Estimating Firebrand Shape and Size from Field Measurements

Univ.AI

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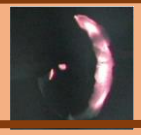


Goal: Characterize Firebrands

- Firebrands: pieces of burning vegetation, lofted, carried by wind.
- Firebrands land ahead of fire-front resulting in very fast fire spread.

Research Questions

- Can CNN trained on video data (four cameras) *classify* firebrand shapes?
- Can CNN combine image & non-image data to predict firebrand volume?

Quad Images & Video Data

Disk (49, 6) mm | Cube 8 mm | Cyl 6, 50 mm

Challenge: Firebrands Tumbling, Rotating

References

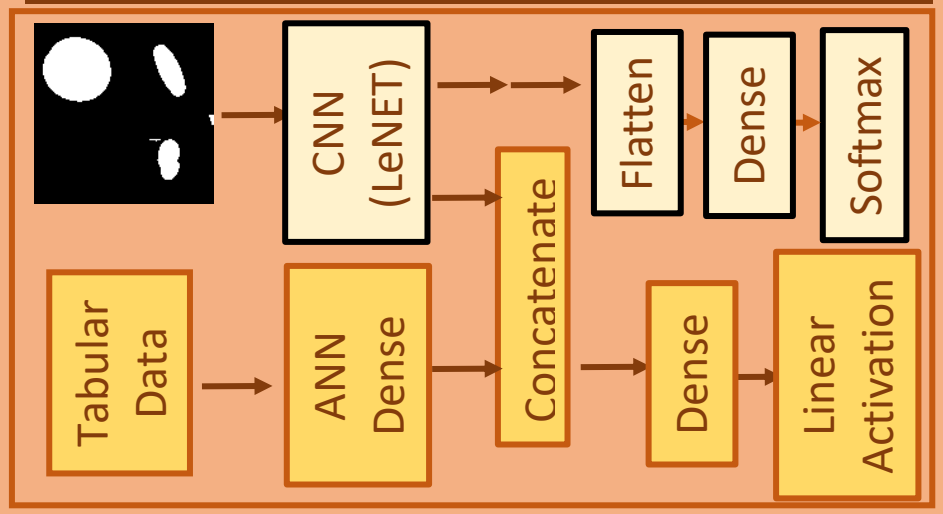
1 Wildland Fire Photo Credit: Wolter Peeters

2. Ember photo – Sam Manzello

Wildland Fires: Destruction to Life / Property

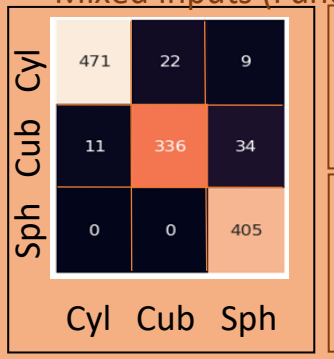
- **Global Issue**: Australia, Greece, Spain, USA
- 2007 Southern California Fire displaced **300,000** people, destroyed **1000 structures**, **$1 B** losses.

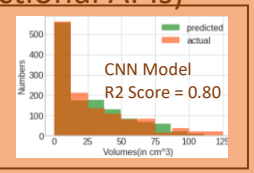
Multiple Inputs and Mixed Data Analysis

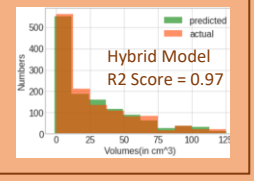


Results & Analysis

- Use of Back Prop / GradCAM to understand why images are classified in-correctly (Saliency)
- Mixed Inputs (Functional APIs)







- Data Augment, LamdaCallbacks
- MobileNet – Transfer Learning
- Saliency, GradCAM, PyTorch

Conclusions

- Classification accuracy 96 %.
- Volume prediction R2: 0.95.
- Distance between camera and firebrand is a critical non-image input feature

Future Work & Impact

- Protect communities - better understanding of firebrand shape and size.
- Irregular shaped firebrands!!