

ECE 462 Project3

Multithreaded programming

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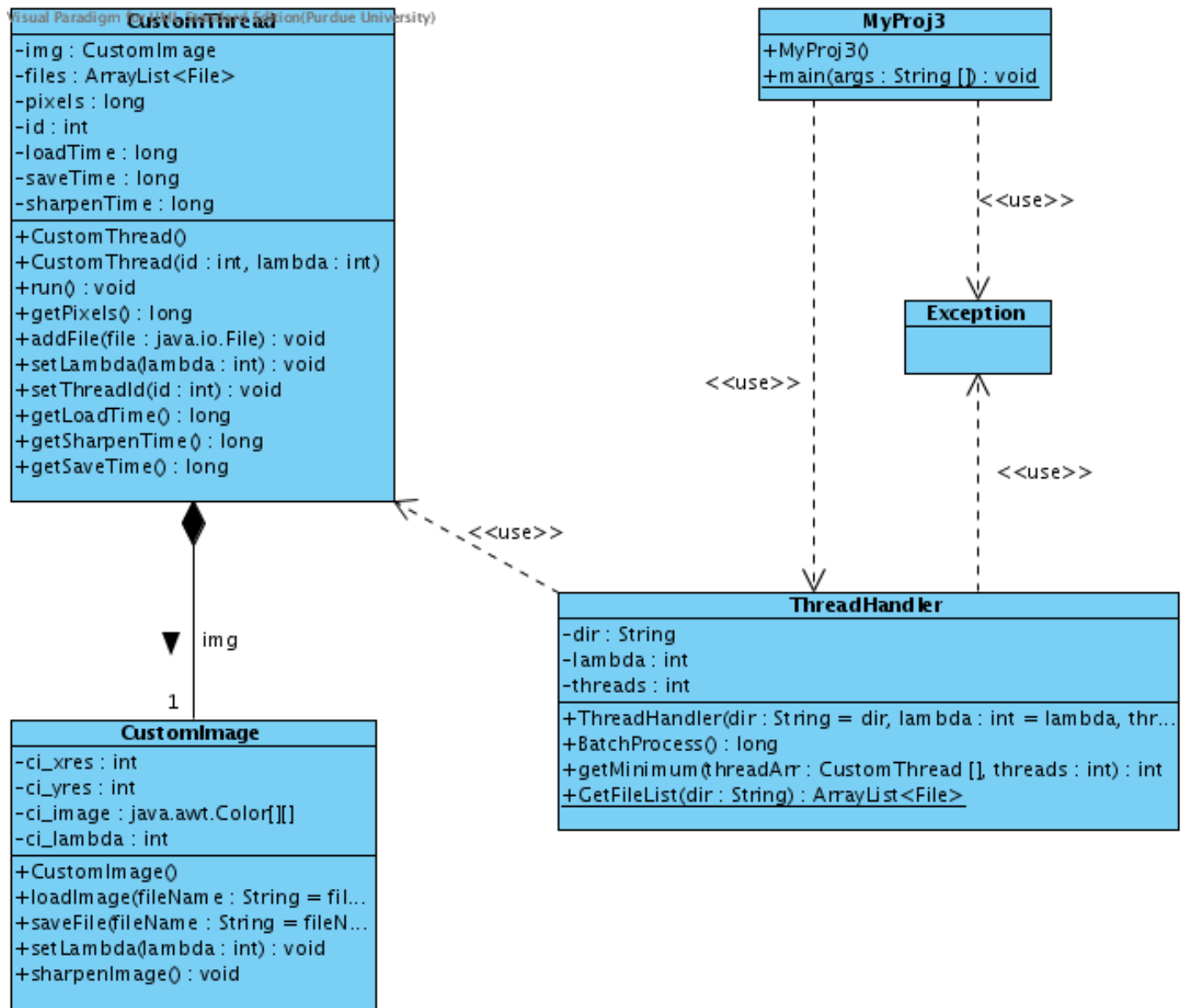
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Class Diagram

Overall class diagram



Summary

Name	Documentation
 CustomImage	Represents an *.rgb image and the relevant operations.
 CustomThread	Represents a thread. Each thread processes a few *.rgb files.
 Exception	Standard Java class included with import java.lang.Exception
 MyProj3	Main class in this project.
 ThreadHandler	This class is intended to manage all threads (for instance, assign *.rgb files to the threads for processing).

Details

CustomImage

Name	Value
Active	false
Visibility	public
Leaf	false
Root	false
Documentation	Represents an *.rgb image and the relevant operations.

