

The background features abstract, flowing, ribbon-like shapes in shades of blue and white. A dark blue rectangular area is positioned on the left side, containing the title text. The overall design is modern and clean.

# **BUILDING CHANGE DETECTION USING CNN MODEL ON AERIAL IMAGES: A COMPARATIVE ANALYSIS OF 2012 AND 2016 DATASETS**

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An aerial photograph of a modern urban development. A river flows along the left side, bordered by a dense line of green trees. A road with a pink-paved pedestrian path runs parallel to the river. In the center, there are several large, modern buildings with glass facades and flat roofs. A large green lawn is situated between the buildings. To the right, more buildings and a parking lot are visible. The overall scene depicts a well-planned, sustainable urban environment.

# MOTIVATION

1. Importance of detecting changes in built environment for urban planning
2. Facilitate data-driven decision-making for sustainable urbanization
3. Satellite image analysis: Real-time, precise, comprehensive data on urban transformation
4. Improve efficiency of urban planning processes

# APPLICATION PROSPECTS

Urban planning: Calculate urbanization rates, monitor growth and transformation of urban structures

Disaster response: Detect demolished buildings, allocate resources efficiently

Environmental monitoring: Changes in lakes, glaciers, forests



# DATASET

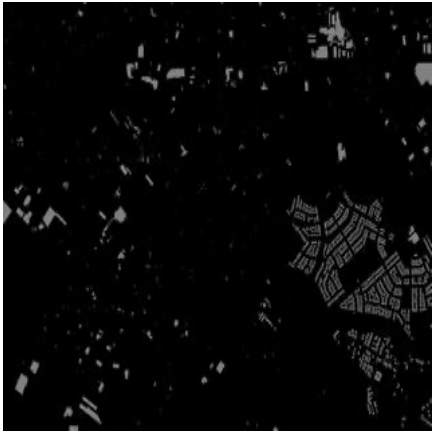
2012

2016

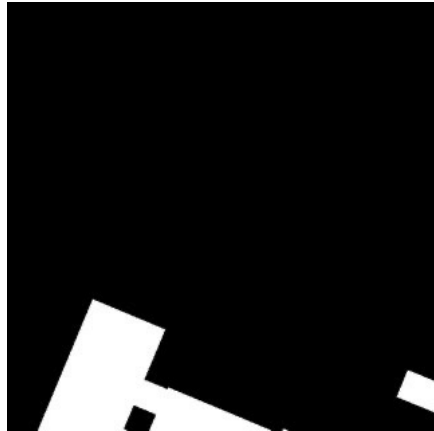
1. Aerial images taken in April 2012 and 2016
2. Covers area affected by a 6.3-magnitude earthquake in February 2011
3. 12,796 buildings in 20.5 km<sup>2</sup> (2012) and 16,077 buildings in the same area (2016)
4. Ideal for studying urban changes in a post-disaster rebuilding context



# CLEANING THE DATASET



The whole image



piece with 500X500 pixels

We manually crop the whole image to get the corresponding change label images.

# DEVELOPMENT TREND

Evolution from image  
differencing to semantic  
segmentation and CNNs

Fully convolutional networks  
(FCNs) for pixel-wise  
classification

Integration of complex  
methodologies (e.g.,  
Siamese neural networks, U-  
Net, attention mechanisms,  
transformers, transfer  
learning)

