INTERNATIONAL WORKSHOP ON

KNOWLEDGE ENGINEERING FOR
DIGITAL LIBRARY DESIGN

Organized by: UNESCO, New Delhi Office and
National Digital Library of India, IIT Kharagpur
25th to 27th October, 2017

Prof. PARTHA PRATIM DAS
General Co-Chair, Joint PI, NDL Project and Professor
Indian Institute of Technology, Kharagpur

25-OCT-2017
India

• Second most populous country in the world with 1.32 billion citizen, yet
• India has more than 50% of its population below the age of 25 and more than 65% below the age of 35.
• It is expected that, in 2020, the average age of an Indian will be 29 years, compared to 37 for China and 48 for Japan; and, by 2030, India's dependency ratio should be just over 0.4
Education in India

- How to leverage this demographic dividend?
- How to educate this young population?
- How to get them rightly skilled?
Challenges of Education in India

- Wide geographic expanse
- Large population
- Huge number of students
- Large number of institutions
- Varied linguistic diversity
- Severe lack of Teachers
- ...

IIT, Kharagpur 25/10/2017 Prof. P P Das, CSE, IIT, Kharagpur
Digital Technology - the Panacea?

- Advances in Digital Technology, specifically in the field of Knowledge Engineering powered by techniques of Artificial Intelligence and Machine Learning, have been changing the face of education and learning across the world since the turn of the millennium...
- Technology Enhanced Learning (TEL) identified as the primary enabler
India embraces the Digital

- 1980’s: UGC Classrooms in National TV
- 1990’s: Distance Mode Learning in some sectors
- 2009: National Mission on Education through Information and Communication Technology (NMEICT) launched
- 2014: NPTEL-NOC: Online MOOCs courses in technology (certificate)
Rooted at the *Gurukul* culture and powered by the British Education System, India has had a strong traditional education system.

New-age digital techniques promised many a solution (with its own challenges, though).

A choice had to be made.
Higher Education in India: Vision 2030 Report from FICCI - MHRD Higher Education Summit 2013 observes (circa 2030) that

- Despite many new national missions/programs and reforms agenda, by both the central and state governments with private sector intervention, the higher education sector is in a state of complete flux.

- If India were to create this additional capacity through increase in brick and mortar institutions alone, it would have had to build six universities and 270 colleges each and every month in the last 20 years (circa 2030) – a feat that would have been impossible to achieve with India’s limited resources. Instead, India chose to go the MOOCs way.”
Digital Initiatives in Education

- **SWAYAM - Study Webs of Active-learning for Young Aspiring Minds**
  - Curriculum based free MOOCs from School (9-12 levels), Under Grad to Post Grad covering all disciplines.

- **SWAYAM Prabha**
  - 32 DTH channels of high-quality educational programs on 24X7 basis using the GSAT-15 satellite.
  - Each channel has 4 hours of fresh contents every day repeated 5 more times.
  - At School, Certificate, Diploma, Graduate and Post-Graduate levels.

- **Global Initiative of Academic Networks (GIAN)**
  - A system of Guest Lectures by internationally and nationally renowned experts.

- **National Academic Depository (NAD)**
  - A national database set up to hold academic awards issued by Academic Institutions (AI) in an electronic form.
The Big Picture

Knowledge Repository: Internet, Mobile

National Digital Library of India

SWAYAM, SWAYAM Prabha, GIAN

Credit Transfer and Virtual Certification (NAD)