Attributes

private ci_xres : int			
Getter	false	Setter	false
Documentation	x - resolution.		

private ci_yres : int			
Getter	false	Setter	false
Documentation	y - resolution.		

private ci_image : java.awt.Color			
Getter	false	Setter	false
Documentation	Represents the image as a two-dimensinal array of Color.		

private ci_lambda : int			
Getter	false	Setter	false
Documentation	Sharpness coefficient.		

Operations

public CustomImage ()	
Query	false
Documentation	No-arg constructor, initializes the attributes.


public loadImage (fileName : String) : void		
Parameters	fileName	
	Type	String
	Direction	inout
	Default Value	fileName
Query	false	
Documentation	Loads an *.rgb image from the hard drive into an array of Color.	

public saveFile (fileName : String) : void		
Parameters	fileName	
	Type	String
	Direction	inout
	Default Value	fileName
Query	false	
Documentation	Saves current image as an *.rgb file	

public setLambda (lambda : int) : void		
Parameters	lambda	
	Type	int
	Direction	inout
Query	false	
Documentation	Sets the value of sharpness coefficient lambda.	

public sharpenImage () : void	
Query	false
Documentation	Sharpens current image.

Relationships

img : Association		
From	Name	Value
	End Model Element	 CustomThread
	Multiplicity	Unspecified
	Visibility	private
	Aggregation Kind	Composited
	Navigable	true
Documentation	CustomThread has CustomImage img as a member.	

CustomThread

Name	Value
Active	false
Visibility	public
Leaf	false
Root	false
Documentation	Represents a thread. Each thread processes a few *.rgb files.

Attributes

private img : CustomImage			
Getter	false	Setter	false
Documentation	Represents the image that is being sharpened.		

private files : ArrayList<File>			
Getter	false	Setter	false
Documentation	List of all files assigned to the thread.		

private pixels : long			
Getter	false	Setter	false
Documentation	Total number of pixels assigned to the thread.		

private id : int			
Getter	false	Setter	false
Documentation	Thread identification number.		

private loadTime : long			
Getter	false	Setter	false
Documentation	Time spent on loading all images in the thread.		

private saveTime : long			
Getter	false	Setter	false
Documentation	Time spent on saving all of the sharpened images in the thread.		

private sharpenTime : long			
Getter	false	Setter	false
Documentation	Time spent on sharpening all images in the thread.		

Operations

public CustomThread ()	
Query	false
Documentation	No-arg constructor

public CustomThread (id : int, lambda : int)		
Parameters	id	
	Type	int
	Direction	inout
	lambda	
	Type	int
Direction	inout	
Query	false	
Documentation	Overloaded two-arg constructor.	

public run () : void	
Query	false
Documentation	Overridden run method

public getPixels () : long	
Query	false
Documentation	Returns the total number of pixels assigned to the thread.

public addFile (file : java.io.File) : void		
Parameters	file	
	Type	java.io.File
	Direction	inout
Query	false	
Documentation	Adds another file to the list of files for the thread.	

public setLambda (lambda : int) : void		
Parameters	lambda	
	Type	int
	Direction	inout
Query	false	
Documentation	Sets the sharpness coefficient	


public setThreadId (id : int) : void		
Parameters	id	
	Type	int
	Direction	inout
Query	false	
Documentation	Sets the thread identification number	


public getLoadTime () : long	
Query	false
Documentation	Returns load time for the thread.

public getSharpenTime () : long	
Query	false
Documentation	Returns the time spent on sharpening in the thread.

public getSaveTime () : long	
Query	false
Documentation	Returns the time spent on saving images.

Relationships


Unnamed Usage	
From	 ThreadHandler
Stereotypes	use
Documentation	ThreadHandler.BatchProcess uses an array of type CustomThread


img : Association		
To	Name	Value
	End Model Element	 CustomImage
	Multiplicity	1
	Visibility	private
	Aggregation Kind	None
	Navigable	true
Documentation	CustomThread has CustomImage img as a member.	

Exception

Name	Value
Active	false
Visibility	public
Leaf	false
Root	false
Documentation	Standard Java class included with import java.lang.Exception

Relationships

Unnamed Usage	
From	 MyProj3
Stereotypes	use
Documentation	Exception is caught in MyProj3.main

Unnamed Usage	
From	 ThreadHandler
Stereotypes	use
Documentation	Exception thrown by ThreadHandler.BatchProcess and .GetFileList

MyProj3


Name	Value
Active	false
Visibility	public
Leaf	false
Root	false
Documentation	Main class in this project.


