The Network Data Exchange in 2016

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The NDEx Network Data Exchange
as it transitions from building infrastructure
to fostering applications, content, and communities.

NDEx: Cancer Networks from Many Sources

Systematic Data Analysis

Pathway Curation

Pathway Commons

AtGO

EMBL-EBI

Interaction Data

Pathway Crowd-Sourcing

NDEx is also a Community

NDEx | Networks | NDEx Networks | MyAccount

Dexter Pratt

dexterpratt

Actions

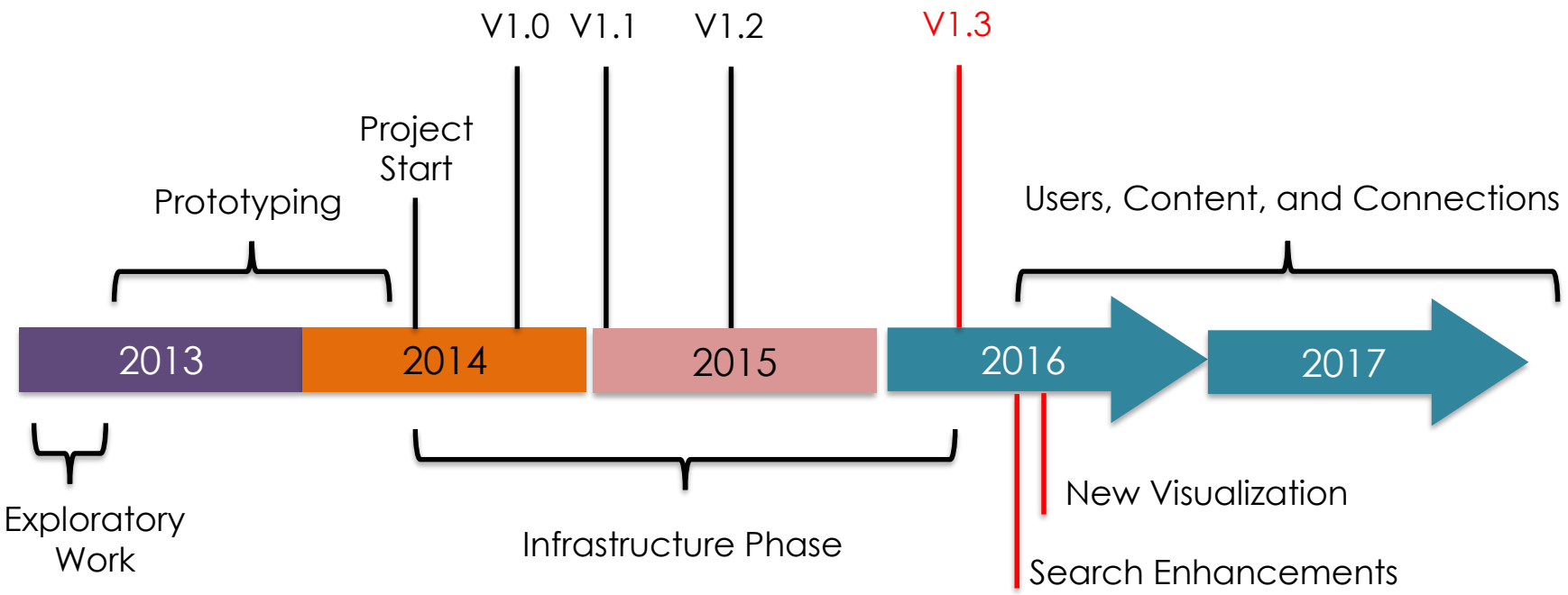
Networks | Groups

Title	Nodes	Edges
BEL Framework Large Corpus Document Subnetwork - 10/1/2014 4:34:38 PM	35	30
BEL Framework Small Corpus Document	1566	2174
actions of nitric oxide in the heart	76	170
Gene Expression Subnetwork - Friday, September 12, 2014 1:03:37 PM	526	833
query of bel Subnetwork - 9/11/2014 4:59:05 PM Subnetwork - 9/11/2014 4:59:37 PM Subnetwork - 9/11/2014 4:59:53 PM	31	26
BEL Framework Large Corpus Document Subnetwork - 9/11/2014 4:09:05 PM Subnetwork - 9/11/2014 4:32:46 PM	2	1

