

# L.I.N.C.



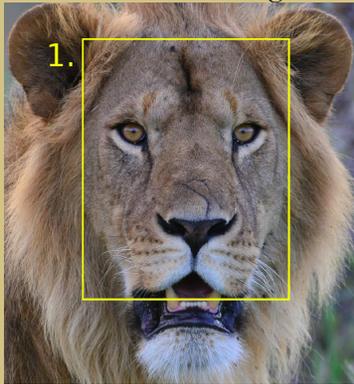
## OUR VISION

The **Lion Identification Network of Collaborators (LINC)** will be a cutting-edge open platform for lion data aggregation and identification. **LINC** has the potential to revolutionize the way the scientific community reports and accesses data. A fundamental principle of effective research and conservation of lions is the ability to identify individuals. Its use will generate a rich source of information that will enable lion researchers to accurately monitor lion populations and the connectivity between them. This greater understanding of broad scale lion populations allows more effective conservation across what remains of African lions rangelands.

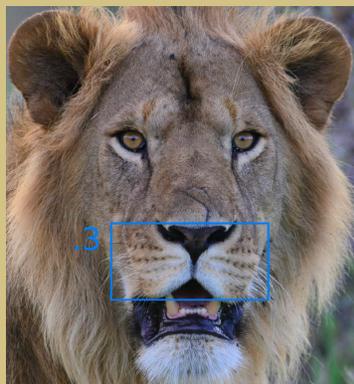
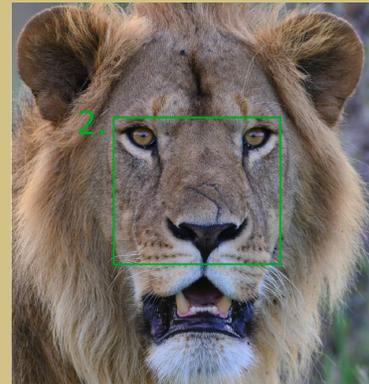
The tool will use an open database paired with the latest computer vision techniques, accessed via an online web portal.

**LINC**'s development, although spearheaded by Lion Guardians, is a collaborative effort with lion researchers across East Africa and software developers around the world. The software development will be led by IEF R&D in the USA.

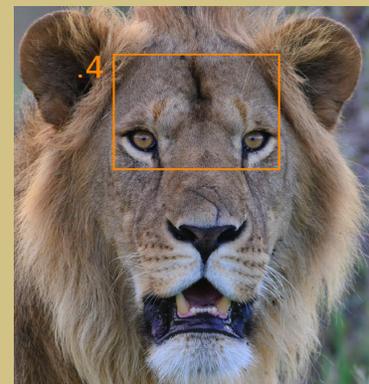
### Automated Facial Recognition System



Users will upload lion sightings onto LINC. LINC will use facial recognition software to match the current observation with observations in the database by focusing on the following specific facial elements.



1. Overall stable area between picture sets.
2. Post puberty, eye to nose to mane relation is stable.
3. Whisker spots: Each marking is unique to individual and does not alter with age.
4. Eye markings are not conclusive but are stable with aging.



# OBJECTIVES

In the past, lions could only be identified through photographs taken with high quality cameras and focusing on specific identification zones, such as whisker spots. Facial recognition of lions would open the door to millions of photographs taken of lions by the public and provide a platform to share that information, thereby vastly increasing our knowledge of lion populations. LINC would therefore allow for intensive monitoring of lions across their range, rather than being restricted to localized projects. Specifically, LINC would allow for:

1. Identification of lions appearing across all areas where lions are photographed
2. Understanding connectivity between lion populations, which populations are growing and sending out dispersers and where they are dispersing to
3. Facilitate broad-scale collaboration across vast landscapes in East Africa
4. Provide an open technological platform that encourages cross-pollination between conservation efforts, combining data and focusing the efforts of the larger community toward common goals.



*Lion populations across East Africa display a metapopulation structure. Connectivity between these “patches” of lion populations will ensure their survival.*

**“LINC will enable lion researchers to understand the connections between these populations and enable conservation on a broad-scale rather than in isolated project areas.”**

-Dr. Stephanie Dolrenry, Director of Science, Lion Guardians

# FUNCTIONALITY

LINC will be an open source application that will incorporate three main elements

1. **Easy-to-use website:** will allow users to access and contribute lion data fast and efficiently
2. **Community generated database:** will store a variety of lion observations in East Africa gathered from lion researchers as well as local and tourist sightings
3. **Facial recognition software:** uses a custom algorithm to match photographs in the database with user-submitted photographs to provide identification with 80% certainty.

LINC will contain the following data

1. Lion presence (date/time and location 'a lion' was seen)
2. Lion demographics (was the lion a male or female? Approx. age? Were there cubs (indicator that reproduction is occurring in the area, or possibly just a dispersal area))
3. Individual ID of lion (whisker spots and other identifying characteristics)
4. Lion ID photographs including camera trap photographs

*At present, in order to accurately identify a lion, we require multiple photographs from different angles, taken specifically for identification purposes.*

EXAMPLE: these 12 images are used to confirm the identification and all are used as a cross-reference. LINC will aid lion researchers by cutting down this initial verification process by 70-90% through the automated match process



These data will be interpreted using advanced facial recognition technology to match photographs contributed by users. The automated system match will be verified by lion researchers in the initial stages. As the product matures, we envision that trained citizen scientists would also be involved in the verification process.

All users will be approved by the system administrators based on strict security levels. Non-contributors will be able to view a preview of the type of information they would be able to access as contributors to the database. Users will have varying levels of access to data based on their security clearance and will fall into the following categories

1. Lion researchers who contribute specific photographs (specific angle, light, etc) for individual identification will be able to view ALL data, run facial recognition searches and run various reports.
2. Lion researchers who do not contribute data can also request specific reports.
3. Tourists/donors/casual observers can submit photographs to contribute to sightings. A report (free of charge) will be sent to them on their particular sighting once it has been verified.

## IMPLEMENTATION & BUDGETARY REQUIREMENTS

The project will be implemented over eight months from 2<sup>nd</sup> October, 2014 to 5<sup>th</sup> June, 2015 including fundraising, database development, facial recognition software and website portal.

Total funds required for development: \$65,000

- System Development Overview: \$7,000
- Database & Web Portal: \$12,000
- Facial Recognition Software: \$28,000
- Project Management & Consulting: \$18,000

### Stages of Implementation

Stage	Proposed Completion Date
1. Fundraising to cover development costs.	2/12/2014
2. Development of database, facial recognition software and portal.	5/6/2015
3. Soft launch amongst lion researchers who contribute data. This will include only males that have disappeared from the project areas over the last five years.	5/6/2015
4. Full-fledged – based on success with soft launch.	5/12/2015
5. Spin-off daily management of database after one year of successful operation.	5/12/2016