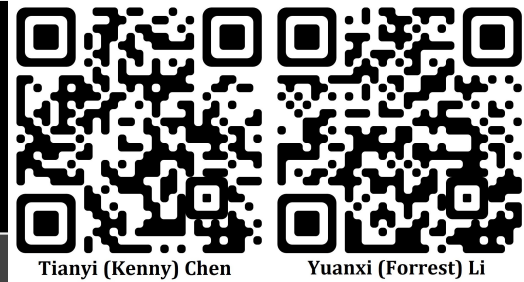


# Energy Efficient Fire Detector

CS5330 Pattern Recognition Computer Vision

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## Introduction

- Canada has suffered from forest fires over recent years. Immense damage was caused leaving large area of forestry land burned. The early detection of such fires can prevent huge amount of losses.
- In this project, we present a computer vision based novel method that can detect fires at their early stages. Our approach combines traditional computer vision algorithms (Little) and deep learning models (Big) that is accurate while being fast & energy efficient. It can be easily deployed on low cost computing devices like Raspberry Pi, etc.

## Methodology

### (Little) Statistical colour model

- Background subtraction
- Noise removal
- Filtering defined fire-like colour (RGB) ranges
  - $R > G \ \& \ G > B$
  - $0.25 \leq G / R \leq 0.65$
  - $0.05 \leq B / R \leq 0.45$
  - $0.2 \leq B / G \leq 0.6$

### (Little) Optical Flow based colour model

- Corner detection
- Extracting motions
- Filtering defined fire-like colour (HSV) ranges
  - Hue:  $H \in (0, 60)$
  - Value:  $V > V^T$
  - Saturation:  $S \geq (255 - R) * S^T / R^T$

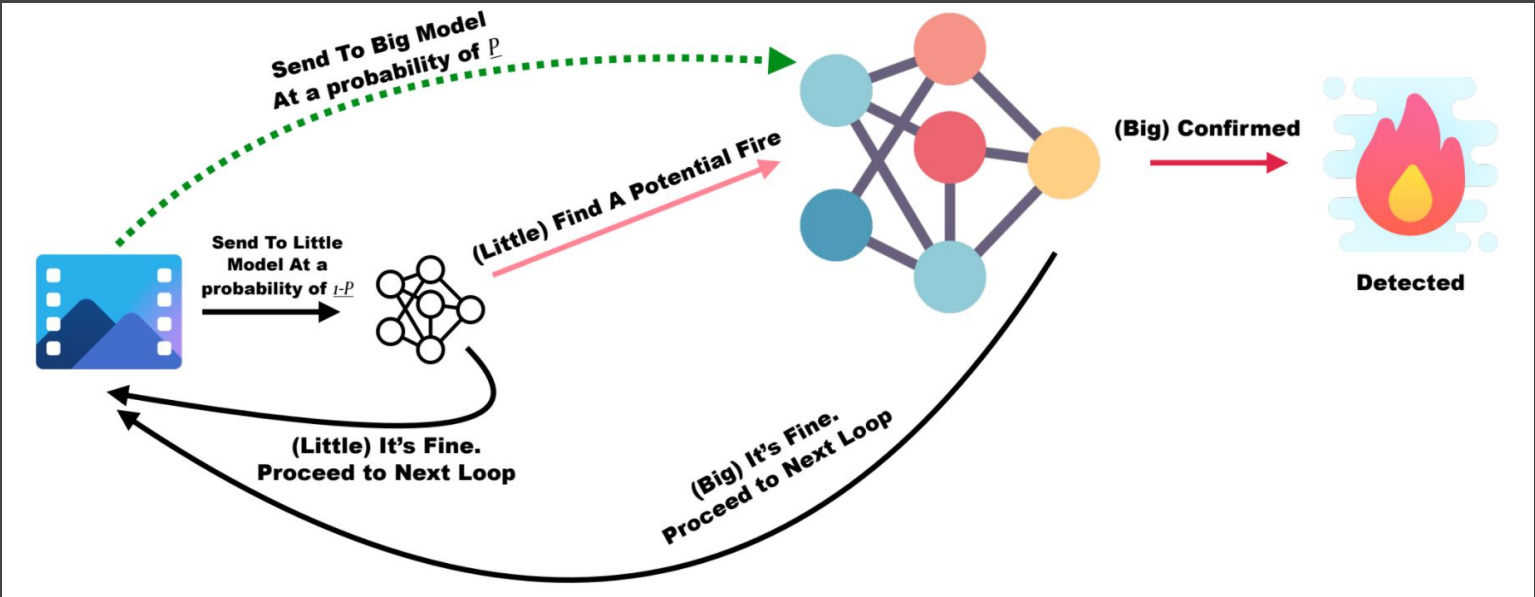
### (Big) Deep learning model - YOLOv5

- Using pre-trained weights “yolov5s.pt”

## Limitations & Future Work

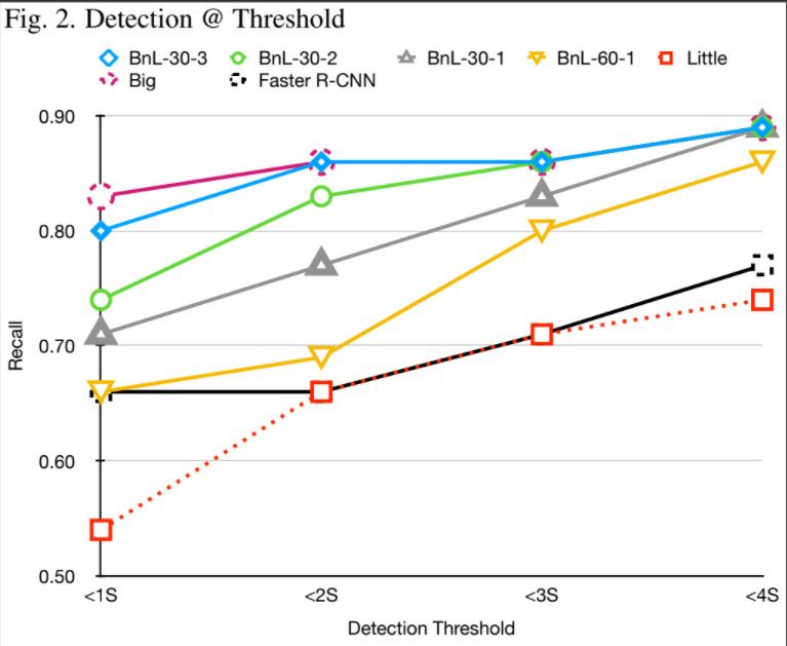
- Scarce of open datasets for forest fires/wildfires
- Traditional CV models
  - Based solely on colors (RGB/HSV)
  - Potential better ones to implement
- Lack of training for deep learning models

## System Design



## System Testing

Model detection rate within 4 seconds			
	BnL-60-1	Big-YOLO	
Detection @ 4S	0.86	0.89	-3%
FPS @ 1 Instance	63.2	4.41	14.3x



Model detection rate within 2 seconds			
	BnL-30-3	Big-YOLO	
Detection @ 2S	0.86	0.86	0%
FPS @ 1 Instance	32.1	4.41	7.3x