Up to 20 credits from MOOCs

SWAYAM: instrument for self-actualisation

School, Certificate, Diploma, UG & PG: Internet

SWAYAM Prabha: 32 DTH, 24x7

School, UG, PG, Open U, IIT PAL: TV - DTH

National Digital Initiative in Education

IIT, Kharagpur
WINNER _mBILLION^th_ SOUTH ASIA AWARD 2017:
IN LEARNING AND EDUCATION CATEGORY
FOR ANDROID MOBILE APP

Pilot: Apr, 2015 - Sep 2017
Phase II: Oct 2017 - Mar 2018
BUILD UP
NATIONAL DIGITAL LIBRARY OF INDIA
AS A NATIONAL KNOWLEDGE ASSET -
THE KEY DRIVING FORCE FOR EDUCATION, RESEARCH, INNOVATION, AND KNOWLEDGE ECONOMY IN INDIA
TO CREATE A 24X7-ENABLED INTEGRATED NDL
AS A UBIQUITOUS DIGITAL KNOWLEDGE SOURCE OF THE NATION – CATERING TO IMMERSIVE E-LEARNING FOR ALL LEARNERS AT ALL LEVELS IN ALL AREAS

TO INITIATE A MOVEMENT FOR INTEGRATED DIGITAL LEARNING ACROSS INDIA

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NDLI Motto

INCLUSIVE & OPEN
Libraries are more important to the education system than the institutions such as schools, colleges and universities

- Rabindranath Tagore
National Digital Library: Issues

User-side
- Wide geographic expanse & Large population
- Huge number of institutions
- Large number of institutions
- Varied linguistic diversity
- Severe lack of Teachers

Provider-side
- Wealth of digital content
  - Books and Articles
  - ETD
  - Question Papers and Solutions
  - Video Lectures - MOOCs
  - Simulations & Animations
  - NMEICT Projects
  - Data
  - ...
- No single-window search
- Google search uses keyword – no metadata search
- Widely varied DL technology
- Lack of Interactivity, Vernacular support
- Low integration between content and learning system
- Weak ecosystem between learners and teachers
National Digital Library: Service Architecture

- Content Creation
- Content Search
- Learning Content
- Experience-based Learning
- Multi-Lingual Content
- Mobile Apps
- Authoring Services
- Acquisition Services
- Digital Repository
- Dissemination Services
- Learning Services
- Personalization Services
- Localization Services
- Open Services
- Mobile Apps
- APIs
- Multifaceted Interface
- Content Access
- Content Borrowing

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Presentation Model

- Not a new library – an umbrella
- Collects and ingests metadata only
- Presents full-text from source view
- Provides:
  - Search
  - Browse
Objective and Scope

TARGETS
CONTENTS,
STAKEHOLDERS,
CONTRIBUTORS,
USERS,
ARCHITECTURE, AND
THE BIG PICTURE

Objective and Scope

TARGETS
CONTENTS,
STAKEHOLDERS,
CONTRIBUTORS,
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THE BIG PICTURE

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25/10/2017
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Objectives

- Create a 24X7-enabled Infrastructure for NDL with single window search facility – To include h/w systems, networks, s/w tools, applications and interoperability standards
- Harvest IDRs (Institutional Digital Repository) across institutions of the nation to provide integrated access
- Facilitate select institutes to disseminate existing content and create new digital content
- Provide support for immersive E-learning environments at multiple levels spanning across
  - All academic levels – school to college to university to life-long learning
  - All disciplines – Science, Arts, Humanities, Engineering, Medical, Law, and
  - All languages (vernacular) used as medium of instruction.
- Support interfaces in Indian Languages & for differently abled users
Digital Contents

Digital, Surrogate Digital, Metadata Digital, etc.

- Born-digital object
- Digital surrogate of a physical object
- Digital metadata of physical object

Metadata at NDL

- NDL does not store contents
- NDL only ingests metadata for Search & Browse
- Content (Full-text) is delivered from Source

A content is included (metadata ingested) in NDL if it is expected to have educational value
Institutional Digital Repository of Contributing Institutes

Range of Content

Institutional and Open Contributions. Multi-modal, Multi-faceted

Faculty Publications, ETD (Electronic Thesis & Dissertation): DSc-PhD-Masters-Undergrad, Research Projects