Tasks

network export completed
download

Transition to Community, Content and Connections to Cancer Network Analysis

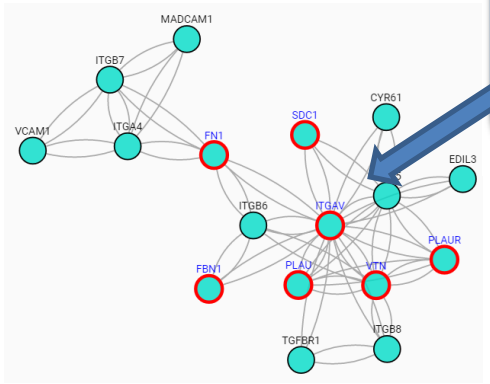


‘Gene- or variant-centered’ Network Analysis

Putative drivers

VEST ▾ Ndex Networks (vest_composite_pvalue)

Pathway	p-value	Genes
Beta1 integrin cell surface interactions	0.0000	ITGA9, COL11A1, PLAUR, ITGA7, FBN1, COL3A1, LAMB2, MDK, NID1, LAMA5, PLAU, VTN, COL4A4, COL4A1, LAMC2, LAMC1, COL7A1, FN1, CSPG4, ITGAV, COL1A1, COL6A3
Syndecan-1-mediated signaling events	0.0001	TGFB1, COL11A1, LAMA5, SDC1, COL1A1, FGF19, COL4A4, COL4A1, MMP9, COL3A1, COL6A3, BSG, PPIB, COL7A1
Integrins in angiogenesis	0.0003	IGF1R, COL11A1, PI4KA, CDKN1B, SDC1, VCL, FN1, ITGAV, VTN, PIK3C2A, COL4A4, PXN, COL4A1, COL1A1, COL3A1, MFGE8, BCAR1, COL6A3, COL7A1
Beta5 beta6 beta7 and beta8 integrin cell surface interactions	0.0010	FN1, PLAUR, ITGAV, VTN, PLAU, SDC1, FBN1
Beta3 integrin cell surface interactions	0.0014	PDGFB, LAMC1, FN1, PLAUR, COL1A1, ITGA2B, PLAU, VTN, COL4A4, ITGAV, COL4A1, SDC1, FBN1
Alpha6 beta4 integrin-ligand interactions	0.0018	LAMC2, LAMC1, LAMB2, ITGB4, LAMA5
Regulation of RAC1 activity	0.0052	SPATA13, TIAM1, NGEF, SOS1, PREX1, VAV1, ARHGEF2, ABI1, DOCK6, RACGAP1, ARHGAP9
FOXA1 transcription factor network	0.0081	SFTPD, BRCA1, PRDM15, GCG, SERPINA6, CDKN1B, VTN, CYP2C18, SP1, AP1B1, EP300, …
Aurora C signaling	0.0097	INCENP, AURKB
Regulation of RhoA activity	0.0098	OBSCN, ARHGEF12, NGEF, ARHGEF15, FARP1, ARHGEF18, CDKN1B, ARHGEF2, VAV1, ARHGAP9, ARHGAP5, AKAP13
Urokinase-type plasminogen activator	0.0120	TGFB1, LRP1, FN1, MMP12, PLAUR, PLAU, VTN,



