, Kavli Neuroscience Discovery Institute, The Johns Hopkins University School of Medicine, Baltimore, MD, USA.

for control vs. 0.41 ± 0.05





<b>Number Of Annotations - Big Data?</b>									
	Manuscript	Layer/	Maps	Time-points	Segments	Annotations	%		
1	Roth RH (Huganir Lab)	/	148	1759	370	204,196	77.1		
2	Tan H (Huganir Lab)	II/III, V	170	1182	489	171,188			
3	Lopez Ortega E (Huganir Lab)	/	47	454	41	21,885			
4	Ye Z (Linden Lab)	V	71	471	275	21,413	90		
		Fixed Tissue		512	631	16,438			
5	Brill J (Linden Lab)	V	16	173	45	18,849	86.8		
6	Agarwal A (Bergles Lab)	Cell	8	111	n/a	9,925	98.7		
		4662	1851	463,894					
					Av	verage Match	88.15%		