Operations

public MyProj3 ()	
Query	false
Documentation	Empty constructor

public main (args : String) : void		
Parameters	args	
	Type Modifier	[]
	Type	String
	Direction	inout
Query	false	
Documentation	Main method.	

Relationships

Unnamed Usage	
To	 Exception
Stereotypes	use
Documentation	Exception is caught in MyProj3.main

Unnamed Usage	
To	 ThreadHandler
Stereotypes	use
Documentation	ThreadHandler th is created in MyProj3.main

ThreadHandler

Name	Value
Active	false
Visibility	public
Leaf	false
Root	false
Documentation	This class is intended to manage all threads (for instance, assign *.rgb files to the threads for processing).

Attributes

private dir : String			
Getter	false	Setter	false
Documentation	Specifies the path to the directory where all images are stored.		


private lambda : int			
Getter	false	Setter	false
Documentation	Sharpness coefficient		

private threads : int			
Getter	false	Setter	false
Documentation	Number of threads to create.		

Operations


public ThreadHandler (dir : String, lambda : int, threads : int)		
Parameters	dir	
	Type	String
	Direction	inout
	Default Value	dir
	lambda	
	Type	int
	Direction	inout
	Default Value	lambda
	threads	
	Type	int
	Direction	inout
	Default Value	threads
	Query	false
Documentation	Creates a new instance of ThreadHandler	


public BatchProcess () : long	
Query	false
Documentation	Scans the specified directory for all .rgb images, assigns them to the threads and starts the threads.


public getMinimum (threadArr : CustomThread, threads : int) : int		
Parameters	threadArr	
	Type Modifier	[]
	Type	 CustomThread
	Direction	inout
	threads	
	Type	int
	Direction	inout
	Query	false
Documentation	Returns index of the thread which has been assigned the smallest number of pixels.	

public GetFileList (dir : String) : ArrayList<File>	
Parameters	dir
	Type String
	Direction inout
Query	false
Documentation	Returns an array of .rgb files.

Relationships

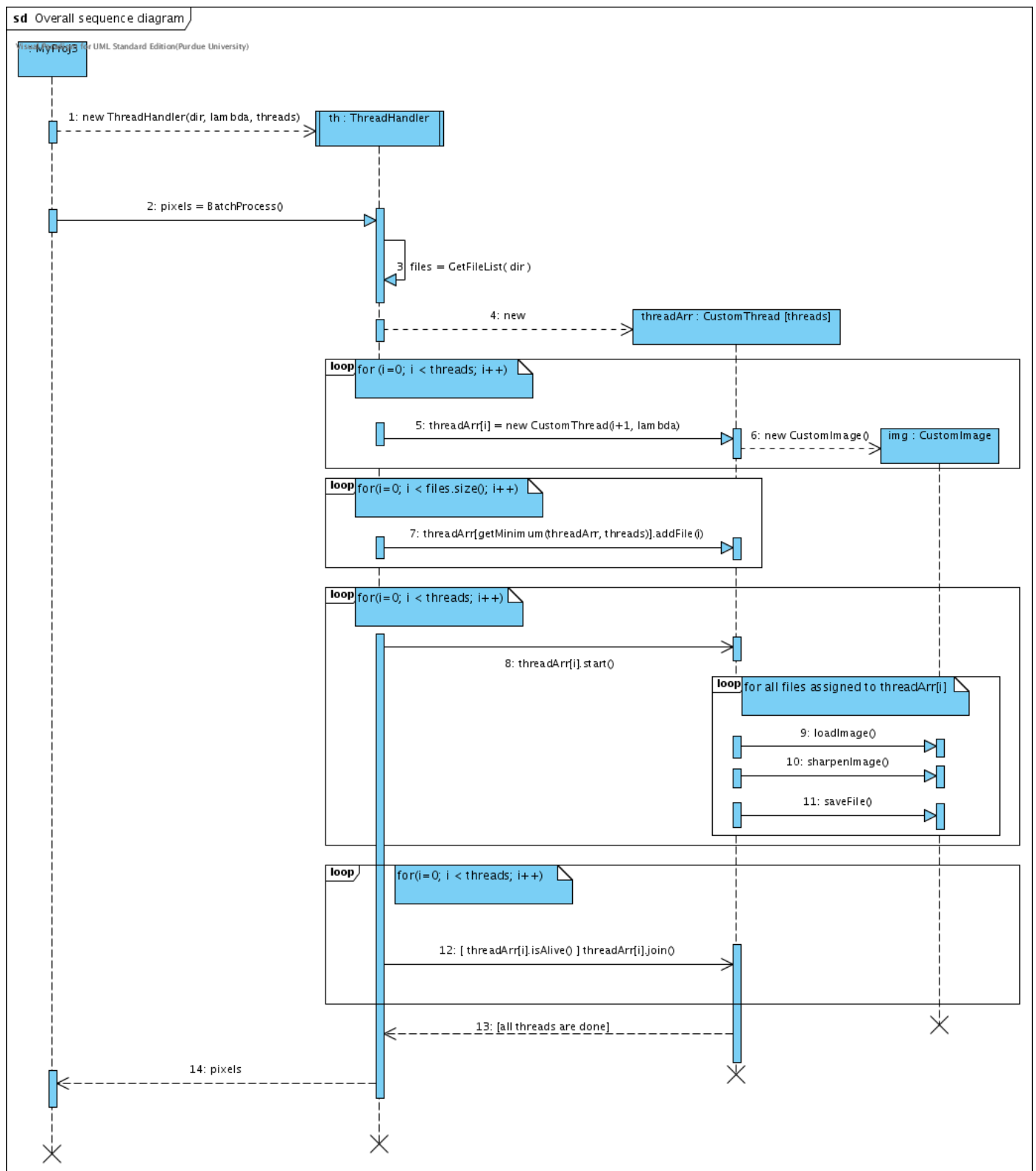
Unnamed Usage	
To	 CustomThread
Stereotypes	use
Documentation	ThreadHandler.BatchProcess uses an array of type CustomThread

