

Current Topics in the Geographic Information Science & Technology Body of Knowledge

Foundational Concepts (FC)		Computing Platforms (CP)	
<u>Origins</u>	<u>Basic Measures</u>	<u>Computing Infrastructures</u>	<u>Software Systems</u>
Public & Private Sector Origins	Academic developments	Graphics Processing Units (GPUs)	Spatial Database Mgmt Systems
<i>Intro to the GIS&T BoK</i>		Cyberinfrastructure	Artificial Intelligence Tools & Platforms
<u>Cognitive</u>		Spatial Cloud Computing	Geospatial Technology Transfer
The Power of Maps and Mapping		Mobile Devices	Web GIS
Place and Landscape		e-Science, Evolution of Science	Enterprise GIS
<i>Foundational Ontologies</i>		<u>Computing Approaches</u>	<u>Examples & Applications</u>
Perceptions & Cognitive Processing		Origins: Computer Systems	Google Earth Engine
<i>Ontologies for Analysis</i>		Origins: Peripheral Devices	ArcGIS Online
Semantic Information Elicitation		<i>High Throughput Computing and GIS</i>	GIS&T and Computational Notebooks
		<i>High Performance Computing and GIS</i>	<i>Apache Spark</i>
		Science Gateways	<i>OSGeo Live</i>
<u>Domains of Geographic Info</u>	<u>Interrogating Geog Info</u>	<u>Social Media & Location Services</u>	
Space	Set Theory	Location-based Services	
Time	SQL & Attribute Queries	Social Media Analytics	
Space-Time Relationships	Spatial Queries	Social Networks	
GIS Data Properties		<i>GIS and the Internet of Things</i>	
Networks	<u>Uncertainty</u>	<i>GIS and Web Services</i>	
Neighborhoods	Conceptual Error/Uncertainty Models	Programming & Development (PD)	
	Problems of Scale and Zoning	<u>Algorithm Design & Approaches</u>	
<u>Philosophical</u>		<u>Application Development</u>	
Openness		Real Time Prgrmmng & Geocomputation	
Epistemology		Natural Language Processing in GIS	
Philosophical Perspectives		Machine Learning Programming for GIS	
		Linear Programming and GIS	
		GIS and Parallel Programming	
		<i>Object-oriented programming</i>	
		<u>Languages & Libraries</u>	
		Python for GIS	
		PySAL and Spatial Statistics Libraries	
		R for Geospatial Analysis & Mapping	
		Javascript for GIS	
		SQL Languages for GIS	
		GDAL/OGR and IO Libraries	
		<u>Development Tools</u>	
		Visual Programming for GIS Apps	
		SpatialMPI for GIS Apps	
		GIS APIs	
Knowledge Economy (KE)		GIS&T and Society (GS)	
<u>GIS&T Workforce</u>	<u>Coordinating Organizations</u>	<u>Law, Regulation, and Policy</u>	
GIS&T Workforce Development	Value of Geospatial Professional Orgs.	<i>The Legal Regime</i>	
Competence in Knowledge Work	<i>Regional GIS Coordination & Collaboration</i>	<u>Governance & Agency</u>	
GIS&T Positions and Qualifications	Multi-Organizational GIS Coordination	<i>Public Participation GIS</i>	
GIS&T Education & Training	Publications and Conferences	Location Privacy	
Professional Certification	The Geospatial Community	Professional & Practical Ethics of GIS&T	
	The Geospatial Industry	Mechanisms of Control of Geosptl Info	
<u>Design & Implementation</u>		Legal Mechanisms for Sharing	
The Process of GIS&T Design		GIS&T for Equity and Social Justice	
Strategic Planning for GIS Design		<u>Critical Perspectives</u>	
Project Planning & Management		Epistemological Critiques	
Measuring GIS ROI		GIS and Critical Ethics	
Measuring GIS Costs		Feminist Critiques of GIS	
Managing Infrastructure & Operations		Balancing Data Access, Security, Privacy	
		GIS&T and Citizen Science	
		GIS&T and Spatial Decision Support	
		Maps/Spatial Justice & Marginal Societies	