Enriched networks

CRAVAT

muPIT INTERACTIVE

CRAVAT/MuPIT

Analysis/Select Top Genes

Genes
APC, ARID1A, B2M, CHEK2, ATM, ATRX, PTPN1

Networks
Ranked by Relevance

Network Viewer

Gene List Query

Enriched Networks

NDEx
Relevance Service

Query for Network Updates

Scan Networks for Genes

Up-to-date Networks

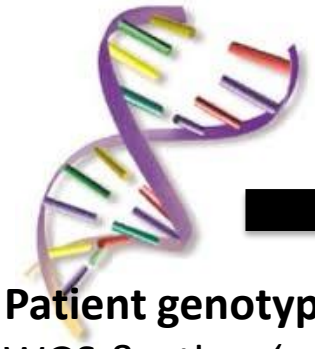
Query for Selected Network

Network Viewer Format

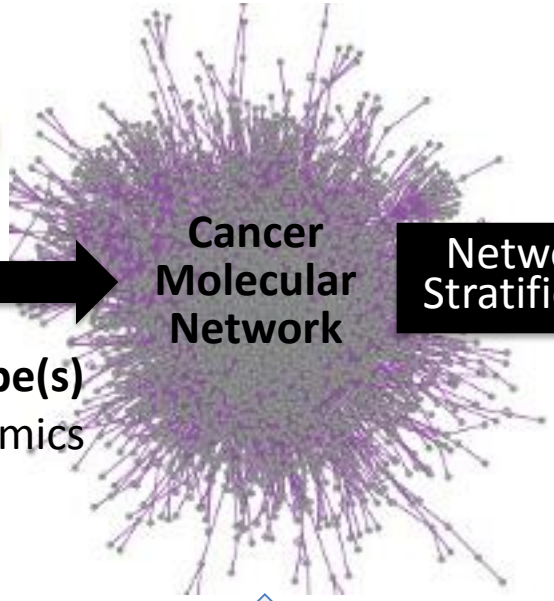
NDEx Public Server

See joint CRAVAT/MuPIT/NDEx poster (with Karchin lab)

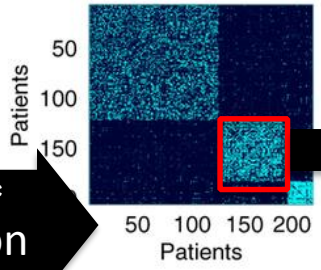
‘Patient-centered’ Cancer Network Analysis