Unnamed Usage	
To	 Exception
Stereotypes	use
Documentation	Exception thrown by ThreadHandler.BatchProcess and .GetFileList




















Unnamed Usage	
From	 MyProj3
Stereotypes	use
Documentation	ThreadHandler th is created in MyProj3.main

Sequence Diagram

Overall sequence diagram



Summary


Name	Documentation
 : MyProj3	
	for (i=0; i threads; i++)
	for(i=0; i files.size(); i++)
	for(i=0; i threads; i++)
	for all files assigned to threadArr[i]
	for(i=0; i threads; i++)
 CombinedFragment	Constructs all elements of threadArr[]
 CombinedFragment2	All threads get started.
 CombinedFragment3	
 CombinedFragment4	All threads get joined.
 InteractionOperand	
 InteractionOperand	
 InteractionOperand	
 InteractionOperand	
 InteractionOperand	
 img : CustomImage	
 loop	Assigns all *.rgb files to threads - the elements of threadArr[]
 th : ThreadHandler	
 threadArr	

Documentation


In this loop, all images assigned to a particular thread get processed.


Details


: MyProj3

Name	Value
Multiplicity	Unspecified
Base Classifier	 MyProj3
Active	false
Stopped	true
Multi Object	false

Relationships

new ThreadHandler(dir, lambda, threads) : Message		
To	Name	Value
	End Model Element	 th
Type	Create Message	
Sequence Number	1	
Asynchronous	false	

pixels = BatchProcess() : Message		
To	Name	Value
	End Model Element	 th
Type	Message	
Sequence Number	2	
Asynchronous	false	
Documentation	Starts file processing and returns the total number of processed pixels.	

pixels : Message		
From	Name	Value
	End Model Element	 th
Type	Message	
Sequence Number	14	
Asynchronous	false	
Documentation	Return the total number of processed pixels.	

 N/A

Relationships

Unnamed Anchor	
From	 CombinedFragment

 N/A

Relationships

Unnamed Anchor	
From	 loop

 N/A

Relationships

Unnamed Anchor	
From	 CombinedFragment2

 N/A

Relationships

Unnamed Anchor	
From	 CombinedFragment3

 N/A

Relationships

Unnamed Anchor	
From	 CombinedFragment4



CombinedFragment

Name	Value
Interaction Operator	loop
Documentation	Constructs all elements of threadArr[]

Interaction Operands

Value
InteractionOperand

Covered LifeLines

Name	Documentation
 img	
 threadArr	



CombinedFragment2

Name	Value
Interaction Operator	loop
Documentation	All threads get started.

Interaction Operands

Value
InteractionOperand

Covered LifeLines

Name	Documentation
 img	
 threadArr	

CombinedFragment3

Interaction Operands

Value
InteractionOperand

CombinedFragment4

Name	Value
Interaction Operator	loop
Documentation	All threads get joined.