		GIS&T and Community Engagement	
		Geospatial Participatory Modeling	
Data Capture (DC)		Domain Applications (DA)	
<u>History & Trends</u>	<u>Remote Sensing Platforms/Sensors</u>	Disaster Management	
Changes Over Time Part 1: Tech Dev	Remote Sensing Platforms Overview	<i>Land Administration</i>	
Changes Part 2: Implications & Cases	Nature of Multispectral Images	<i>Earth Science Research</i>	
Georeferencing & Georectification	Unmanned Aerial Systems	<i>Economic Development</i>	
<u>Software & Data Coordinating Orgs.</u>	Landsat	<i>Ecosystem Science & Management</i>	
National Organizations & Programs	Light Detection & Ranging (LiDAR) Basics	Education & Training	
International Organizations & Programs	<i>Hyperspectral Imagery</i>	<i>Energy Development</i>	
	<i>Airborne LiDAR Bathymetry</i>	<i>Environmental Science & Management</i>	
<u>Data Sources & Capture Methods</u>	<i>Thermal Imagery</i>	Epidemiology	
Historical Paper Maps	<i>Radar, Sonar, and Echolocation</i>	Facilities Management	
Global Navigation Satellite Systems		Forestry	
Aerial Photos: History & Georeferencing	<u>Processing Remotely-Sensed Data</u>	Geodesign	
Street-Level Imagery	Image Interp: Photos & Satellites	<i>Humanitarian Mapping</i>	
Social Media Platforms	<i>Feature Extraction in Satellite Imagery</i>	<i>Hydrology and Hydraulics</i>	
<i>Mobile Applications</i>	<i>Structure from Motion Photogrammetry</i>	<i>Insurance</i>	
<i>Texts</i>	Ground Verification & Accuracy	Intelligence & National Security	
Volunteered Geographic Info (VGI)	<i>Spectral Properties Terrestrial Surfaces</i>	<i>Insurance</i>	
Time-of-Arrival Localization	<u>GIS and Surveying</u>	International Affairs	
<u>Field Data Collection</u>	Professional Land Surveying		
<i>Sampling: Size, Selection, Types</i>	Land Records		
Field Data Capture Technologies	<i>Ocean Surveying</i>		
U.S. Census Data			
Domain Applications (DA)		GIS&T Body of Knowledge	
Agriculture	<i>Climate Studies & Atmos. Science</i>	9/30/2022	
Archaeology	Computational Geography	bold = revised & expanded	
Architecture	<i>Conservation</i>	regular = original & still limited	
Business	Criminal Justice / Law Enforcement	<i>italics = future or forthcoming</i>	
Civil Engineering	Digital Humanities	https://gistbok.ucgis.org	

GIS&T Body of Knowledge
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Data Management (DM)

<p><u>Spatial Databases</u></p> <p style="padding-left: 20px;">Spatial Database Mngmnt Systems</p> <p style="padding-left: 20px;">Relational DBMS and Extensions</p> <p style="padding-left: 40px;"><i>Geodatabases</i></p> <p style="padding-left: 40px;"><i>Topological Relationships</i></p> <p style="padding-left: 20px;">Database Administration</p> <p style="padding-left: 20px;">Conceptual Data Models</p> <p style="padding-left: 20px;">Logical Data Models</p> <p style="padding-left: 20px;">Physical Data Models</p> <p style="padding-left: 40px;">Array Databases</p> <p style="padding-left: 40px;">NoSQL databases</p> <p><u>Representation of Spatial Objects</u></p> <p style="padding-left: 20px;">Raster Data Models</p> <p style="padding-left: 40px;">Hexagonal Models</p> <p style="padding-left: 20px;">Triangular Irregular Network (TIN) Models</p> <p style="padding-left: 20px;">Hierarchical Data Models</p> <p style="padding-left: 40px;">Topological Models</p> <p style="padding-left: 40px;">Vector Data Models</p> <p style="padding-left: 40px;">Network Models</p> <p style="padding-left: 20px;">Entity-based