Patient genotype(s)
WGS & other ‘omics

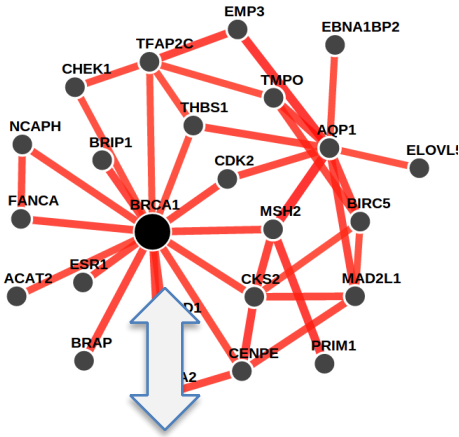


Network *
Stratification



Driver pathway &
associated clinical
phenotype(s)
Prognosis & Response

Patient Similarity Network **



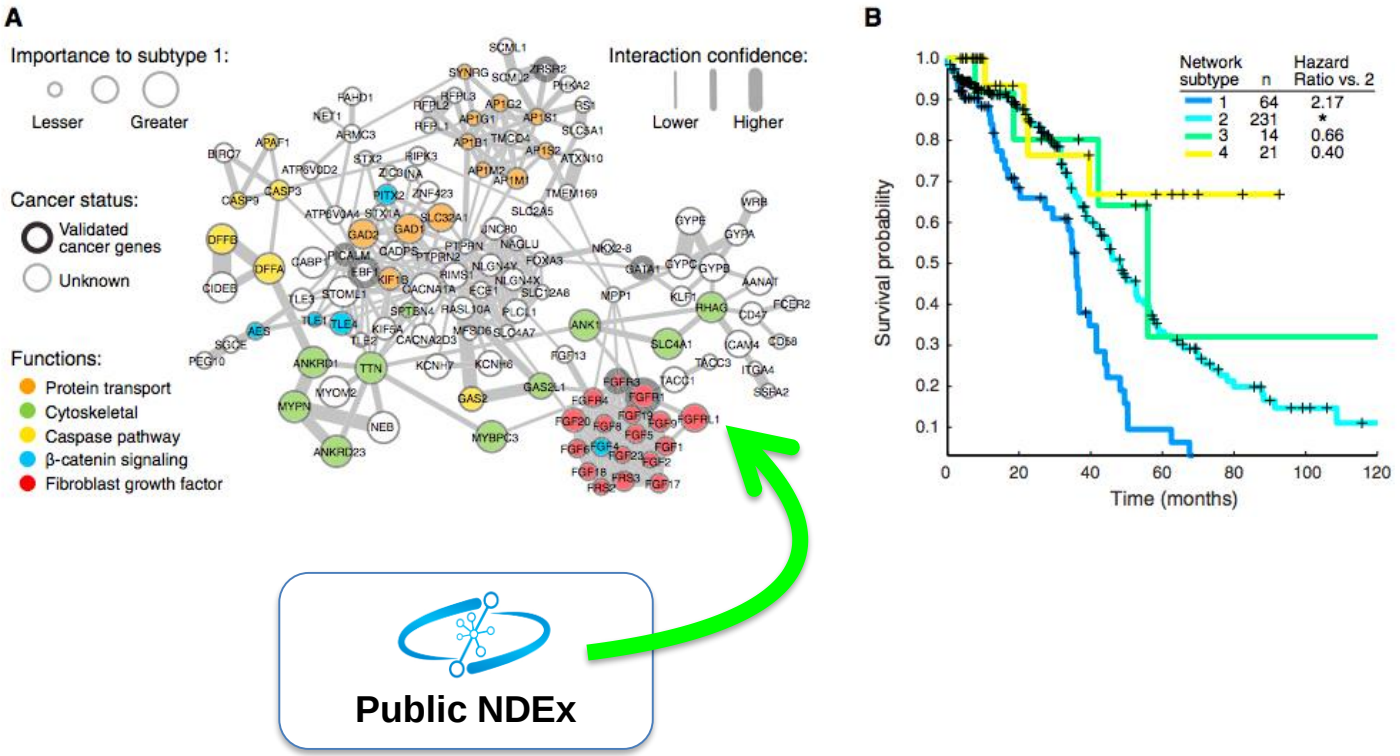
Public NDEx

* Hofree et al. *Nat. Methods* 2013
** Wang et al. *Nat. Methods* 2014

Network Stratification

- NDEx and Cytoscape as a foundation for building gene-centered and patient-centered analysis pipelines.
- Example: Network Based Stratification (NBS, Hofree *et al. Nat Methods* 2013)

  Places cancer patients into clinically informative subtypes using differences in networks.

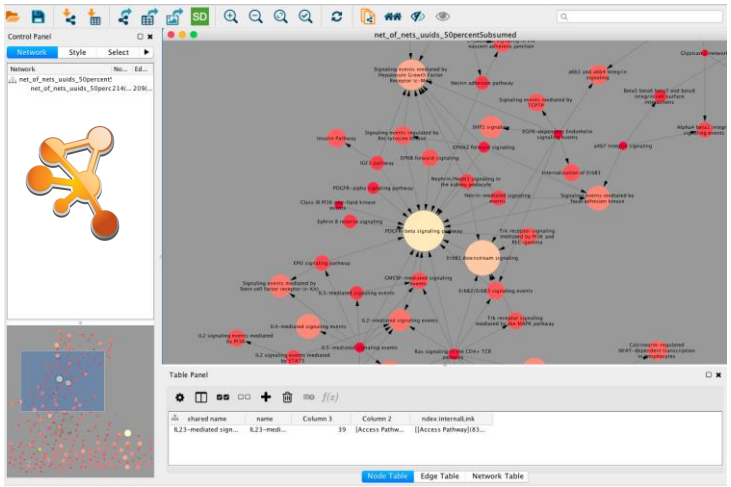


Cytoscape and NDEx

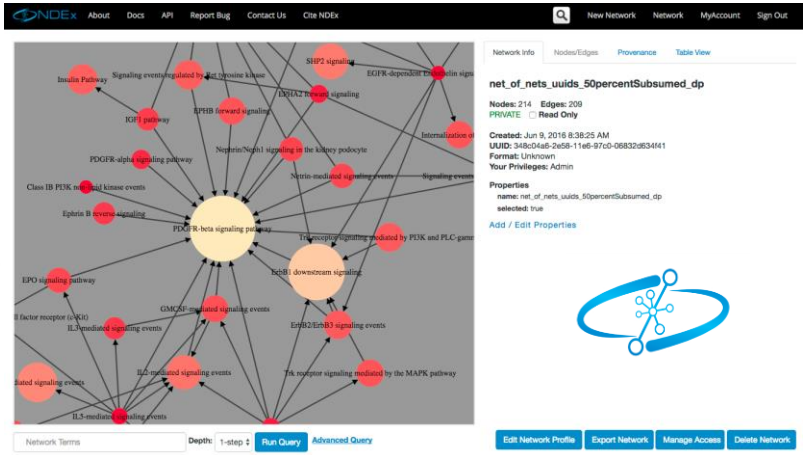
CyNDEx

Cytoscape App Store

CyNDEx allows users to seamlessly transfer networks between NDEx and Cytoscape and , in certain cases, even perform network updates in NDEx.



