**Full List of Dataset Columns**

1. **Original CFDB Columns**

|  |  |
| --- | --- |
| **Descriptors** | **Normed?** |
| ID |  |
| Photo Date |  |
| Media Folder |  |
| Photo |  |
| Infrared |  |
| Ground Truth |  |
| Material |  |
| Focal Length |  |
| Sensitivity |  |
| Infrared Spectrum |  |
| Exposure Time |  |
| Height |  |
| Width |  |
| Time |  |
| Location |  |
| Region |  |
| GPS Position |  |
| Fire Direction | ✓ |
| Occupancy Rate | ✓ |
| Dominant Color (Fire Color) | ✓ |
| Density | ✓ |
| Superposition Rate | ✓ |
| Smoke Color | ✓ |
| Luminosity | ✓ |
| Vegetation | ✓ |
| Moment | ✓ |
| Cloud | ✓ |
| Distance | ✓ |
| Presence | ✓ |
| Valid |  |
| Owner |  |
| Sequence |  |
| Image Number |  |

1. **Descriptors Created or Computed**

|  |  |
| --- | --- |
| **Descriptors** | **Normed?** |
| Area Coverage | ✓ |
| Fire Intensity | ✓ |
| Spread Direction (dx, dy) | ✓ |
| Fire Presence | ✓ |

**Normed Descriptors**

* 1. **Fire Characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Word** | **Definition** | **Range/Values (Examples)** | **Heuristic** | **Source** |
| Fire Presence | Indicates whether flames are visibly present. | yes / no | Label as "yes" if flame regions are clearly visible and occupy >5% of the image area; otherwise "no." Use visual clarity and pixel brightness contrast for judgment. | Gemini Output |
| Fire Color | Dominant color of fire pixels. | red / orange / yellow-white / other | Each fire pixel is assigned to red, orange, or yellow-white using HSI thresholds. The color with >70% dominance among fire pixels is chosen. If no color exceeds 70%, label "other." | CFDB Column, Gemini Output |
| Fire Intensity | The brightness level of fire emission. | low / medium / high | Compute average grayscale intensity of fire pixels normalized between 0 and 1. Low (<0.3), Medium (0.3–0.6), High (>0.6). Higher values imply stronger flame energy emission. | Computed from fire\_intensity function |
| Superposition Rate | Percentage of fire pixels covered by smoke. | low (<30%) / medium (30–70%) / high (>70%) | Calculate the proportion of fire pixels superimposed by smoke. Classify as Low if <30%, Medium if between 30–70%, High if >70%. Superposition inferred via pixel standard deviation changes over fire mask. | CFDB Column, Computed from superposition function, Gemini Output |
| Luminosity | Average brightness of entire image. | low / medium / high | Calculate the average pixel brightness across the full image normalized to [0,1]. Low (<0.3), Medium (0.3–0.6), High (>0.6). Consider lighting condition (e.g., overcast daytime scenes). | CFDB Column, Gemini Output |
| Area Coverage | Fire pixel proportion relative to the full image. | small (<20%) / medium (20–60%) / large (>60%) | Area Coverage = (Number of fire pixels / Total number of image pixels). Small if <20%, Medium if 20–60%, Large if >60%. | Computed from area\_coverage function |

* 1. **Smoke Characteristics**

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| --- | --- | --- | --- | --- |
| **Word** | **Definition** | **Range/Values (Examples)** | **Heuristic** | **Source** |
| Smoke Color | Dominant smoke color above flames. | white / gray / black / brown / NA | Visually inspect smoke region. Assign the most frequent color (>70% of smoke pixels). If unclear, label as "NA." Classify using typical smoke color standards: white (light smoke), gray (moderate), black (dense), brown (heavy organic burn). | CFDB Column, Gemini Output |

* 1. **Movement and Direction**

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| --- | --- | --- | --- | --- |
| **Word** | **Definition** | **Range/Values (Examples)** | **Heuristic** | **Source** |
| Spread Direction | Direction of fire spread between frames. | north / northeast / east / southeast / south / southwest / west / northwest | Measure center-of-mass shift (dy, dx) across frames. Convert arctangent(dy/dx) into compass direction by binning into 8 equal 45° sectors. | Computed from spread\_direction function |
| Fire Direction | Movement of fire boundary relative to camera. | left / right / move closer / move away | Analyze motion trends: if flames shift left/right across frames relative to camera frame, label left/right. If fire front moves toward center (camera), label "move closer." If receding, label "move away." | CFDB Column |

* 1. **Environmental Context**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Word** | **Definition** | **Range/Values (Examples)** | **Heuristic** | **Source** |
| Vegetation Type | Vegetation type fueling the fire. | crimp wood / low maquis shrubland / high maquis shrubland / trees / grass | **Shrubland:** Needle-like small leaves, no woody trunk. Low shrubland: close to ground, dense. High shrubland: taller, vertical growth. **Wood/Trees:** Bigger leaves; wood = thinner trunk, trees = very tall with thick trunks. | CFDB Column |
| Distance | Distance of fire relative to observer. | near / far / NA | Visual estimation based on object scaling: label "near" if <200 meters, "far" otherwise. Label "NA" if distance cannot be reasonably inferred. | CFDB Column |
| Cloud Presence | Amount of visible clouds. | clear / partly cloudy / cloudy | Clear = <10% clouds; Partly Cloudy = 10–60% clouds; Cloudy = >60% cloud coverage. Evaluate whole sky portion of image. | CFDB Column |
| Moment (Time of Day) | Scene illumination state. | day / night | If sunlight or strong diffuse light is absent, label "night." If ambient natural light visible even under overcast, label "day." Use sun angle if time metadata available. | CFDB Column |

* 1. **Human and Vehicle Presence**

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| --- | --- | --- | --- | --- |
| Word | Definition | Range/Values (Examples) | Heuristic | Source |
| Presence | Human or vehicle visual occurrence. | none / men / truck / other | Prioritize labeling in this order if multiple objects: truck > men > other. Trucks should be labeled even if partially obscured. "None" only if no discernible objects. | CFDB Column |