# MACHINE LEARNING MODEL - SEMANTIC SEGMENTATION

**Semantic segmentation  
based on fully connected  
neural network (FCN)**

**a computer vision task in  
which the goal is to  
categorize each pixel in an  
image**

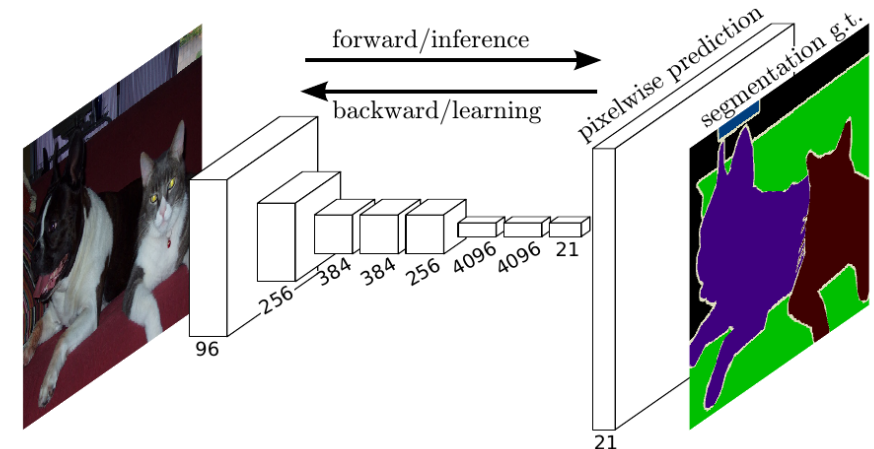


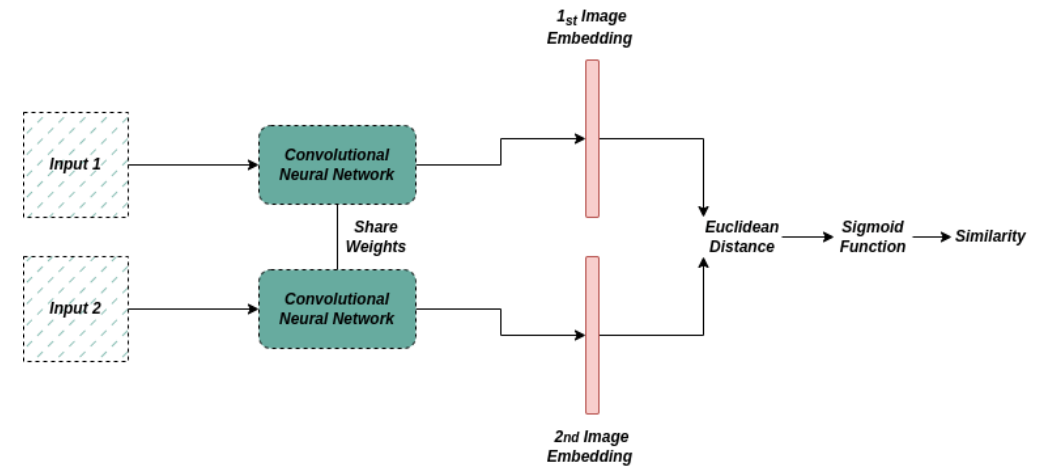
Figure 1. Fully convolutional networks can efficiently learn to make dense predictions for per-pixel tasks like semantic segmentation.

J. Long, E. Shelhamer, and T. Darrell, "Fully Convolutional Networks for Semantic Segmentation," arXiv.org, 2014.  
<https://arxiv.org/abs/1411.4038>

# MACHINE LEARNING MODEL - SIAMESE NETWORK

A Siamese neural network (sometimes called a twin neural network) is an artificial neural network that uses the same weights while working in tandem on two different input vectors to compute comparable output vectors.

Application: face recognition



<https://www.baeldung.com/cs/siamese-networks>

[https://en.wikipedia.org/wiki/Siamese\\_neural\\_network](https://en.wikipedia.org/wiki/Siamese_neural_network)



# MACHINE LEARNING MODEL - SATELLITE IMAGE CHANGE DETECTION

How we combine semantic  
segmentation and siamese  
network

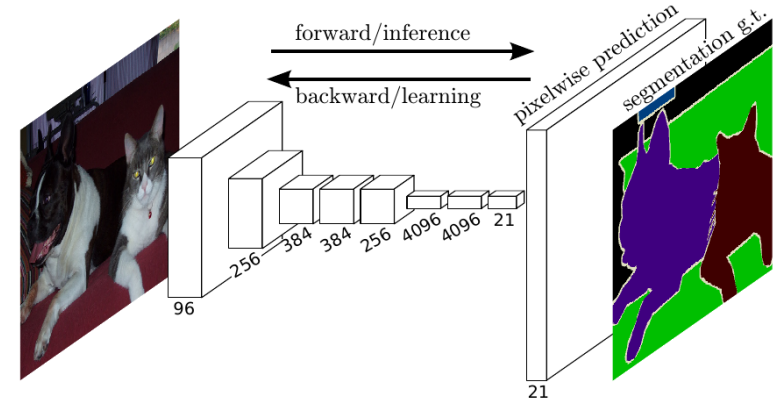
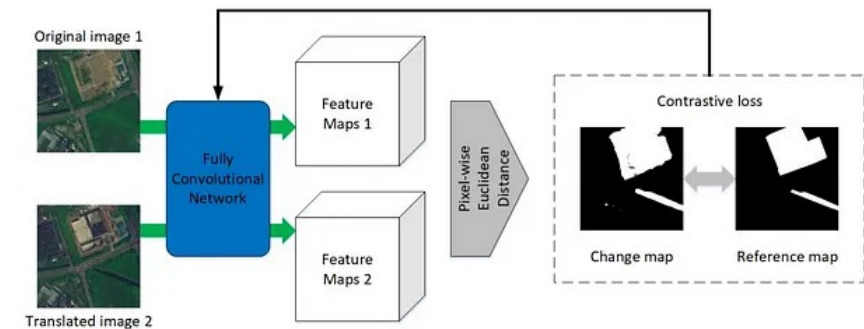


Figure 1. Fully convolutional networks can efficiently learn to make dense predictions for per-pixel tasks like semantic segmentation.



# CRITICAL SCIENTIFIC PROBLEMS TO BE SOLVED



1. Minimizing false positives: To ensure the accuracy of our model, it is crucial to minimize false positives, such as misidentifying vehicles or other objects as buildings.



2. Satellite image alignment: We must develop algorithms capable of aligning images for precise comparison and quantification of changes in the built environment.



3. Scalability and adaptability: Our proposed system must be scalable and adaptable to various satellite images and time periods, ensuring its applicability across different urban environments and diverse applications.

A bright, modern dining room with a table set for a meal, a large potted plant, and open windows looking out onto a garden. The room features light-colored walls, a wooden floor, and a large potted plant. The table is covered with a light blue patterned tablecloth and is set with white dishes. Two windows with white frames are open, showing a view of a garden with green trees and white flowers. A black pendant lamp hangs over the table, and a white pendant lamp hangs over the window. A wooden table is visible in the foreground on the right.

**THANK YOU**