CX



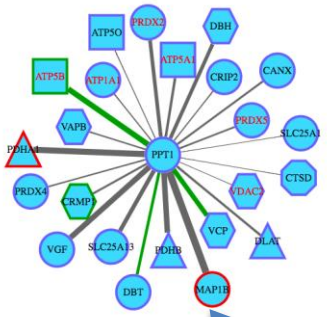
Cytoscape and NDEx communicate via the novel CX exchange format, a first step in making NDEx a core Cytoscape resource.

Journal Links: Networks Published as Data

The public NDEx site as a a conduit for network submission and review.

Private NDEx servers as repositories for embedded interactive networks in online journal articles.

Pre-Publication Authoring

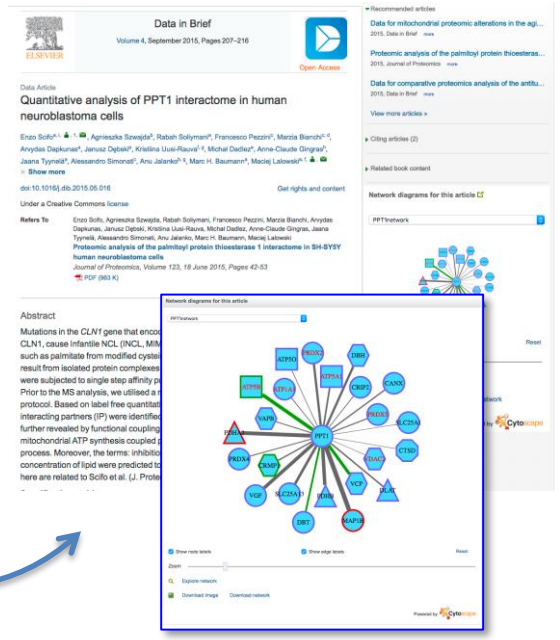


Submission for Publication

Public NDEx

Publisher Private NDEx (e.g. Elsevier)