Books & Periodicals, Open Access Journals, E-Books & Subscribed E-Resource

Annual Reports, Project Reports, Convocation, Working Papers, Others

Encyclopaedia, Dictionaries, Directories, Others

Research and Professional Institutions, Central / State University

Institutions of School & Higher Education, Boards

Lecture Slides, Videos, Class Notes, Courseware

Term Papers, Assignments, Solutions

Lab Experiments, Manuals, Case Studies

Question Banks (JEE / GATE / NET / CAT), Model Answers

Datasets, Benchmarks, Models, Maps, Software

Manuscripts, Painting, Sculpture, Music, Dance, Drama

Audio & Video Content

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Content View Architecture

Vertical-Specific Custom Interface and Search

- Domain Metadata
- Textbook, Lesson View
- Search

- Domain Vertical (Medical/Legal/...)
- School Vertical
- Data Browser
- App Launcher
- Compete Exam Vertical
- MCQ/MSQ...
- Data Vertical
- Application Vertical

Content Baseline

Generic Interface and Search

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### Stakeholders

#### Roles and Responsibilities

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Roles and Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government</strong></td>
<td>1. Sponsor and facilitator</td>
</tr>
<tr>
<td></td>
<td>2. Content Contributor</td>
</tr>
<tr>
<td></td>
<td>• Ministries / Departments</td>
</tr>
<tr>
<td></td>
<td>• R &amp; D Labs</td>
</tr>
<tr>
<td><strong>Institutions</strong></td>
<td>1. Host Institution – IIT Kharagpur</td>
</tr>
<tr>
<td></td>
<td>2. Contributing Institution – Supporting IDRs</td>
</tr>
<tr>
<td></td>
<td>3. Participating Institution – Providing Users &amp; Feedback</td>
</tr>
<tr>
<td><strong>Public</strong></td>
<td>1. Use and Feedback</td>
</tr>
<tr>
<td></td>
<td>2. Metadata by Crowd Sourcing</td>
</tr>
<tr>
<td></td>
<td>3. Content by Crowd Sourcing</td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td>1. Technology Providers</td>
</tr>
<tr>
<td><strong>Publishers</strong></td>
<td>1. Metadata Provider</td>
</tr>
<tr>
<td></td>
<td>2. Content Provider (under various licensing schemes)</td>
</tr>
</tbody>
</table>
• Registration is **Open to all**

• Registration Types:
  - **Individual**
    - Registers directly
  - **Institutional**
    - By request from Institution
    - Managed by authenticated Nodal Person
    - Convenient for bulk upload of users
Walkthrough

Where the mind is without fear and the head is held high
Where knowledge is free
Where the world has not been broken up into fragments
By narrow domestic walls
Where words come out from the depth of truth
Where tireless striving stretches its arms towards perfection
Where the clear stream of reason has not lost its way
Into the dreary desert sand of dead habit
Where the mind is led forward by thee
Into ever-widening thought and action
Into that heaven of freedom, my Father, let my country awake.

– Rabindranath Tagore
Search Result Page

magnetism

13,913 results found in 0.3452 secs

Magnet and Compass - Magnetism, Magnetic Field, Magnets
Source: PHET Interactive Simulations
Classroom | Homework

Abstract: Ever wonder how a compass works to point you to the Arctic? Explore the interactions between a compass and bar magnet, and then add the earth and find the surprising answer! Vary the magnets strength! View more

Magnetism
Source: Digital Library of India
Author: Hadfield, D.
Reading

Magnetism
Source: Digital Library of India
Reading

Magnetism
Source: Digital Library of India
Author: Stoner, Edmund C., Author, Preface By Richards, O. W
Reading

Magnetism
Source: Librivox
Abstract: Librivox's Short Story Collection 034: a collection of 20 short works of fiction in the public domain read by a group of Librivox members.