Models</p> <p style="padding-left: 40px;">Modeling 3-D Entities</p> <p style="padding-left: 40px;">Fields in Space and Time</p> <p style="padding-left: 40px;">Fuzzy Models</p> <p style="padding-left: 20px;">Events and Processes</p> <p style="padding-left: 40px;">Genealogical Relationships, Lineage</p> <p style="padding-left: 20px;">Geospatial Data Conflation</p> <p><u>Spatial Access Methods</u></p> <p style="padding-left: 20px;">Spatial Data Retrieval Strategies</p> <p style="padding-left: 20px;">Spatial Indexing</p> <p style="padding-left: 40px;">Space-driven Structures</p> <p style="padding-left: 40px;">Data-driven structures</p> <p style="padding-left: 20px;">Modeling Unstructured Spatial Data</p> <p style="padding-left: 20px;">Modeling Semi-structured Spatial Data</p>	<p style="text-align: center;"><u>Query Processing</u></p> <p style="padding-left: 40px;"><i>Optimal I/O Algorithms</i></p> <p style="padding-left: 40px;">Spatial Joins</p> <p style="padding-left: 40px;"><i>Complex Queries</i></p> <p style="text-align: center;"><u>Georeferencing Systems</u></p> <p style="padding-left: 40px;">Linear Referencing</p> <p style="padding-left: 40px;">Earth's Shape, Sea Level, Geoid</p> <p style="padding-left: 40px;">Geographic Coordinate Systems</p> <p style="padding-left: 40px;">Planar Coordinate Systems</p> <p style="padding-left: 40px;"><i>U.S. National Grid</i></p> <p style="padding-left: 40px;">Vertical (Geopotential) Datums</p> <p style="padding-left: 40px;">Horizontal (Geometric) Datums</p> <p style="text-align: center;"><u>Data Manipulation</u></p> <p style="padding-left: 40px;">Point, Line, Area Generalization</p> <p style="padding-left: 40px;">Vector-to-Raster and R-to-V Conversions</p> <p style="padding-left: 40px;">Raster Resampling</p> <p style="padding-left: 40px;">Coordinate Transformations</p> <p style="padding-left: 40px;">Transaction Management</p> <p style="text-align: center;"><u>Data Standards & Infrastructures</u></p> <p style="padding-left: 40px;">Metadata, Quality, and Uncertainty</p> <p style="padding-left: 40px;">Geospatial Content Standards</p> <p style="padding-left: 40px;">Spatial Data Warehouses</p> <p style="padding-left: 40px;">Spatial Data Infrastructures</p> <p style="padding-left: 40px;">U.S. National Spatial Data Infrastructure</p> <p style="padding-left: 40px;">Ontology for Geosptl Semantic Interop.</p> <p style="padding-left: 40px;">Hydrographic Geospatial Data Standards</p> <p style="padding-left: 40px;">Marine Spatial Data Infrastructures</p>
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Cartography & Visualization (CV)

<p><u>History & Trends</u></p> <p style="padding-left: 20px;">Cartography & Science</p> <p style="padding-left: 20px;">Cartography & Art</p> <p style="padding-left: 20px;">Cartography & Power</p> <p><u>Data Considerations</u></p> <p style="padding-left: 20px;">Vector Formats & Sources</p> <p style="padding-left: 20px;">Raster Formats & Sources</p> <p><u>Map Design Fundamentals</u></p> <p style="padding-left: 20px;">Scale & Generalization</p> <p style="padding-left: 20px;">Statistical Mapping</p> <p style="padding-left: 20px;">Map Projections</p> <p style="padding-left: 20px;">Visual Hierarchy & Layout</p> <p style="padding-left: 20px;">Symbolization & Visual Variables</p> <p style="padding-left: 40px;">Color Theory</p> <p style="padding-left: 40px;">Typography</p> <p style="padding-left: 20px;">Design and Aesthetics</p> <p style="padding-left: 