Embedded Interactive Network

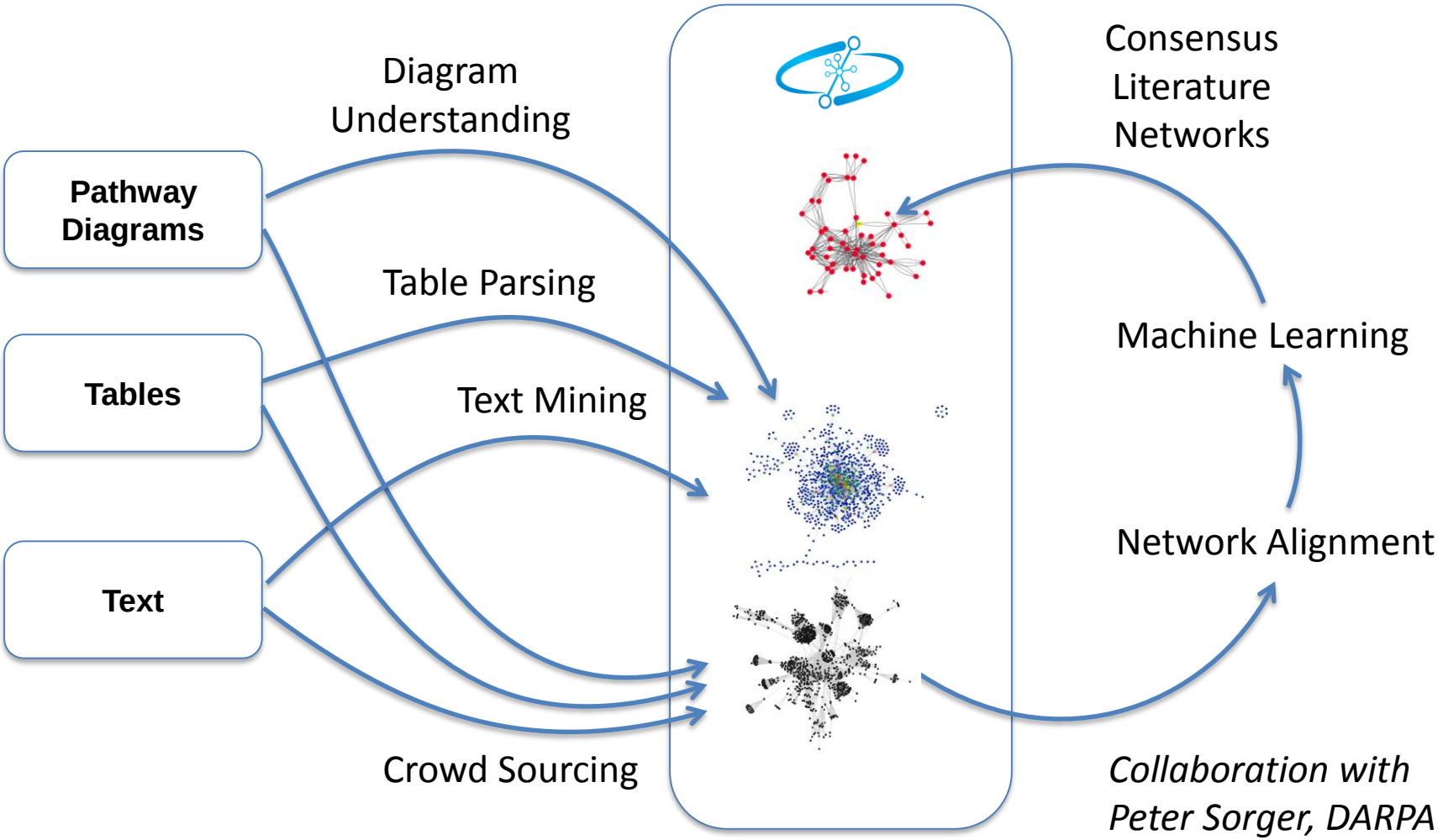


Collaboration with Kaia Motter and Hylke Koers, Elsevier

Massive Guided Network Curation

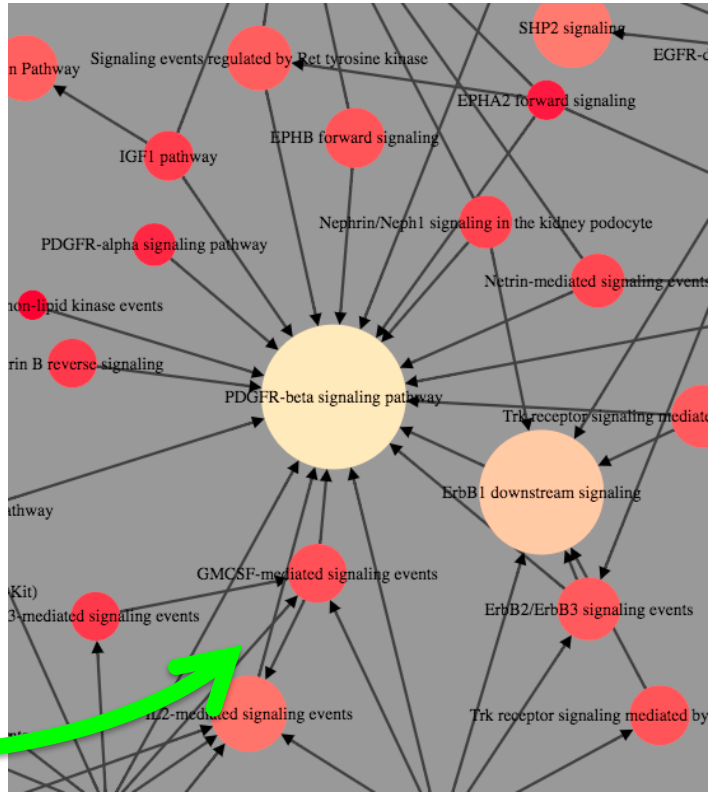
Question: How far can automated methods go towards capture of the many cancer-related networks in the published literature?