PDF

IIT, Kharagpur 25/10/2017
Please use this identifier to cite or link to this item: http://dspace.library.iitb.ac.in/jspui/handle/100/1441

Title: Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn3

Authors: MAZUMDAR, C
HOSSAIN, Z
NAGARAJAN, R
GODART, C
DHAR, SK
GUPTA, LC
PADALIA, BD
VIJAYARAGHAVAN, R

Keywords: cerusn3

Issue Date: 1996

Publisher: AMER INST PHYSICS

Citation: JOURNAL OF APPLIED PHYSICS,79(8)6349-6351

Abstract: SmRuSn3 is a unique compound among the known Sm-based valence fluctuation (VF) systems. Its crystallographic structure has two inequivalent Sm sites and Sn ions at only one of them are in VF state while the Sm ions in the other site orders magnetically. Our (119)Mossbauer studies show a quadrupolar splitting at the Sn site, consistent with the noncubic symmetry of the Sn site. A broadening of the Mossbauer spectrum is seen due to magnetic ordering of the material. The transferred hyperfine field at Sn site at 4.2 K is small. (C) 1996 American Institute of Physics.

URI: http://dx.doi.org/10.1063/1.361996
http://dspace.library.iitb.ac.in/xmlui/handle/10054/14612
http://hdl.handle.net/100/1441

ISSN: 0021-8979

Appears in Collections: Proceedings_papers
Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn3

Author: Mazumdar, G., Hossein, Z., Nagarajan, R., Godart, C., Chakraborty, S. K., Gupta, L. C.
Publisher: AVER INST PHYSICS
Source: IIT Bombay
Content type: Text
File Format: HTM / HTML
Language: English

Subject Keyword: oru8an3

Abstract: SmRuSn3 is a unique compound among the known Sm-based valence fluctuation (VF) systems. Its crystallographic structure has two inequivalent Sn sites and Sm ions at only one of them are in the VF state while the Sm ions in the other site orders magnetically. Our (119)Mossbauer studies show a quadrupolar splitting at the Sn site, consistent with the noncubic symmetry of the Sn site. A broadening of the Mossbauer spectrum is seen due to magnetic ordering of the material. The transferred hyperfine field at Sn site at 4.2 K is small. (C) 1996 American Institute of Physics.

Education Level: UG or PG
Learning Resource Type: Article
Transport, magnetic, and 119Sn Mössbauer studies on magnetically ordered valence fluctuating compound SmRuSn3


Citation: J. Appl. Phys. 79, 6349 (1996), doi: 10.1063/1.361996
View online: http://dx.doi.org/10.1063/1.361996
View Table of Contents: http://jap.aip.org/resource/1/JAPIAU/V79/I8
Published by the American Institute of Physics.

Related Articles
Valence fluctuation and electron–phonon coupling in La68–xCexAl10Cu20Co2 (x = 0, 34, and 68) metallic glasses
Intermediate valancy of Eu in a cubic intermetallic compound Ce0.5Eu0.5Pd3
Interface and Mn valence effects in ferromagnetic insulating multilayers based on Mn and tin oxide
Charge states of strongly correlated 3d oxides: from typical insulator to unconventional electron–hole Bose liquid
The effect of mixed Mn valences on Li migration in LiMn2O4 spinel: A molecular dynamics study

Additional Information on J. Appl. Phys.
Refine Search (Educational Level) Page

- Project OSCAR
  - Author: Sahasrabuddhe, Sameer
  - Demonstration, Self Learning, Class IX to X, Class XI to XII

- Magnetism and matter
  - Source: NCERT
  - Reading, Class XI to XII
  - Abstract: This chapter introduces the bar magnet, magnetism and Gauss's law. It also includes magnetic properties of materials and permanent magnets and electromagnets.

- Moving charges and magnetism
  - Source: NCERT
  - Reading, Class XI to XII
  - Abstract: This chapter introduces the concept magnetic force, motion in a magnetic field, motion in combined electric and magnetic fields. It deals with Biot-Savart Law, Ampere's circuit law.