20px;">Map Production & Management</p> <p><u>Map Use</u></p> <p style="padding-left: 20px;">Map Reading</p> <p style="padding-left: 20px;">Map Interpretation</p> <p style="padding-left: 20px;">Map Analysis</p> <p style="padding-left: 20px;">Lesson Design in Cartography Education</p>	<p style="text-align: center;"><u>Map Design Techniques</u></p> <p style="padding-left: 40px;">Common Thematic Map Types</p> <p style="padding-left: 40px;">Multivariate Mapping</p> <p style="padding-left: 40px;">Spatio-Temporal Representation</p> <p style="padding-left: 40px;">Representing Uncertainty</p> <p style="padding-left: 40px;">Terrain Representatoin</p> <p style="padding-left: 40px;">Cartograms</p> <p style="padding-left: 40px;">Map Icon Design</p> <p style="padding-left: 40px;">Narrative & Storytelling</p> <p style="padding-left: 40px;">Flow Maps</p> <p style="padding-left: 40px;">Collaborative Cartography</p> <p style="text-align: center;"><u>Interactive Design Techniques</u></p> <p style="padding-left: 40px;">User Interface & User Experience (UI/UX)</p> <p style="padding-left: 40px;">Web Mapping</p> <p style="padding-left: 40px;">Virtual & Immersive Environments</p> <p style="padding-left: 40px;">Big Data Visualization</p> <p style="padding-left: 40px;">Mobile Maps & Responsive Design</p> <p style="padding-left: 40px;">Usability Engineering & Evaluation</p> <p style="padding-left: 40px;">Geovisual Analytics</p> <p style="padding-left: 40px;">Geovisualization</p>
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Analytics & Modeling (AM)

<p style="text-align: center;"><u>Methodological Context</u></p> <p style="padding-left: 20px;">Geospatial Analysis & Model Building</p> <p style="padding-left: 20px;">Evolution of Reasoning, Analytics</p> <p><u>Building Blocks</u></p> <p style="padding-left: 20px;">Overlay & Combination Operations</p> <p style="padding-left: 20px;">Areal Interpolation</p> <p style="padding-left: 20px;">Aggregation of Spatial Entities</p> <p style="padding-left: 20px;">Grid Operations & Map Algebra</p> <p style="padding-left: 20px;">Classification & Clustering</p> <p style="padding-left: 40px;"><i>Boundaries & Zone Membership</i></p> <p style="padding-left: 40px;">Buffering</p> <p><u>Data Exploration & Spatial Stats</u></p> <p style="padding-left: 40px;">Spatial Statistics</p> <p style="padding-left: 40px;">Spatial Sampling for Spatial Analysis</p> <p style="padding-left: 40px;">Exploratory Spatial Data Analysis</p> <p style="padding-left: 40px;">Point Pattern Analysis</p> <p style="padding-left: 40px;">Kernels & Density Estimation</p> <p style="padding-left: 40px;">Spatial Interaction</p> <p style="padding-left: 40px;">Cartographic Modeling</p> <p style="padding-left: 40px;">Multi-Criteria Evaluation</p> <p style="padding-left: 40px;">Landscape Metrics</p> <p style="padding-left: 40px;">Hot-spot and Cluster Analysis</p> <p style="padding-left: 40px;">Global Measures of Spatial Association</p> <p style="padding-left: 40px;">Local Indicators Spatial Autocorrelation</p> <p style="padding-left: 40px;">Simple Regression & Trend Surfaces</p> <p style="padding-left: 40px;">Geographically Weighted Regression</p> <p style="padding-left: 40px;">Spatially Autoregressive Models</p> <p style="padding-left: 40px;">Spatial Filtering Models</p> <p><u>Network & Location Analysis</u></p> <p style="padding-left: 20px;"><i>Intro to Network & Location Analysis</i></p> <p style="padding-left: 20px;"><i>Network