Approach : Infer networks by human consensus seeded by image/text parsing

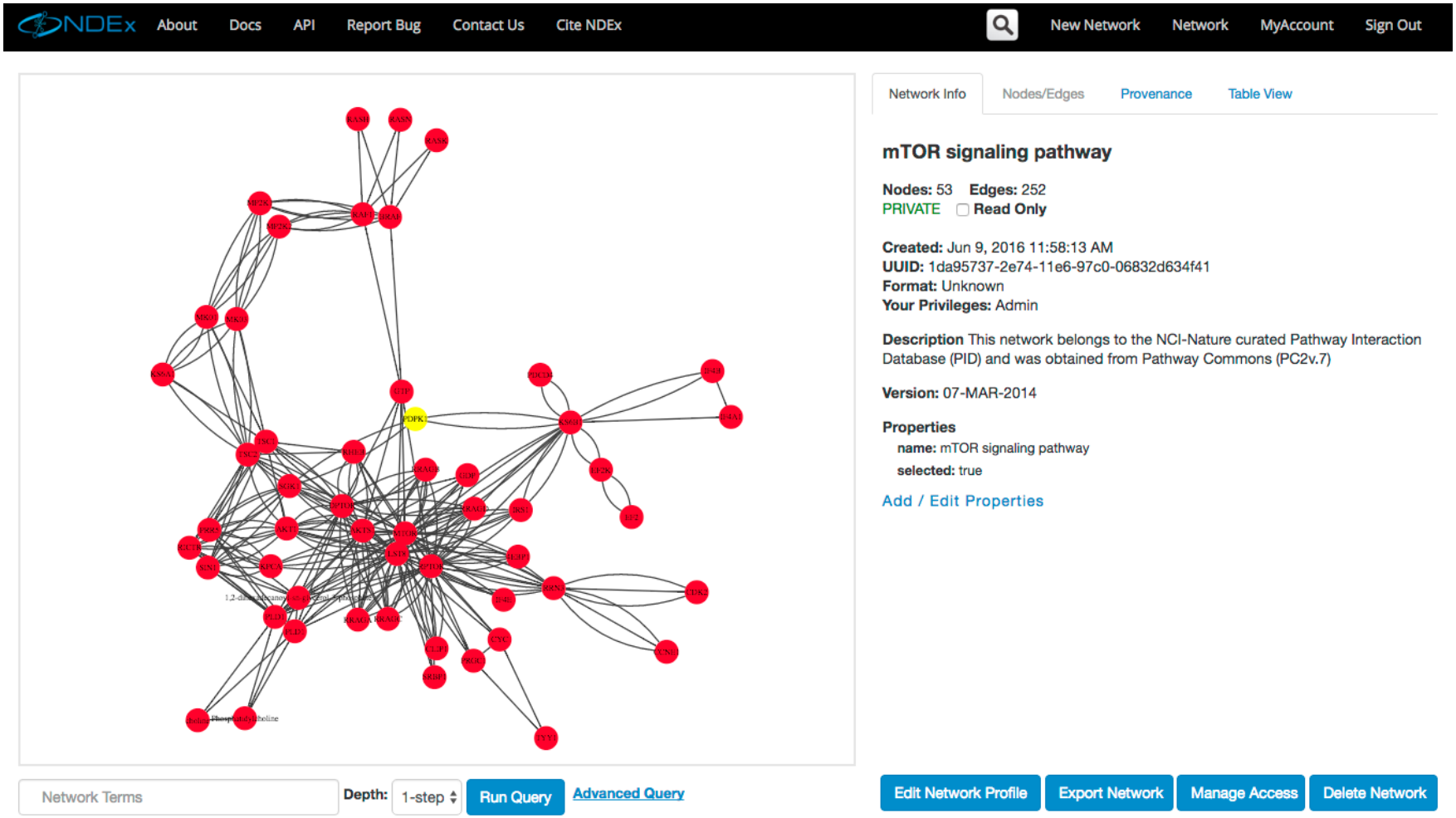


Networks to Seed Communities

- Engage cancer research communities to share and review knowledge of networks and pathways.
- Seed the efforts with canonical networks, starting with the Pathway Interaction Database (NCI-PID) now hosted by NDEx.
- Form an NDEx Cancer Advisory Board to guide community development.
- Create tools for publishing catalogs of reviewed networks:
  - communities share expertise and reward high-quality curation.