- Physical: question paper
  - Source: NCERT
  - Assessment, Class XI to XII
  - Abstract: This section contains problem set having physics code no 55/1 of series S3/1 of class XI.
Chapter Five
MAGNETISM AND MATTER
| महामाया गांधी | सौदागरीसन | महामाया गांधी और राष्ट्रीय अंदोलन | नीर | स्वतंत्रता की ओर | महामाया गांधी की पाठ्य पुस्तक का काय तथा पर्याय | कार्यक्रम नामांकन की पर्याय पर जरूरत | कार्यक्रम नामांकन की पर्याय पर जरूरत | कार्यक्रम नामांकन की पर्याय पर जरूरत | कार्यक्रम नामांकन की पर्याय पर जरूरत |
|----------------|----------------|-------------------------|-----|-----------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| तमिळ, तमिळनाडु | कृष्ण | कृष्ण त्रिकुटा | कृष्ण | कृष्ण | कृष्ण | कृष्ण | कृष्ण | कृष्ण | कृष्ण | कृष्ण |
| के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी | के.माया गांधी |
| विद्य | विद्य | विद्य | विद्य | विद्य | विद्य | विद्य | विद्य | विद्य | विद्य | विद्य |
| विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय |
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| विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय |
| विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय |
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| विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय | विद्यालय |
NDL Mobile App

Available on

Android

And

iOS

IIT, Kharagpur
HOW DOES NDL COPE WITH COPYRIGHT AND LICENSING ISSUES
Copyright is a bundle of rights given by the law to
- Creators of literary, dramatic, musical and artistic works and
- Producers of cinematograph films and sound recordings

Rights are:
- reproduction of the work,
- communication of the work to the public,
- adaptation of the work and,
- translation of the work

Creator / Author is the first Owner
Ownership (Title) can be transferred (assigned)
Copyright of Metadata

- NDL principles as follows:
  - Vast Majority of Metadata is Not Subject to Copyright Restrictions
  - NDL’s Partners Share the NDL’s Commitment
  - NDL Asserts No Rights Over its Database of Metadata and Dedicates its Contributions to the Public Domain
  - Free and Unencumbered Access to Metadata

License Mechanisms

Content Access Views in NDL

- Metadata View
  - This shows the metadata of the item – as maintained in NDL

- Full Text View
  - This shows the view and provides access to full text – offered by the content source

A license encapsulates the rights & privileges that a copyright holder grants to someone else vis-a-vis something they have created
## Access Options

<table>
<thead>
<tr>
<th>Access Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Open</strong></td>
<td>Full-text available to all (Example: NCERT)</td>
</tr>
<tr>
<td><strong>NDL Users</strong></td>
<td>Full-text available through NDL, <em>not directly</em> from Source (Example: South Asia Archive)</td>
</tr>
<tr>
<td><strong>Limited Access</strong></td>
<td>Part of text available but full-text requires authorization by Source authority (Example: IISER, Bhopal)</td>
</tr>
<tr>
<td><strong>Subscribed</strong></td>
<td>Full-text available from institutions that have subscribed to the Source (Example: Springer)</td>
</tr>
<tr>
<td><strong>Restricted</strong></td>
<td>Full-text access requires authorization by Source authority and separate login to the Source (Example: IIT Jodhpur)</td>
</tr>
</tbody>
</table>
National Licensing

• An initiative by eSS:
  ◦ e-ShodhSindhu: Consortium for Higher Education Electronic Resources

• Licensing being negotiated with Publishers
  ◦ Institutional License:
    ▫ Accessible from within designated institutional network: IP filtered
  ◦ NDL Supported License:
    ▫ Accessible if requested from NDL: Concurrent use-basis
Research in NDLI

METADATA ENGINEERING

RESEARCH AGENDA
Metadata Engineering

- Metadata Standard
- Metadata Acquisition
Metadata Standard

Source: http://courseweb.ischool.illinois.edu/~butler9/LIS501b/current.html
NDL Metadata Design Challenges

- Wide category of resources
  - Generic metadata or domain specific?