Route & Tour Problems</i></p> <p style="padding-left: 20px;">Location & Service Area Problems</p> <p style="padding-left: 40px;">Accessibility Modeling</p> <p style="padding-left: 40px;">Location-Allocation Modeling</p> <p style="padding-left: 20px;">The Classic Transportation Problem</p>	<p style="text-align: center;"><u>Analysis of Errors & Uncertainty</u></p> <p style="padding-left: 20px;">Spatial Data Uncertainty</p> <p style="padding-left: 20px;">Thematic Accuracy and Assessment</p> <p style="padding-left: 20px;">Mathematical Models of Uncertainty</p> <p style="padding-left: 20px;">Error-based Uncertainty</p> <p style="padding-left: 40px;">Stochastic Simulation & Monte Carlo</p> <p style="padding-left: 40px;">Fuzzy Aggregation Operators</p> <p style="text-align: center;"><u>Big Data & Geospatial Analysis</u></p> <p style="padding-left: 20px;">Pattern Recognition and Matching</p> <p style="padding-left: 20px;">Artificial Intelligence Approaches</p> <p style="padding-left: 20px;">Intro to Spatial Data Mining</p> <p style="padding-left: 20px;">Rule Learning for Spatial Data Mining</p> <p style="padding-left: 20px;">Machine Learning Approaches</p> <p style="text-align: center;"><u>Surface & Field Analysis</u></p> <p style="padding-left: 40px;">Modeling Surfaces</p> <p style="padding-left: 40px;"><i>Gridding, Interpolation, & Contouring</i></p> <p style="padding-left: 40px;"><i>Inverse Distance Weighting</i></p> <p style="padding-left: 40px;"><i>Radial Basis and Spline Functions</i></p> <p style="padding-left: 40px;"><i>Polynomial Functions</i></p> <p style="padding-left: 40px;"><i>Kriging Interpolation</i></p> <p style="padding-left: 40px;"><i>LiDAR Point Cloud Analysis</i></p> <p style="padding-left: 20px;">Intervisibility, Line-of-Sight, Viewsheds</p> <p style="padding-left: 40px;"><i>DEM and Terrain Metrics</i></p> <p style="padding-left: 40px;"><i>TIN-based models and Terrain Metrics</i></p> <p style="padding-left: 20px;">Watersheds and Drainage</p> <p style="padding-left: 40px;"><i>3D Parametric Surfaces</i></p> <p style="text-align: center;"><u>Geocomputation Methods/Models</u></p> <p style="padding-left: 40px;">Cellular Automata</p> <p style="padding-left: 40px;">Agent-based Modeling</p> <p style="padding-left: 40px;">Simulation Modeling</p> <p style="padding-left: 40px;"><i>Artificial Neural Networks</i></p> <p style="padding-left: 20px;">Genetic Algorithms / Evolutionary Cmptng</p> <p style="text-align: center;"><u>Space-Time Analytics & Modeling</u></p> <p style="padding-left: 20px;">Capturing Spatiotemporal Dynamics</p> <p style="padding-left: 20px;">GIS-based Computational Modeling</p> <p style="padding-left: 20px;">Computational Movement Analysis</p> <p style="padding-left: 40px;"><i>Volumes and Space-Time Volumes</i></p>
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Domain Applications (DA) (continued)

<p style="padding-left: 20px;">Real Estate</p> <p style="padding-left: 20px;">Recreation Planning & Management</p> <p style="padding-left: 20px;">Retail Businesses</p> <p style="padding-left: 20px;">State & Regional Government</p> <p style="padding-left: 40px;"><i>Telecommunications</i></p>	<p style="padding-left: 20px;">Urban & Regional Planning</p> <p style="padding-left: 40px;"><i>Utilities</i></p> <p style="padding-left: 40px;"><i>Water Resources</i></p> <p style="padding-left: 40px;"><i>Wildlife & Fisheries Science</i></p>	
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