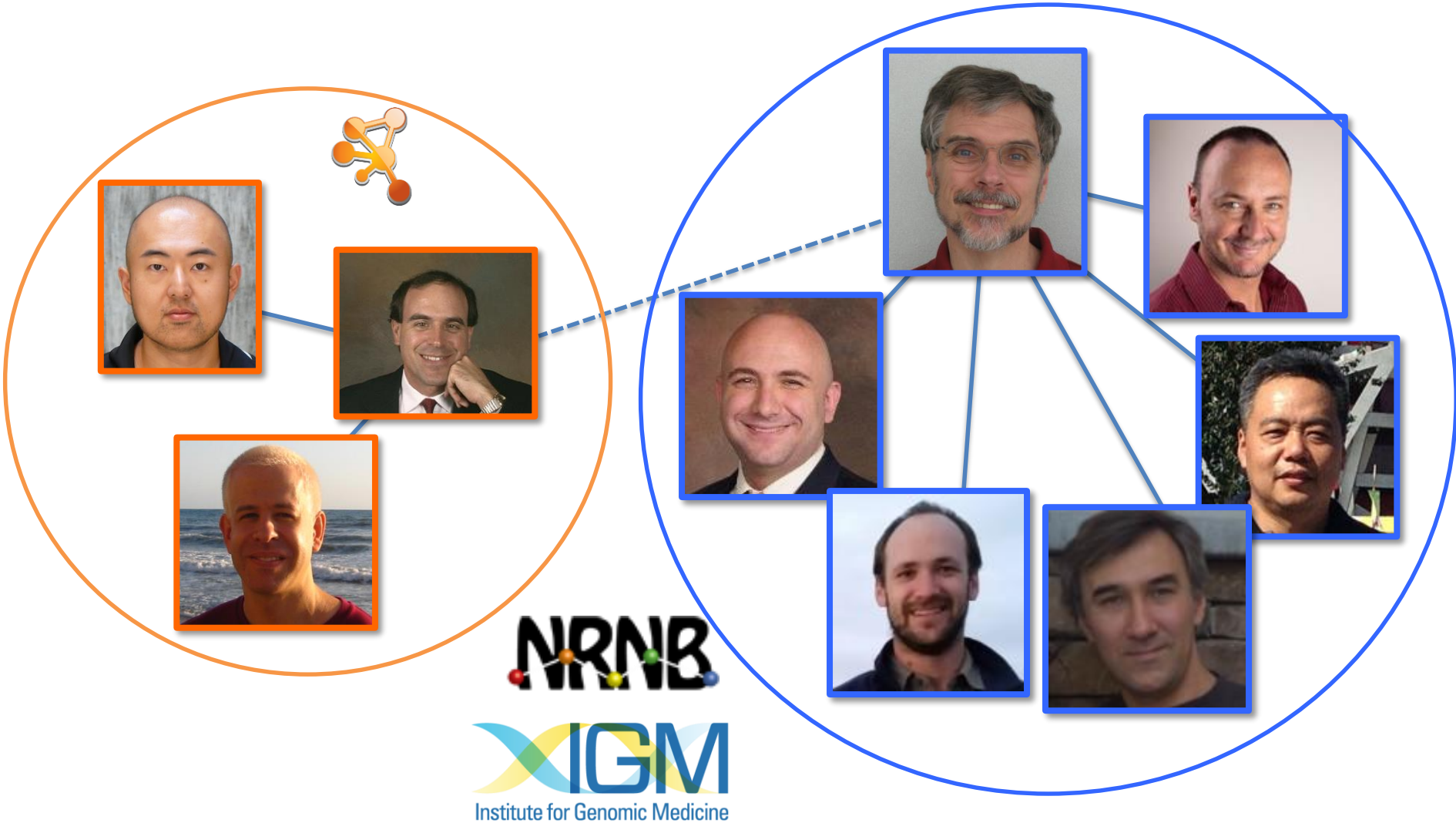


Higher-scale organization of networks using maps and ontologies



A Computed Hierarchy of NCI-PID Pathways

NDEx



NRNB

IGM
Institute for Genomic Medicine

Janssen
PHARMACEUTICAL COMPANIES OF Johnson & Johnson

NETWORK PHARMACOLOGY

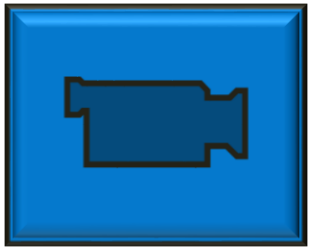
Pfizer

Roche

ITCR
Informatics Technology for Cancer Research

NATIONAL CANCER INSTITUTE

Acknowledgements

NDEx Video Demo – June 2016

- Overview of Search Improvements
- New Network Visualizer
  - *(Coming Q3 2016)*
- Network Round-trip between NDEx and Cytoscape