- Openness of repository
  - Closed metadata standard may fail to describe a new resource

- Scale is enormous
  - Manual annotation is infeasible
  - Automatic annotation guided by crowd sourcing?
NDL Metadata Standard

- NDL Metadata Standard v 1.0 is an Open Virtual Standard

- Schema is categorized into three profiles:
  - **Generic Metadata:**
    - Describes general attributes of the contents
    - Adopted from Dublin Core Metadata Standard
  - **Educational Metadata:**
    - Describes the educational attributes of the resources and helps in enumerating properties of the contents relevant to teaching-learning process
    - Adopted from Learning Resource Metadata Initiative (LRMI)
  - **Thesis Metadata:**
    - Describes dissertation or thesis related metadata fields
    - Adopted from Shodhganga Thesis Metadata Standard

- More profiles may be added in future

- Uses the namespace of Dublin Core (dc.)
Metadata Envelop

Dublin Core (generic)
- title
- type
- date
- language
- description
- author

NDL Metadata

LRMI (educational)
- board
- difficultyLevel
- typicalLT
- prerequisiteTopic
- typeofLM
- pedagogicObjective
- educationLevel

Shodhganga (thesis)
- researcher
- keyword
- advisor
- place
- department
- institution
- awarded
- degree
$\frac{M \Sigma}{\delta(\alpha)}$ 

**Metadata Acquisition**
## Acquisition Scenarios

<table>
<thead>
<tr>
<th>Locate Content</th>
<th>Acquire Metadata</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Harvest Institutional IDRsWith automated or manual processes.</td>
<td>• Creation</td>
</tr>
<tr>
<td>• Crawl Websites with automated or manual processes.</td>
<td>○ Manual</td>
</tr>
<tr>
<td>• In Bulk – from Publishers</td>
<td>○ Automated</td>
</tr>
<tr>
<td>• Donated by Source with source-supported API</td>
<td>• Translation</td>
</tr>
<tr>
<td>• Source-supported API</td>
<td>○ Format</td>
</tr>
</tbody>
</table>

### Other Processes
- Translation (Format, Standard / Schema)
- Curation (Manual, Assisted)
- Ingestion
Challenges in Metadata Acquisition

- Different sources follow different norm in annotation
  - Automation of curation
- Errors in sourced data
  - Error listing
  - Manual curation
- Errors in manual annotation
  - Review step before actual submission in database
  - Manual curation
- Set up norm/guideline
  - Controlled vocabulary
Translation Issues

• Variation in Subject classification standards
  ○ Dewey Decimal Classification (DDC)
  ○ Library of Congress Classification (LCC)
  ○ Library of Congress Subject Headings (LCSH)

• Mapping terminology for different languages
  ○ Translate when equivalent terminology is present
  ○ Transliterate otherwise
NDL Metadata Extraction Toolkit

- Automated metadata extraction workflow
- Syntactic metadata extractor
  - Author name, ISBN, Publisher, dates etc.
- Table of content extractor
- Wikification for keyword extraction
- Learning resource metadata
- Toolchain for metadata extraction

*Once completed and tested, the toolkit will be released to public and open-sourced*
NDL Research

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25/10/2017

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Summary

The only thing that you absolutely have to know (may use Google, though), is the URL of NDL:

ndl.iitkgp.ac.in

Rest you find in NDL?

Why are you waiting?

'The only thing that you absolutely have to know, is the location of the library.'

Albert Einstein

- An umbrella over all IRs of India
- User-Centric Design
  - Multi-lingual Indic Interface
  - Multi-faceted Search
  - Multi-modal Filters
  - User Experience Tracking for Personalization
- Deep research for new-age solutions
- Metadata Engineering
  - Metadata Standard
  - Open Source Toolkit
- NDL Services
  - Open APIs for 3rd party development
- Spearheads NDL Movement to

Learn * Share * Grow

25/10/2017

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