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**Abstract**

Active thermography provides infrared images that contain sub-surface defect information, while visible images only reveal surface information. Mapping infrared information to visible images offers more comprehensive visualization for decision-making in rail inspection. However, the common information for registration is limited due to different modalities in both local and global level. For example, rail track which has low temperature contrast reveals rich details in visible images, but turns blurry in the infrared counterparts. This paper proposes a registration algorithm called Edge-Guided Speeded-Up-Robust-Features (EG-SURF) to address this issue. Rather than sequentially integrating local and global information in matching stage which suffered from buckets effect, this algorithm adaptively integrates local and global information into a descriptor to gather more common information before matching. This adaptability consists of two facets, an adaptable weighting factor between local and global information, and an adaptable main direction accuracy. The local information is extracted using SURF while the global information is represented by shape context from

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