Interaction Operands

Value
InteractionOperand

Covered LifeLines

Name	Documentation
 img	
 threadArr	

InteractionOperand

 **InteractionOperand**

 **InteractionOperand**


Children

Name	Documentation
 CombinedFragment3	


 **InteractionOperand**


 **InteractionOperand**


 **img : CustomImage**


Name	Value
Multiplicity	Unspecified
Base Classifier	 CustomImage
Active	false
Stopped	true
Multi Object	false

Relationships

new CustomImage() : Message		
From	Name	Value
	End Model Element	 threadArr
Type	Create Message	
Sequence Number	6	
Asynchronous	false	

Unnamed Message		
From	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	9	
Asynchronous	false	

Unnamed Message		
From	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	10	
Asynchronous	false	

Unnamed Message		
From	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	11	
Asynchronous	false	


loop

Name	Value
Interaction Operator	loop
Documentation	Assigns all *.rgb files to threads - the elements of threadArr[]


Interaction Operands


Value
InteractionOperand


th : ThreadHandler


Name	Value
Multiplicity	Unspecified
Base Classifier	 ThreadHandler
Active	true
Stopped	true
Multi Object	false


Relationships


new ThreadHandler(dir, lambda, threads) : Message		
From	Name	Value
	End Model Element	
Type	Create Message	
Sequence Number	1	
Asynchronous	false	


pixels = BatchProcess() : Message		
From	Name	Value
	End Model Element	
Type	Message	
Sequence Number	2	
Asynchronous	false	
Documentation	Starts file processing and returns the total number of processed pixels.	


files = GetFileList(dir) : Message		
To	Name	Value
	End Model Element	 th
Type	Self Message	
Sequence Number	3	
Asynchronous	false	


new : Message		
To	Name	Value
	End Model Element	 threadArr
Type	Create Message	
Sequence Number	4	
Asynchronous	false	


threadArr[i] = new CustomThread(i+1, lambda) : Message		
To	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	5	
Asynchronous	false	

threadArr[getMinimum(threadArr, threads)].addFile(i) : Message		
To	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	7	
Asynchronous	false	

threadArr[i].start() : Message		
To	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	8	
Asynchronous	true	

[threadArr[i].isAlive()] threadArr[i].join() : Message		
To	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	12	
Asynchronous	true	


[all threads are done] : Message		
From	Name	Value
	End Model Element	 threadArr
Type	Message	
Sequence Number	13	
Asynchronous	true	
Documentation	Control returns to th.BatchProcess when all threads are done.	


pixels : Message		
To	Name	Value
	End Model Element	
Type	Message	
Sequence Number	14	
Asynchronous	false	
Documentation	Return the total number of processed pixels.	


threadArr


Name	Value
Multiplicity	Unspecified
Active	false
Stopped	true
Multi Object	false


Relationships


new : Message		
From	Name	Value
	End Model Element	 th
Type	Create Message	
Sequence Number	4	
Asynchronous	false	


threadArr[i] = new CustomThread(i+1, lambda) : Message		
From	Name	Value
	End Model Element	 th
Type	Message	
Sequence Number	5	
Asynchronous	false	


new CustomImage() : Message		
To	Name	Value
	End Model Element	 img
Type	Create Message	
Sequence Number	6	
Asynchronous	false	


threadArr[getMinimum(threadArr, threads)].addFile(i) : Message		
From	Name	Value
	End Model Element	 th
Type	Message	
Sequence Number	7	
Asynchronous	false	

threadArr[i].start() : Message		
From	Name	Value
	End Model Element	 th
Type	Message	
Sequence Number	8	
Asynchronous	true	


Unnamed Message		
To	Name	Value
	End Model Element	 img
Type	Message	
Sequence Number	9	
Asynchronous	false	

Unnamed Message		
To	Name	Value
	End Model Element	 img
Type	Message	
Sequence Number	10	
Asynchronous	false	

Unnamed Message		
To	Name	Value
	End Model Element	 img
Type	Message	
Sequence Number	11	
Asynchronous	false	

[threadArr[i].isAlive()] threadArr[i].join() : Message		
From	Name	Value
	End Model Element	 th
Type	Message	
Sequence Number	12	
Asynchronous	true	

[all threads are done] : Message

To	Name	Value
	End Model Element	 th
Type	Message	
Sequence Number	13	
Asynchronous	true	
Documentation	Control returns to th.BatchProcess when all threads are done.	